

## Background

- Insulin is a high-risk medication that can lead to significant morbidity and mortality, especially in young children who require smaller, weight-based dosing
- Insulin is a common medication associated with inpatient medication errors due to:
  - Manual calculations by nurses
  - Order entry errors by prescribers

## Purpose

- The aim of this project is to evaluate whether implementation of a medication administration record (MAR)-based insulin calculator reduces rapid-acting subcutaneous insulin errors in an inpatient pediatric setting by 25%

## Methods

- The project occurred from January 2023 to April 2024 and is divided into four PDSA cycles-
  - Cycle 1 (January-November 2023): MAR based inpatient subcutaneous insulin calculator built and configured into Epic Hyperspace, order set/panel developed, and education with inpatient providers and nurses
  - Cycle 2 (February 2024): Customization of calculator to include an ICR of 0
  - Cycle 3 (March 2024): Inpatient hyperglycemia guideline developed with calculator guidance and continued education with inpatient staff
  - Cycle 4 (April 2024): Implementation of dosage guardrails for ICR and ISF for higher insulin doses
- Rapid acting insulin errors were tracked monthly from January 2020 to May 2025 and categorized as either order or administration errors across three time periods-
  - Pre-PDSA (January 2020-December 2021)
  - During PDSA (November 2023-April 2024)
  - Post-PDSA (May 2024-May 2025) implementation

## Implementation Cycle 1

Ordering View

Administration View

**Insulin Lispro (HUMALOG JUNIOR KWIKPEN) Injection Pen 0-75 Units**

Order Instructions: Restricted to pediatric patients LESS than 30 kg OR requiring 0.5 unit dose increment

Reference Links: Lexi-Comp, Lexi-Comp Peds, Management of Pediatric Hyperglycemia and Diabetes in Non-Critically Patients

Blood Glucose Target - Daytime (mg/dL): 100

Blood Glucose Target - Bedtime (mg/dL): 150

At 0200 only, give correctional insulin if Blood Glucose is greater than (mg/dL): 350

Hyperglycemia Correction Factor:

Carbohydrate Ratio (g/unit):

Additional Instructions: Do not give a correction dose for high blood glucose within 3 hours of the last dose of rapid-acting insulin.

Dose: 0.75 Units 0.75 Units

Route: SUBCUTANEOUS

Frequency: FIVE TIMES DAILY (0200... QID wimeals and bedtime 5 times daily (0200, wimeals and bedtime)

Starting: 4/23/2024 Today Tomorrow

First Dose:

Give 1st Dose Now On Routine Schedule

First Dose:	Today 1200	Final Dose:	Until Discontinued
04/23	04/24	04/25	04/26
1200	0200	0200	0200
1700	0700	0700	0700
2100	1200	1200	1200
1700	1700	1700	1700
2100	2100	2100	2100

Admin Instructions: If POC Glucose less than or equal to 70 mg/dL, see hypoglycemia treatment order. If bedtime or overnight POC Glucose 71-100 mg/dL, see bedtime/overnight glucose management order.

Next Required

**Administration Details**

Action: Given Date: 04/23/2024 Time: 1200 Comment:

Route: SUBCUTANEOUS Site: Dose: Units Expected Dose: 0.75 Units Order Concentration: 100 Units/mL

**Associated Flowsheet Rows**

Time taken: 4/23/2024 0929 Responsible: Restgre Show Details

If no new assessment is needed, check the box to link flowsheet rows to the previous assessment. Use All Previous Values

Flowsheet data cannot be documented in the future. Flowsheet time has been set to 4/23/2024 0929.

**Insulin Calculator - Select Current Mealtime**

Mealtime: Breakfast Lunch Dinner Bedtime 2 am

Was rapid-acting insulin given within previous 3 hours? Yes No

**Enter Current POC Blood Glucose and Carbohydrate Intake:**

Blood Glucose (mg/dL): 253 Carb Intake (grams): 64

**Calculated Dose (Enter in the "Dose" Field Above):**

Dose (Units) (Rounded Down to Nearest Half Unit): 7 Units

Insulin Dose Calculation:  $((\text{Carb Intake (g)}) / (\text{Carb Ratio Meals and Bedtime (g/unit)})) + (((\text{Blood Glucose (mg/dL)}) - (\text{BG})))$

Insulin Dose Calculation Values:  $((64/15) + (((253-100)/50) * (253 + 100)))$

Additional Instructions: Additional Instructions (cont.):

## Cycle 4

WARNING: Hyperglycemia Correction Factor less than or equal to 20 is for patients with INSULIN RESISTANCE only. Please confirm if this is intended.

Carbohydrate Ratio (g/unit):

WARNING: Carbohydrate ratio less than or equal to 5 g/unit is for patients with INSULIN RESISTANCE only. Please confirm if this is intended.

Additional Instructions:

Dose:

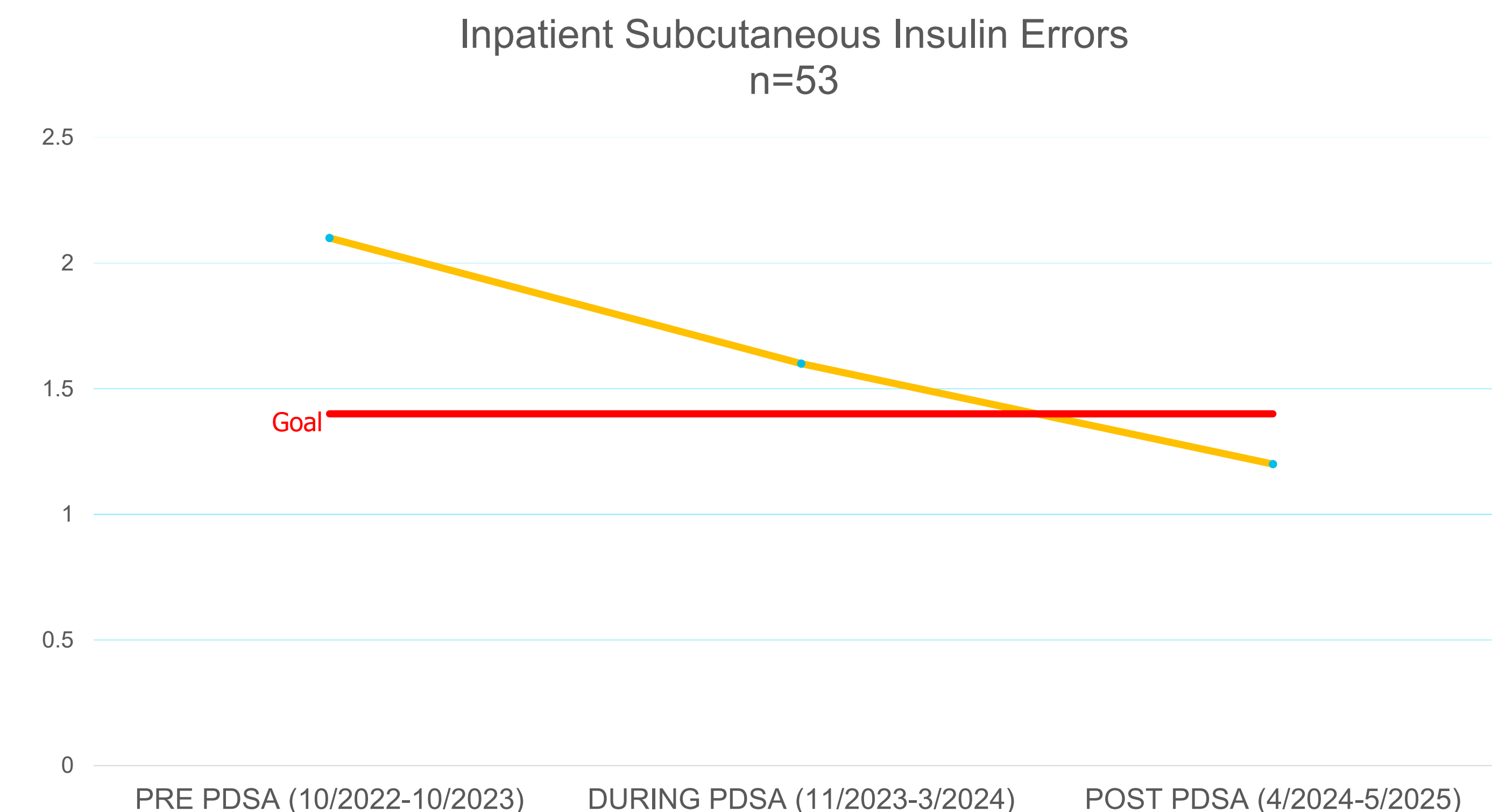
Yes - Patient has a history of INSULIN RESISTANCE and requires a high dose of insulin for correction.

No - Return and correct the Hyperglycemia Correction Factor response.

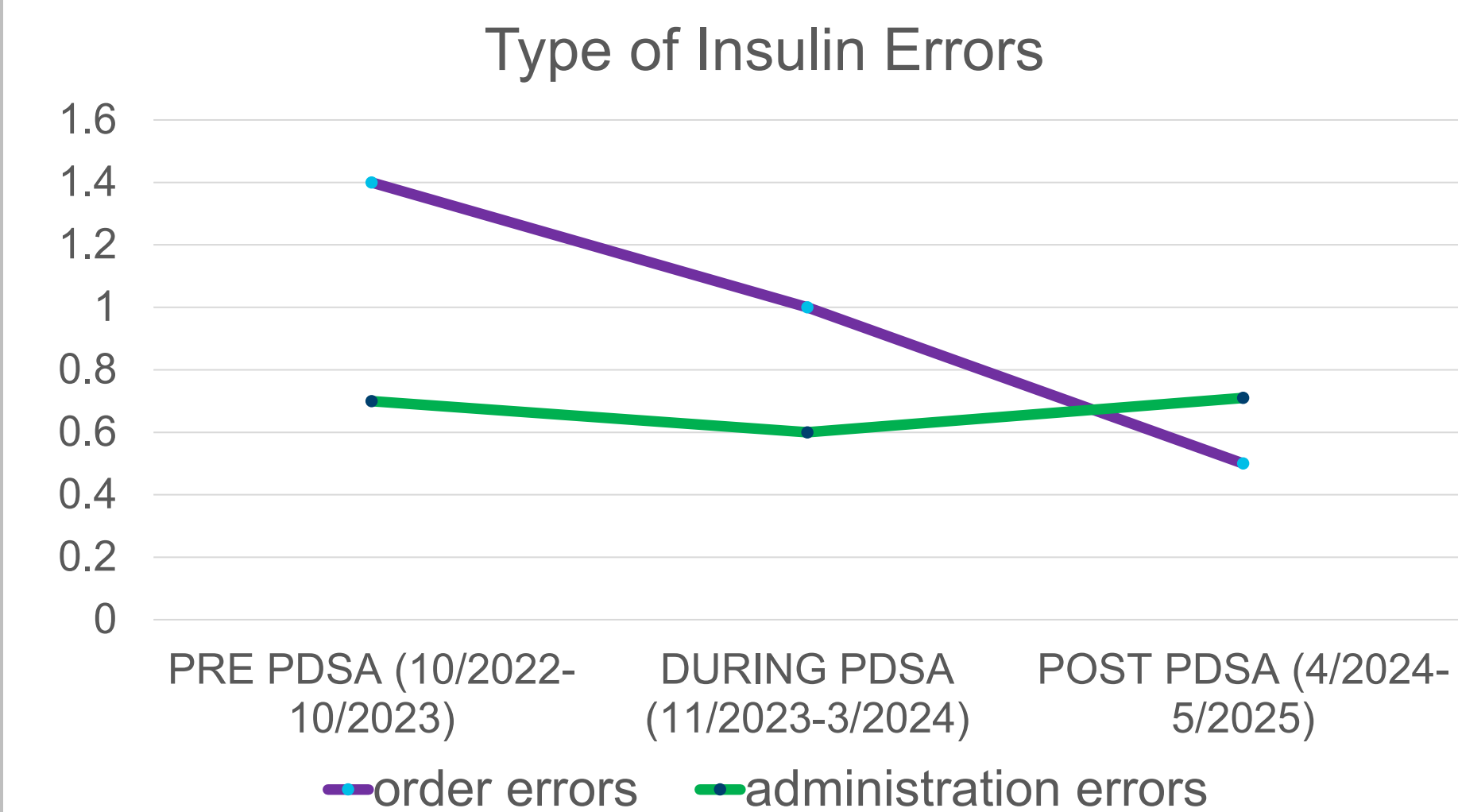
Yes - Patient has a history of INSULIN RESISTANCE and requires a high dose of insulin for correction.

No - Return and correct the Carbohydrate Ratio response.

## Results



total errors per month goal



- Following implementation of the MAR-based calculator and PDSA cycles, total subcutaneous insulin errors decreased by 50%

## Conclusion

- Use of a MAR-integrated insulin dosing calculator significantly reduces insulin errors in hospitalized pediatric patients with diabetes
- While order errors trended down throughout the PDSA cycles, administration errors increased post PDSA cycles
  - More investigative work is required to explain this uptrend
- Next steps include root cause analysis of administration errors and evaluation if reduced inpatient insulin errors was associated with reductions in inpatient length of stay

## Acknowledgements

Pediatric Diabetes Nurse Champions group

## Correspondence

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