Mass General Brigham

Electronic Insulin Calculator Implementation: A Collaborative Journey

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Challenges with Paper Algorithms for Insulin Adjustment

Insulin is a high-risk medication that requires dosage adjustments based on blood glucose levels

Mass General Brigham (MGB) nurses were using paper algorithms for dosage calculations, which complicated accuracy and protocol adherence

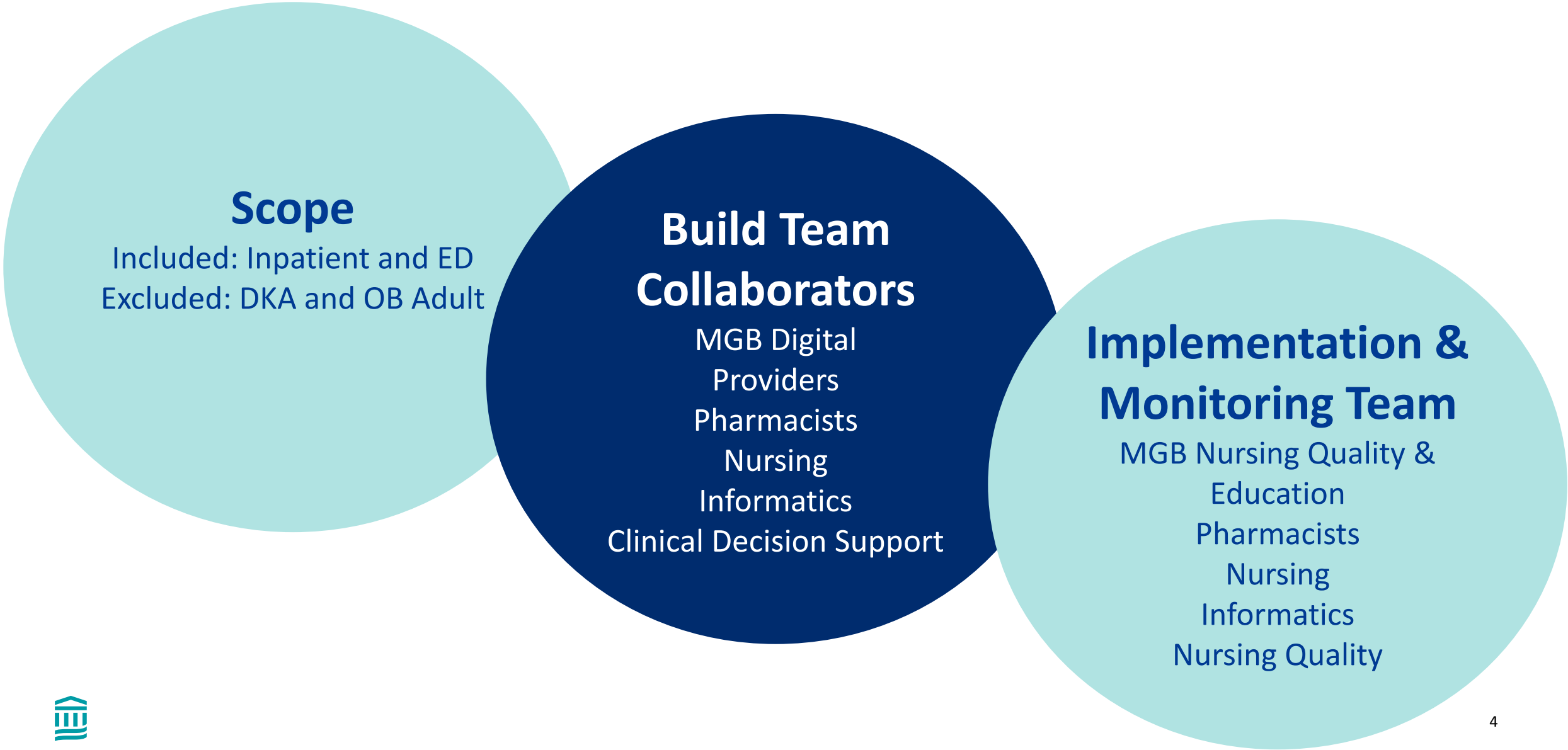
Table 2: ADJUSTMENT FACTOR (MULTIPLICATION) FACTORS					
CURRENT Blood Glucose	**CHANGE IN Blood Glucose** since the prior reading				
	DEcreased more than 30	**DE**creased 11-30	**No change** +/- 10	**IN**creased 11-30	**IN**creased more than 30
70-110	X 0.25	X 0.50	X 0.75	Continue Current Rate	X 1.5
111-150	X 0.50	X 0.75	Continue Current Rate	X 1. 25	X 1. 5
151-180	X 0.75	Continue Current Rate	X 1. 25	X 1.5	X 2.0
181-210	Continue Current Rate		X 1.5		X 2.0
Above 210	Continue Current Rate	X 1.5		X 2.0	

Goal to Standardize Practice Using an Insulin Calculator

MGB moved to an electronic calculator within the electronic health record (EHR) that uses an Insulin Sensitivity Coefficient (ISC) algorithm. The ISC algorithm provides benefits such as:

- ✓ Standardized orders and clinical decision support
- ✓ Dynamically adjusting insulin doses according to blood sugar levels and their rate of change
- ✓ Improved management of critically ill patients with varying insulin sensitivities
- ✓ Improved patient safety by eliminating human error with manual calculations

Scope, Collaborators, Implementation & Monitoring Teams

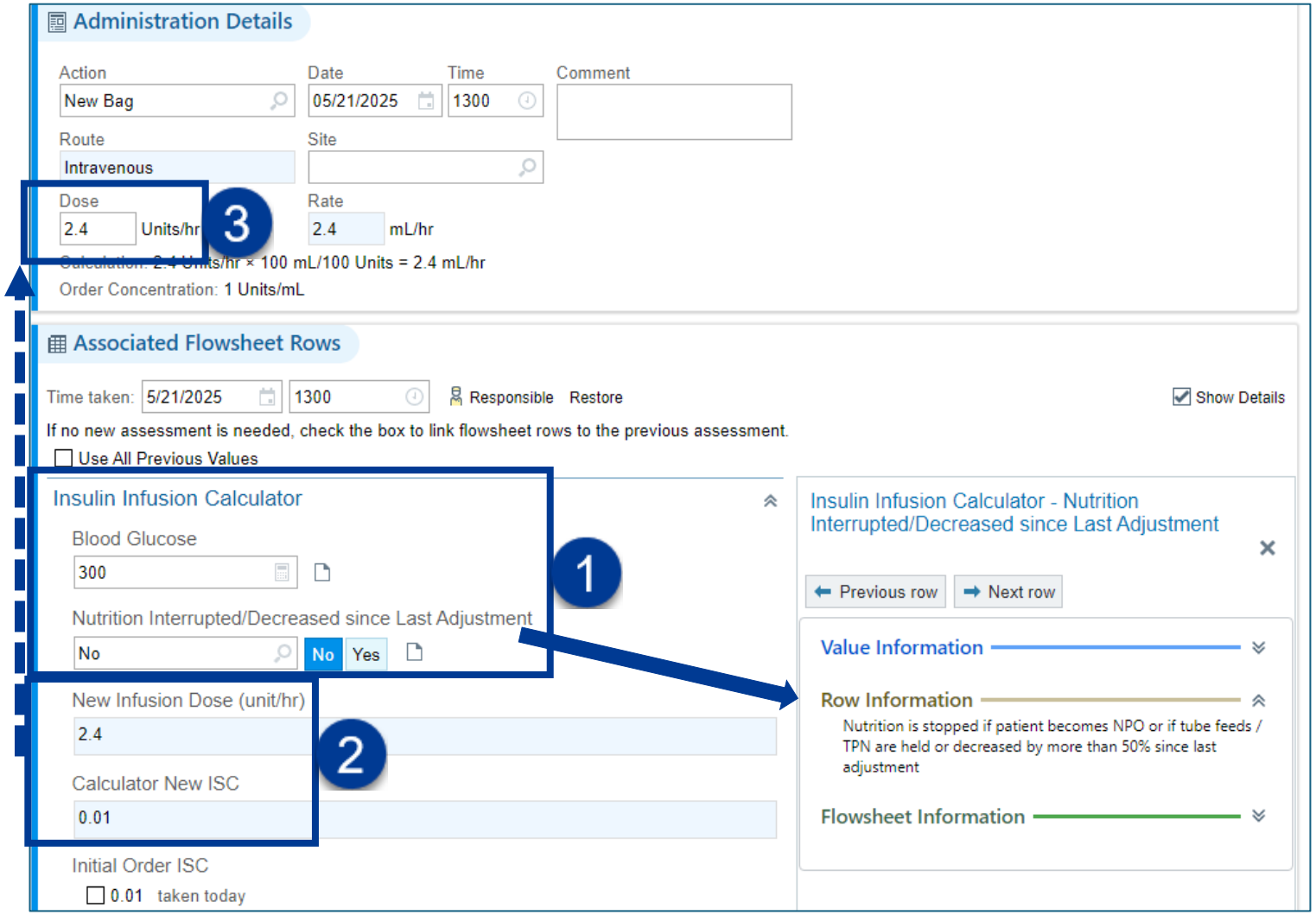


Insulin Calculator - MAR Flowsheet Rows

1. Nurse documents the Blood Glucose and if Nutrition Interrupted/Decreased Since Last Adjustment fields (all other fields are not edited by the nurse)

2. The New Infusion Dose (unit/hr) and Calculator New ISC values are calculated

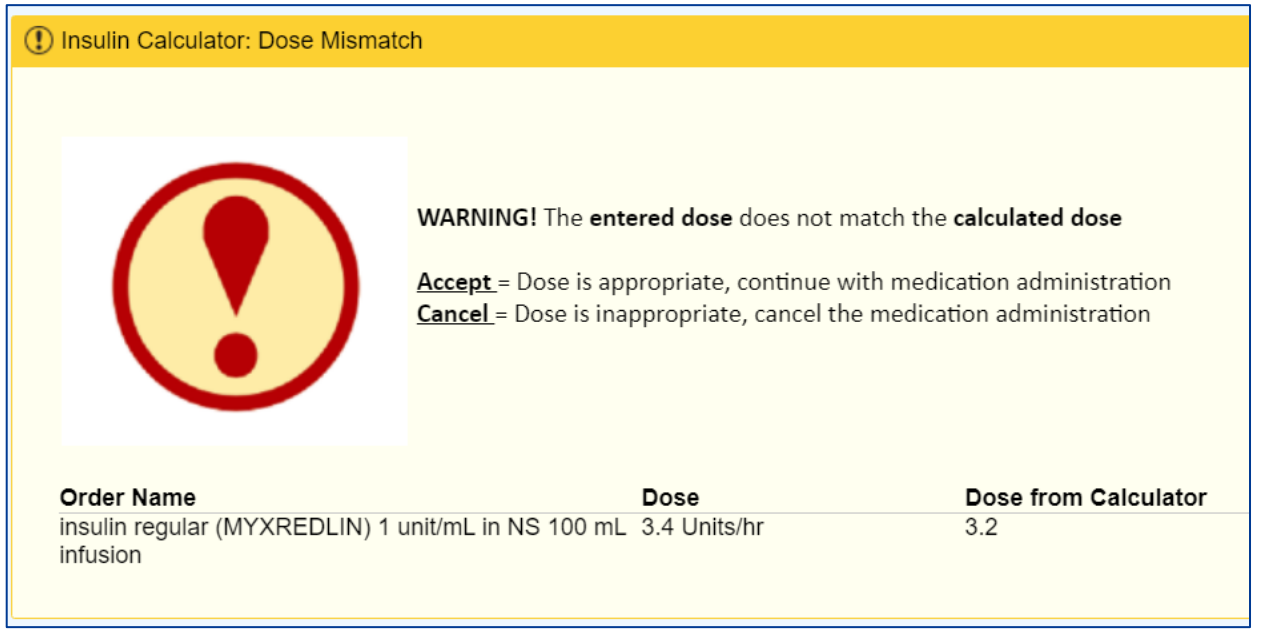
3. Nurse transcribes the value from the New Infusion Dose (unit/hr) field into the Dose field



Clinical Decision Support Advisories (CDS)

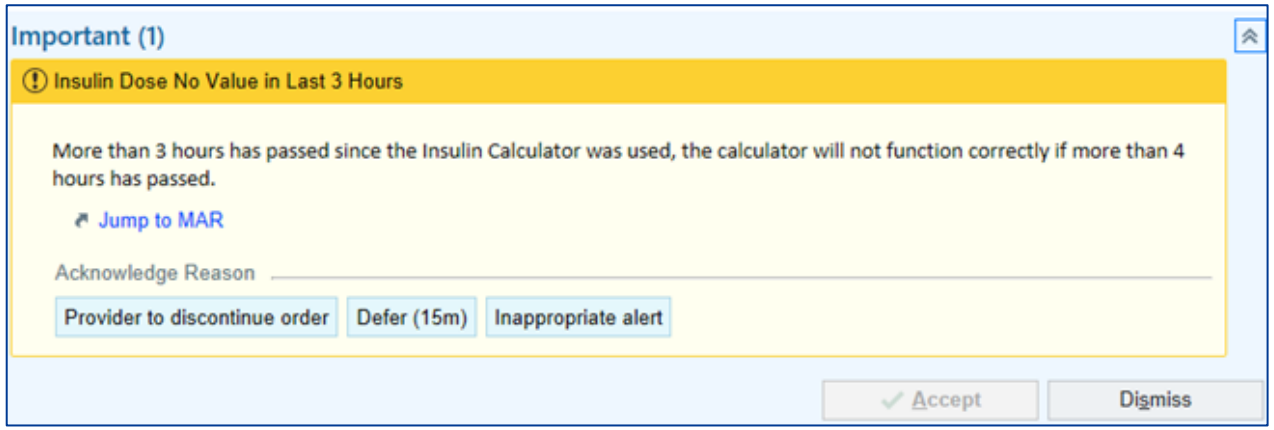
Dose Transcription Discrepancy in the MAR

- Appears if Entered Dose Does Not Match Calculated Dose



Timely Documentation of the Calculator Use

- Appears to the nurse when a patient has an active Insulin Calculator Order and more than three hours have passed without a New Bag or Rate/Dose Change MAR Action



Implementation Journey

3/12/2024 Big Bang Go Live at all MGB Sites

4 days post Go Live Insulin Calculator functionality backed out of EHR due to a look back error in the formula

6/4/2024 Updated Insulin Calculator piloted at BWH

Formula corrected and CDS optimized based on data from initial go live

9/25/2024 Expansion of updated Insulin Calculator to all MGB sites

Successful go live! Tools and reports provided to all sites to facilitate continued quality monitoring

Transition Strategy From Paper to Electronic Calculator

Training Tools

- Created online learning module that simulated live tool
- Playground environment available along with case studies for practice
- Tip sheets available from drug reference guides

Go Live Process

- Multidisciplinary collaboration to convert orders on go live day
- Conversion checklist created to standardize the process
- One-on-one support with the clinical nurse to convert patient to new calculator

Post Live Support

- Nurse educator team rounded 24/7 for real time support
- Daily list of patients on calculator sent to clinical leaders and pharmacists
- Daily touch point meetings 7 days post go live
- Shared tools and reports with clinical leaders for ongoing quality monitoring

Conversion Checklist

Insulin Sensitivity Coefficient (ISC) Calculator Conversion Checklist

Patients on BHIP or Portland Insulin Paper protocols will be converted to the Epic ISC calculator on 3/12/24.

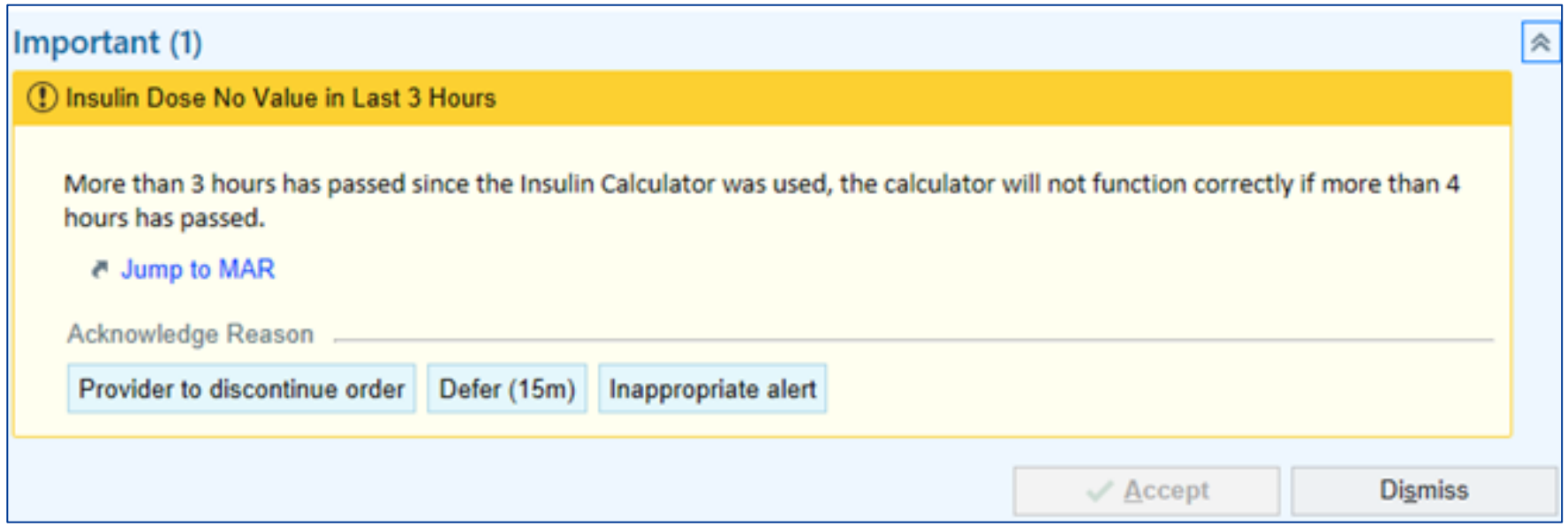
- Patients that will not be converted:
  - Patients on the provider driven protocol for DKA or HHS
  - Pregnant patients on OB BHIP

Below are the steps for the conversion process.

☐	PDM/ educator will identify nurses caring for patient on BHIP/Portland protocol after go live
☐	RpH, PDM/educator and RN will collaborate with the responding clinician to discontinue current insulin infusion order and write new Adult Insulin Infusion- Protocol Adjusted order during/ after rounds.
☐	When ready for conversion nurse will acknowledge new order in Epic and open Mar to view new order. Review ordered target blood glucose and ISC
☐	Scan patient and insulin bag
☐	**To transition the patient to the ISC calculator the following steps must be completed to initiate the ISC calculator.** Document MAR action as "Same Bag" unless hanging a "New bag"
☐	In **Administration Details on the MAR,** document only the: a. **Last** Date/Time insulin dose recorded, not the current time. b. **Last** Dose/Rate insulin recorded from the flowsheet /MAR Note: If the Date/Time documented in the administration details is a time prior to when the Epic order is entered the user will receive warning "Order is not yet active", select Continue
☐	In **Insulin Infusion Calculator section on the MAR**, document: a. Blood Glucose field: **Last** glucose recorded from Epic flowsheet. **b.** Nutrition Stopped Since Last Adjustment: **Select Yes or No As appropriate.** c. Dose Prior to Transition to Calculator/Downtime Dose: **Last** Dose/Rate insulin recorded. Will be the same Dose/Rate entered in the MAR Admin window) **Note: New ISC will be calculated, No New Rate will calculate**. d. Select **Accept**
☐	**Transition to calculator is complete, begin to use the Insulin Calculator at next hourly check of blood glucose.**
☐	**Dose Titration** When next hourly glucose check is done to make dose adjustment scan the patient and the insulin bag
☐	Begin by documenting within the **Associated Flowsheet Rows**. a. **To help use the Calculator, select Show Details.** b. Document the **Blood Glucose** and **Nutrition Stopped Since Last Adjustment** fields (all other fields are not edited by the nurse). **NOTE**: If the patient becomes NPO, or if tube feeds/TPN are held or decreased by more than 50% since the last calculator adjustment, enter Yes here. c. The **New Infusion Dose (unit/hr)** and **Calculator New ISC** values are calculated.
☐	Transcribe the value from the **New Infusion Dose (unit/hr)** field into the **Dose** field and click "Accept"
☐	Confirm correct new dose is programmed on the infusion pump
☐	Repeat steps for Dose Titration for next hourly glucose check

Lessons Learned: Clinical Decision Support (CDS)

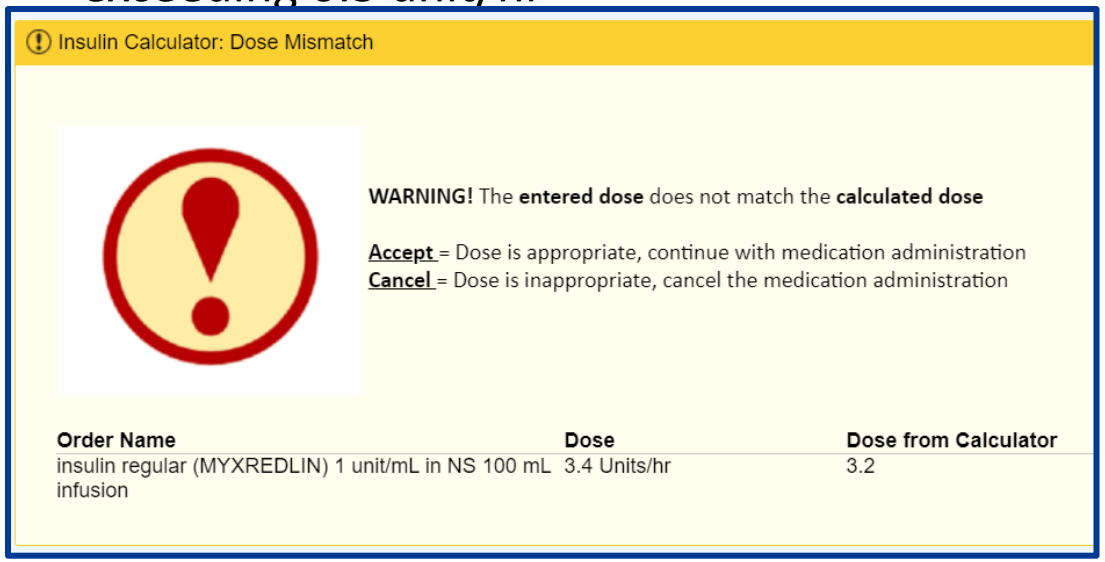
- Decision support is an integral tool when it triggers appropriately and supports nursing workflow
- Use objective data to make decisions on the utility of the clinical decision support
  - ➢ Clinical staff reported the over alerting of the CDS, data confirmed the number of alerts
- Electronic tools are real time, paper actions are often delayed
  - ➢ Consider the impact of other technologies on the implementation



Lessons Learned: Consider Impact of "Other" Technologies

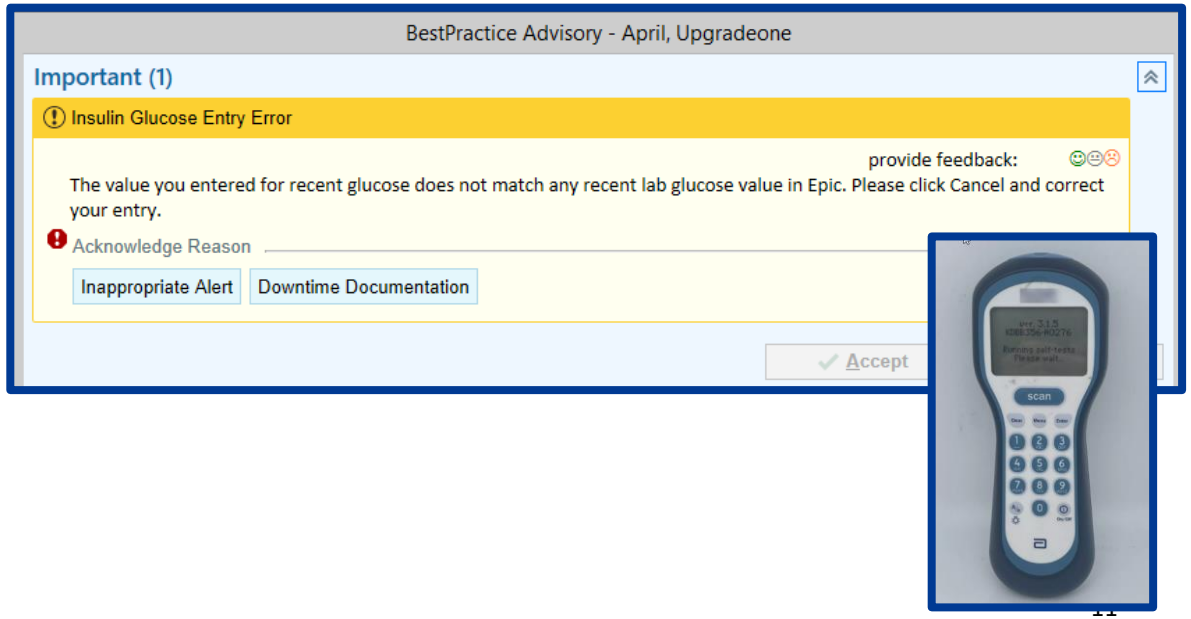
Dose Discrepancy:

- The electronic calculator could calculate doses as low as 0.1 unit/hr, while infusion pumps only deliver 0.5 unit/hr, leading to overfiring
- The CDS was adjusted to trigger for doses exceeding 0.5 unit/hr



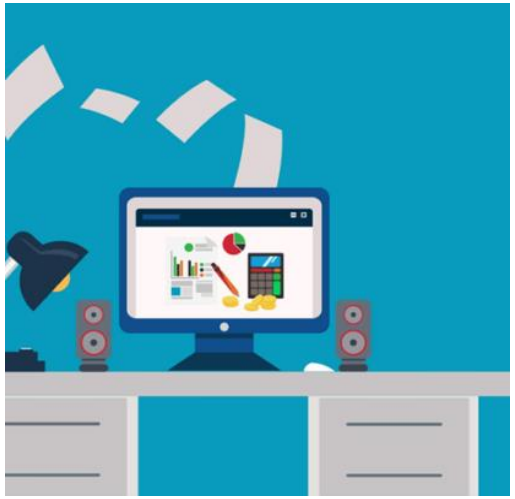
Timely Documentation

- Delays in the glucose results uploading to the EHR caused an over alerting of the decision support
- The CDS was turned off



Lesson Learned: Workflow Redesign

- Identify all paper workflows to avoid potential challenges after go live
  - Create a nonjudgmental forum for stakeholders to share all workarounds
- Testing scenarios should simulate real life clinical practice
  - Utilizing a simulation lab may have demonstrated workflows not reported
- Muscle memory is hard to change!
  - Paper workflow did not require documentation when glucose is in target range
  - Electronic workflow requires hourly documentation of glucose for the calculator to work correctly, even when glucose is in target range
- Any opportunity to pilot a project will yield great findings



Conclusion

Continued Education

- Nurses/pharmacists who have not used the calculator since go live
- New hires

Share Outcome Data

- Targeted monitoring of calculator use
- Research in progress to analyze data
  - # of patients on the insulin calculator
  - # of episodes of hyper and hypoglycemia
  - Time to target glucose
- Will build trust with the new functionality

Forums for Staff Feedback

- Review outcome data for any opportunities to optimize workflow and technology
- Utilize shared governance councils for regular staff feedback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