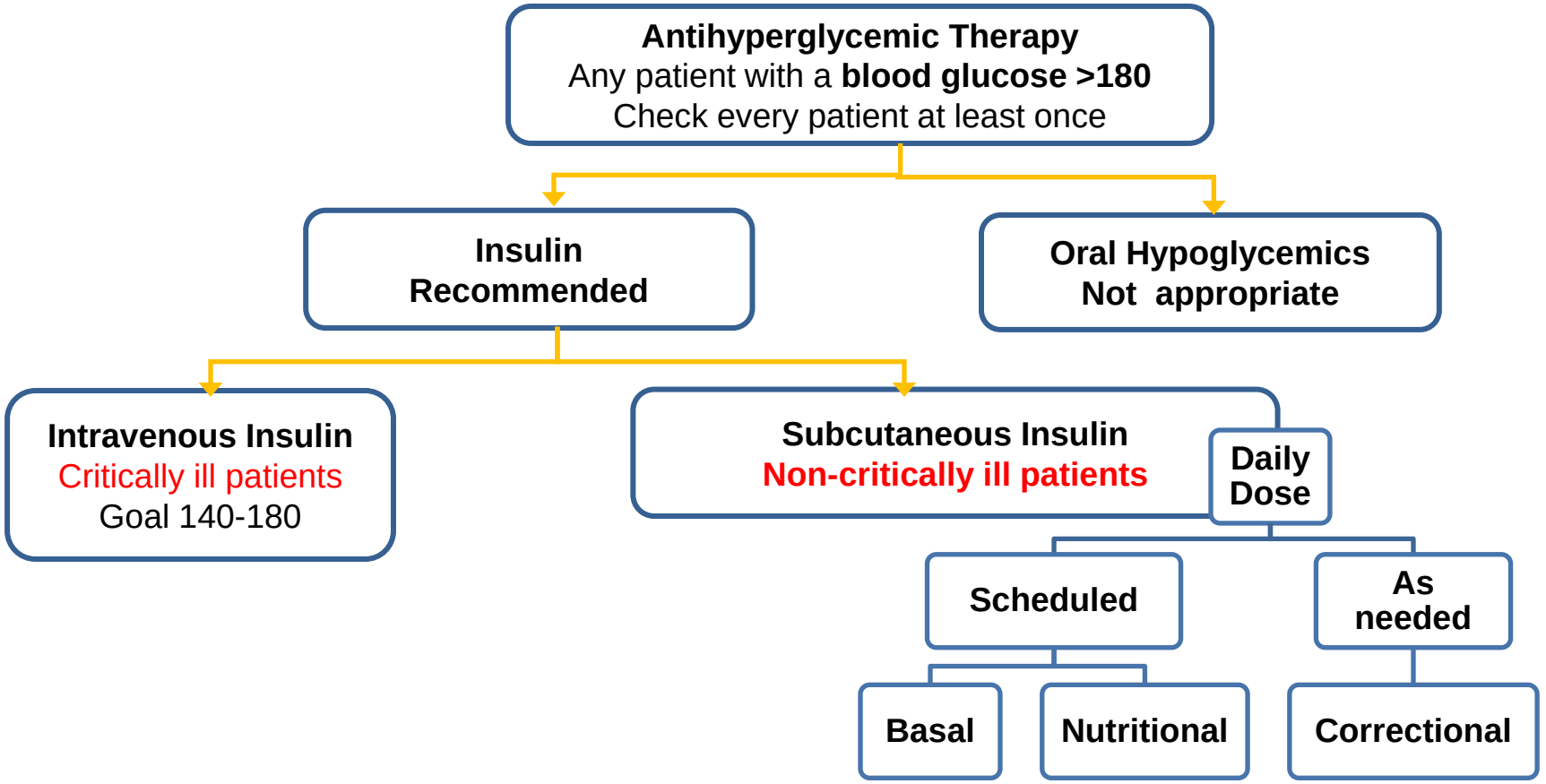
Improving Glycemic Control in the Non-Critical Care Setting

Current Inpatient Guidelines
for Anti-hyperglycemic Therapy



Learning Objectives

- Subcutaneous **basal/bolus insulin** in the Non-Critical Care Setting

- Apply better **coordination and communication with bedside nursing** related to **timing** of patient nutrition related to delivery of care and calorie/carbohydrate calculations within a Non-Critical Care Unit.

- Develop or improve **protocols** around subcutaneous order sets, DKA order sets, transitioning from IV to subcutaneous insulin, hypoglycemia protocols, transitions out of the hospital, and patient/frontline education within a Non-Critical Care Unit.

ADA/Endocrine Society Target Glucose Levels in Non–Critical Care Patients

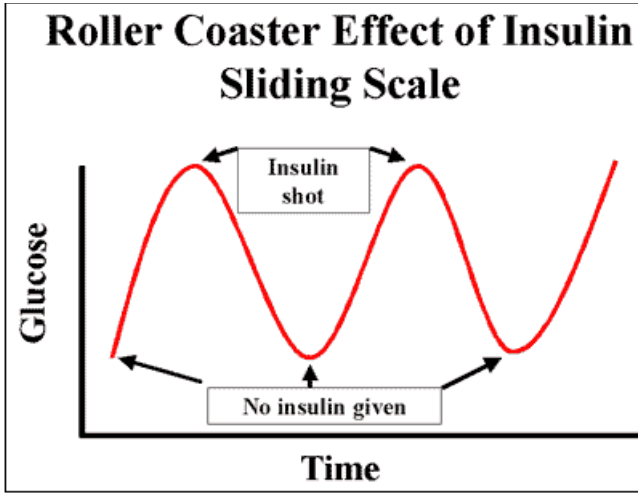
- Endocrine Society (2012)
  - **Premeal glucose targets 100-140 mg/dL**
  - **Random BG <180 mg/dL**
  - To avoid hypoglycemia, reassess insulin regimen if BG levels fall below 100 mg/dL
  - Occasional patients may be maintained with a glucose range below and/or above these cut-points
- American Diabetes Association (2016)
  - Target 140–180 mg/dL most patients
  - Certain groups <140 mg/dL
  - Certain groups with higher targets (terminally ill or comorbities)

Hypoglycemia = BG <70 mg/dL
Severe hypoglycemia = BG <40 mg/dL

1. Umpierrez, GE; Hellman, R; Korytkowski, M; Kosiborod, M; Maynard, G; Montori, VM, Seley, JJ; Van den Berghe, G. (2012). Management of Hyperglycemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline. (2012). J *Clin Endocrinol Metab* 97: 16–38
2. *Diabetes Care* 2016; 39 (Suppl. 1): S99-S104

How do we achieve target glucose?

- Orals
  - Hold them all



- Insulin
  - **Sliding Scale** – **What is sliding scale insulin therapy?**
    no longer used, too many highs and lows
  - **Basal / Bolus** – preferred, most physiologic
  - Insulin Drip – basal insulin for acutely or critically ill

When to Use Basal/Bolus Insulin?

Immediately at the time of admission for:

- All patients with type 1 diabetes
- Patients with type 2 diabetes (T2DM) if…
  - They are on insulin prior to admission
  - They are known to be poorly controlled (*high A1c, BG>180 mg/dL*)
  - They are known to require multiple doses of oral agents that will be *held* in the hospital

During hospitalization

- Any patient with blood glucose levels consistently above the target range (>180 mg/dLx2 in 24 hrs)

What Are Other Factors To Consider?

- **Outpatient**
  - Outpatient regimen
  - Following regimen?
  - Control? Last A1C?
  - Diet
  - Activity level

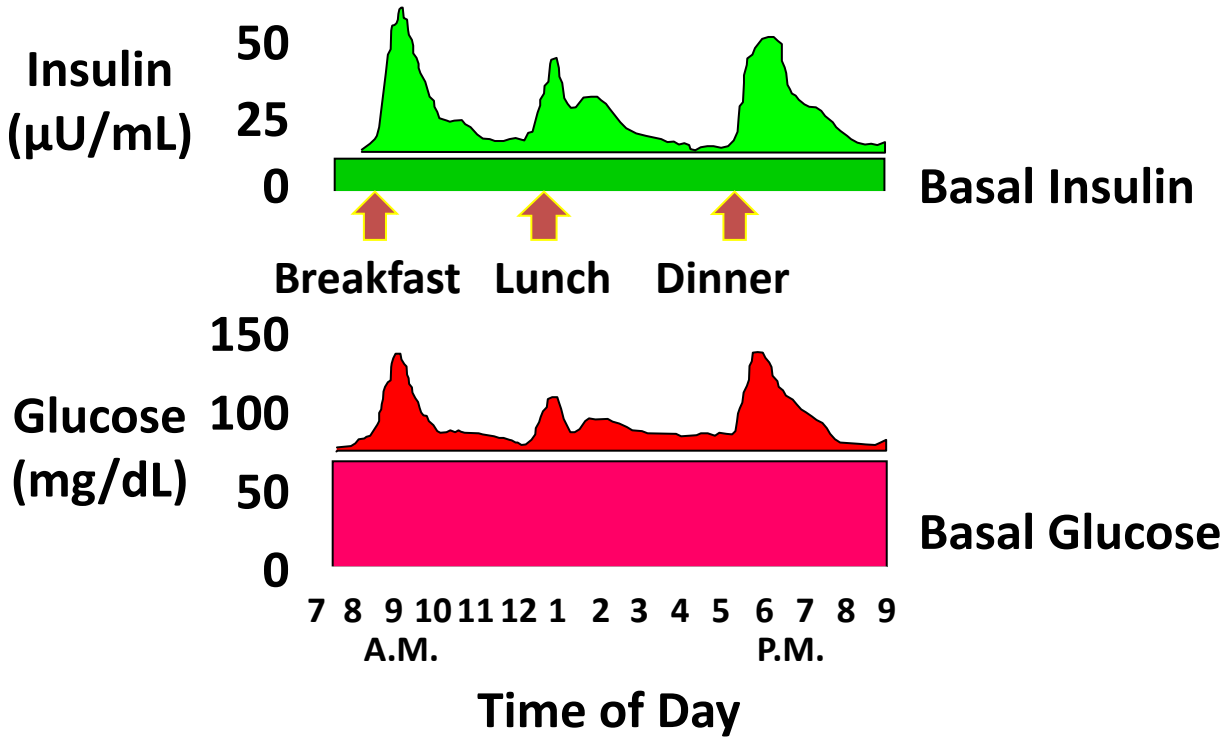
- **Inpatient**
  - Dietary changes (↓)
  - Activity changes (↑)
  - Active infection/illness (↑)
  - Steroids (↑)
  - Pressors (↑)
  - Parenteral nutrition (↑)
  - RN Providing Regimen (↓)
  - What medications are still on board when admitted?

(↓) (↑)= effect on blood sugar

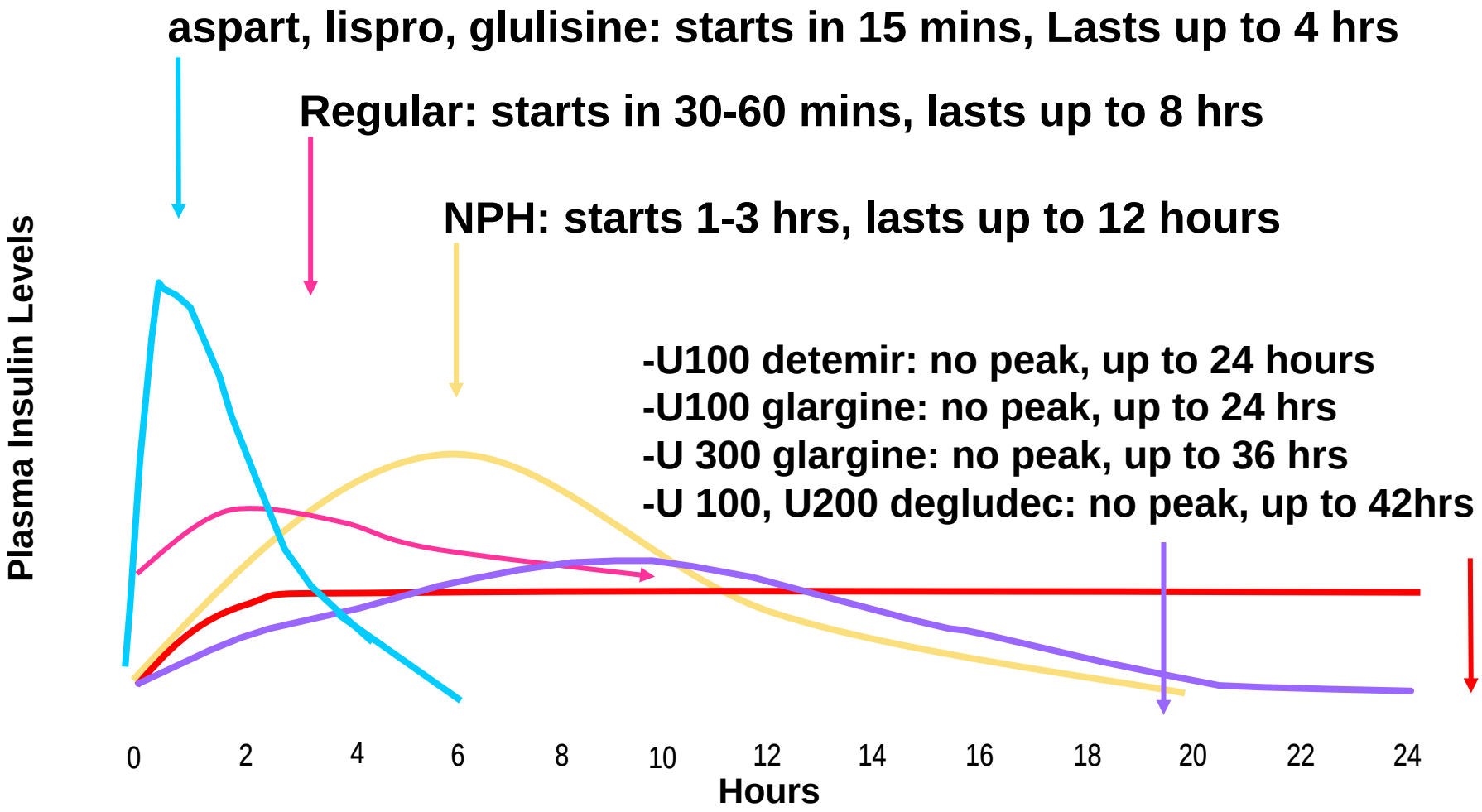
Physiologic Insulin Secretion: **Designing an Insulin Regimen**

Insulin Requirements:

1. Basal
1. Nutritional
2. Correctional

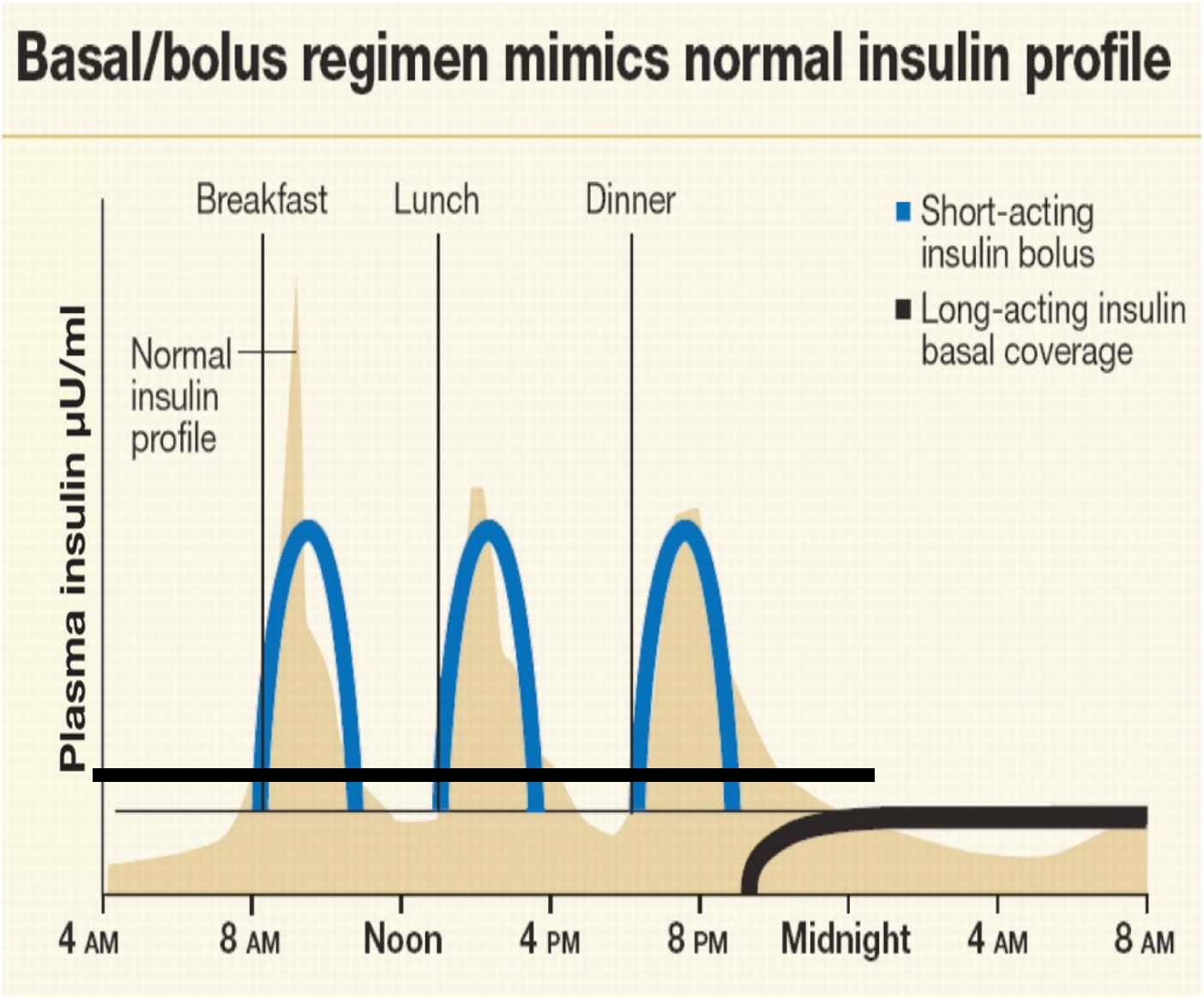


Human & Analog Insulin in US



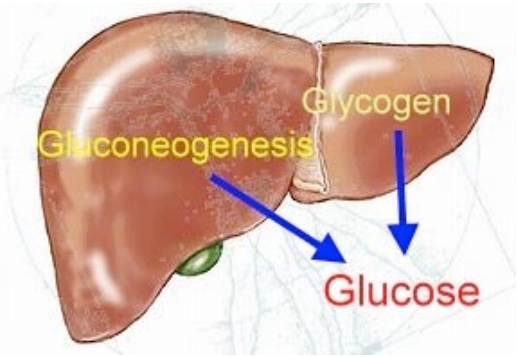
Adapted from American Diabetes Association. *Diabetes in the Latino Population.* Available at: http://www.diabetes.org/uedocuments/LatinoSlidesAugust05.ppt.

Basal/bolus regimen mimics normal insulin profile



Magaji V , Johnston J M *Clin Diabetes* 2011;29:3-9

Basal Insulin

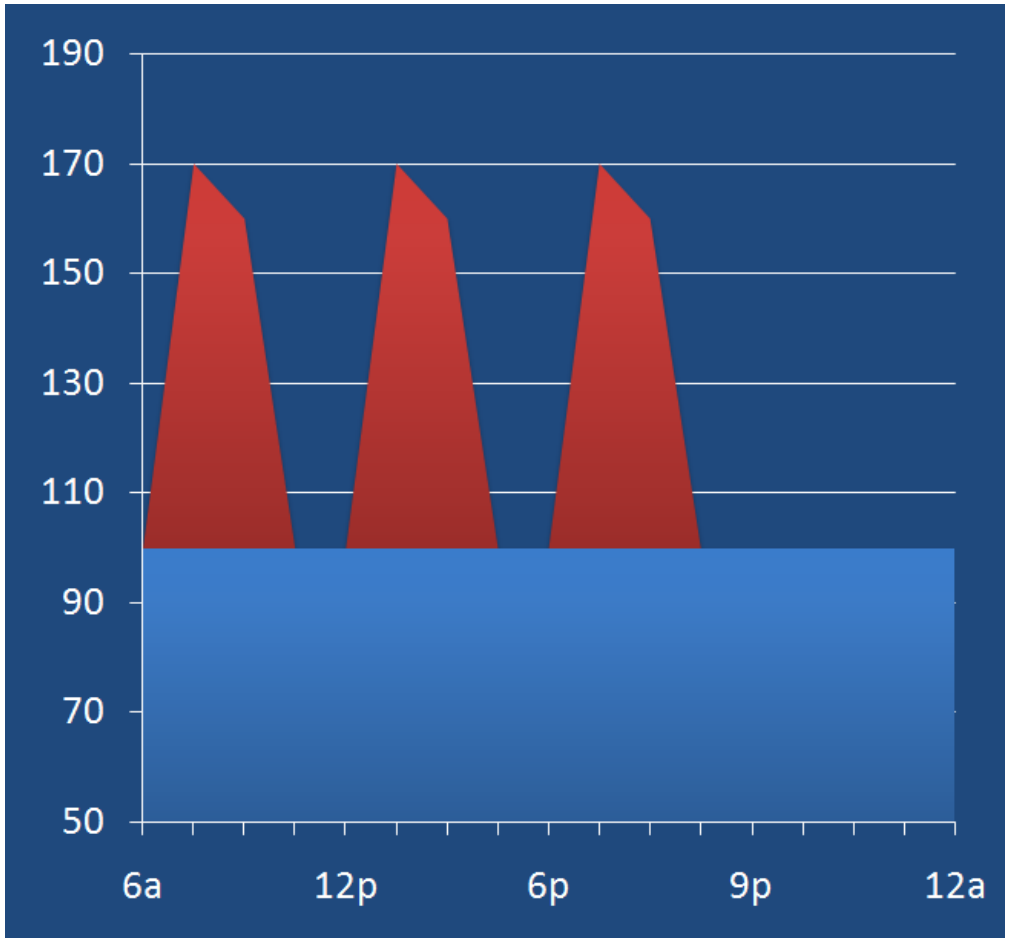


- Long-acting, no peak
- Purpose: suppresses hepatic glucose production (HGP) overnight and ketone production
- Required at all times in T1DM patients, even when NPO
- Most T2DM patients will require basal insulin in the hospital
- Estimated to be ~1/2 of the total daily dose (TDD) of insulin

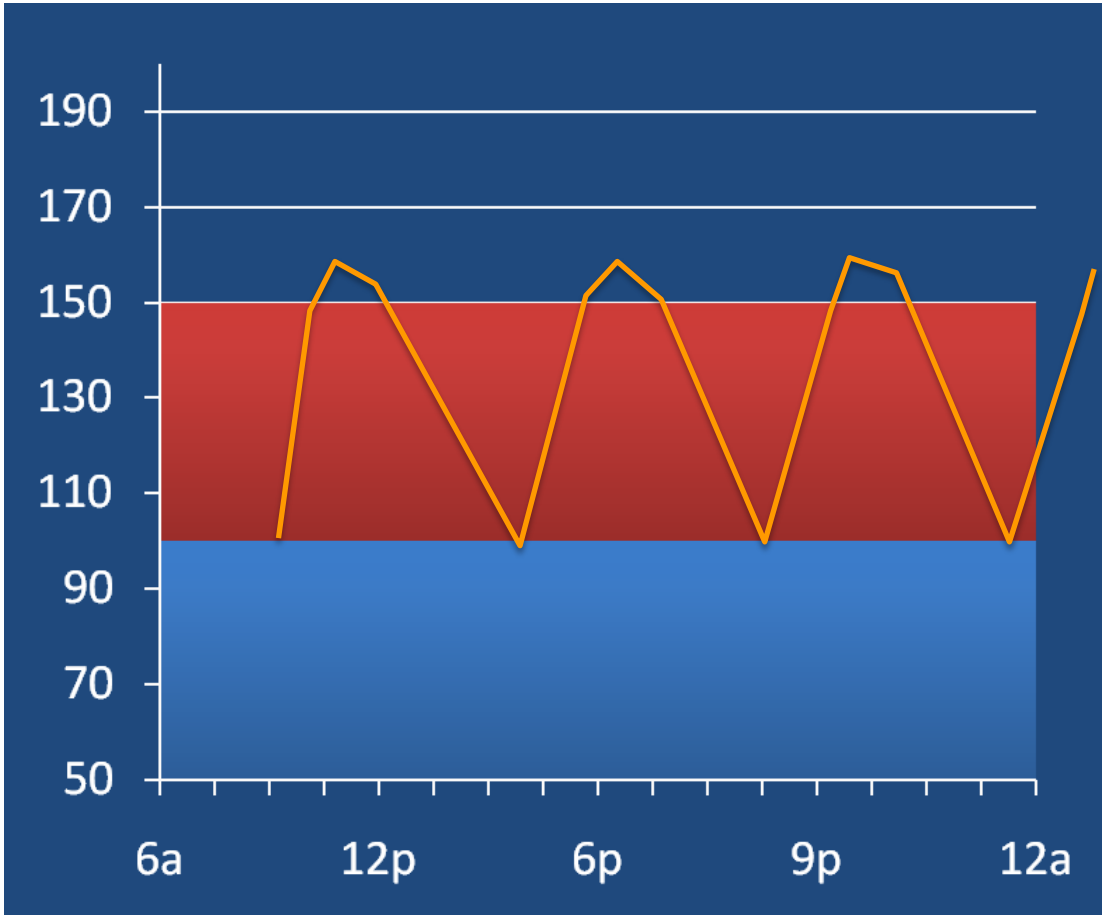
Nutritional Insulin

- Purpose: covers food
- Rapid-acting insulin analogue (preferred) or regular insulin for patients who are eating meals
- Should not be given to patients who are NPO
- Must be matched to the patient's nutrition pattern:
  – e.g. eating 3 meals reliably
- Can be estimated to be about ½ of total daily dose (TDD) of insulin

Eating meal or receiving bolus tube feeding (TF): use prandial coverage



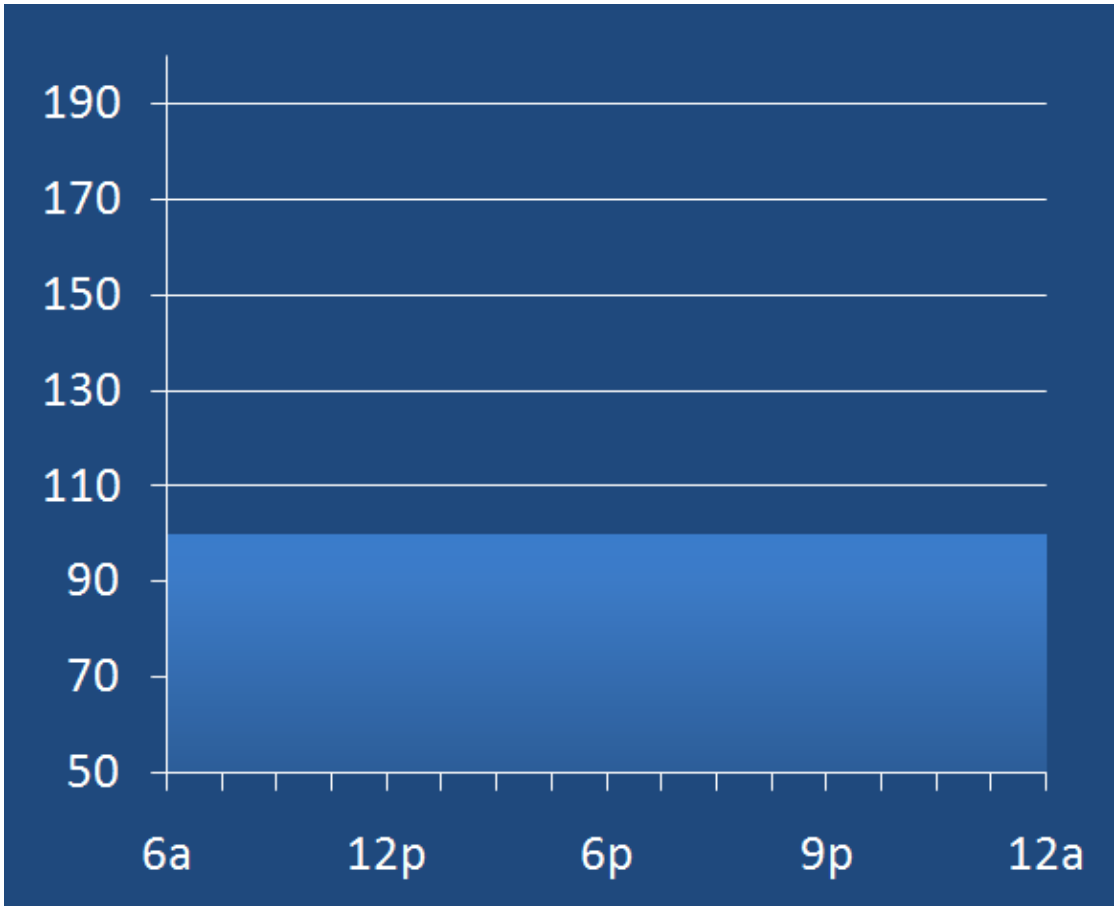
Patient receiving continuous TF or TPN: several options



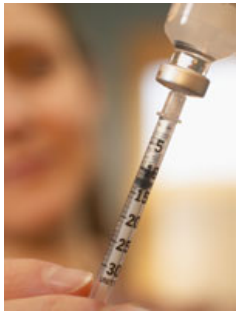
Continuous nutrition coverage options:

- Rapid acting **q4hr**
- Regular **q6hr**
- Intermediate NPH **q12hr**
- Long acting **q12-24hr**

NPO Patient: still requires *basal*



Correction Insulin



- Purpose: Correct hyperglycemia back to target
- Extra insulin given to *correct* hyperglycemia
- Rapid-acting (preferred) or regular insulin: usually the same insulin as the nutritional insulin)
- Can be given when NPO (even if rapid-acting)
- If correctional insulin is required often, or in high doses: consider modifying basal and/or nutritional insulin doses

Designing Insulin Regimens

- **Basal insulin**: Use non-peaking, longer acting insulins
  - Glargine or detemir are preferred
  - NPH possible, not preferred
- **Nutritional insulin**: Depends on type of nutrition
  - Rapid-acting insulin preferred when pts are eating meals
  - Regular insulin possible, not preferred
- **Correctional insulin**: Use rapid-acting (preferred) or regular insulin
  - Usually the same as the nutritional insulin

Principles of **Basal/Bolus** Insulin Dosing

1. **Total Daily Dose** (TDD): Estimate how much insulin patient needs throughout the day if eating meals

1. Assess patient's **nutritional status**

3. Divide the TDD into **50%** basal insulin and **50%** nutritional insulin

4. Add a **correction scale** based on the patient's expected insulin sensitivity (e.g. low, medium, high)

5. **Assess BGs** daily, adjusting insulin doses as needed

STEP 1: Estimate Amount of Insulin Patient Will Need Over One Day If Getting Adequate Nutrition = TDD

- For patients already treated with insulin, consider pre-admission subQ insulin regimen if known & glycemic control on that regimen HINT: Get A1c early…

- **Weight-based** estimate:
  - TDD = 0.3-0.8 units per Kg depending on sensitivity
    - Lower end more conservative, use in:
      - DM1, insulin sensitive or naïve, elderly, renal impairment, hypoglycemia risk factors
    - Higher end more aggressive, use in:
      - Known insulin resistance, steroids

STEP 2: Assess the Nutritional Status

- **Eating meals or receiving bolus tube feeds**
- Eating meals but with unpredictable intake
- Getting continuous tube feeds
- Getting tube feeds for only part of the day
- Getting parenteral nutrition
- NPO

STEP 3: Divide the TDD into approximately 50% basal insulin and 50% nutritional insulin

- Basal Insulin about 1/2 of TDD

- Nutritional insulin makes up the remaining 1/2 of TDD

50:50

STEP 4: Add a correction scale based on expected insulin sensitivity

- Correction scales vary from low to high dose
- Need more than one to fit varying levels of insulin sensitivity
- At least a low dose (sensitive) and high dose (resistant) scale should be available, more options help prescriber tailor to patient's needs

Our Approaches

	UCSD San Diego	VMMC Seattle	NYPH New York
Order Set	Computer (EPIC)	Computer (Cerner)	Computer (Sunrise)
BG Target	100-180 mg/dL	100-180 mg/dL	100-180 mg/dL
SubQ Protocols: Total Daily Dose (TDD)	Weight based 0.3 units/kg DM1,lean, renal impairment 0.4 units/kg standard 0.5-0.6 units/kg DM2, resistant, steroids	Weight based 0.3 units/kg	Weight based 5 levels: NPO, very low dose, low dose, medium dose, high dose 0.2 units/kg – 0.6 units/kg TDD
Correction Scales	Low, moderate, high and custom	Customizable-Cerner calculates insulin correction factor based on TDD	NPO, very low dose, low dose, medium dose, high dose all customizable

Now how do you write these orders?

Order sets are KEY!

Enhancing insulin-use safety in hospitals: Practical recommendations from an ASHP Foundation Expert Consensus Panel

Cobaugh D, Maynard G, et al. *Am J Health-Syst Pharm* 2013;70:1404-13.

Table 1.
Expert Panel-Identified High-Priority Insulin Errors, by Phase of Medication-Use Process

Order Sets Can Prevent Errors

Phase	Error
Prescribing	Incorrect dosage/irrational insulin orders
	Nomenclature-related errors
Transcribing	Incorrect transcription of verbal or telephone orders
	Transcription of an incorrect dose
Dispensing and storage	Failure to double-check insulin products (i.e., preadministration)
	Look-alike containers
	Unsecure and/or non-segregated storage in patient care areas and/or pharmacy areas
Administering	Administration of incorrect doses
	Incorrect use of insulin pens
	Name confusion
	Relationship of insulin administration to nutrition
Monitoring	Failure to appropriately monitor for insulin effects and adjust dose accordingly

Steps for Developing and Implementing Protocols & Order Sets

- Form a glycemic control **steering committee**
- Assess current care processes**, identify barriers**
- **Choose best practices** & preferred regimens
- Integrate best practices into glycemic control protocol
- Crystallize protocol into one page summary sheet
- *Monitor use of your order sets and protocol*
- Find slow adopters to protocol and intervene
- Revise order sets & protocols as needed

Integrate Best Practices into Protocols, Order Sets & Documentation

- Share glycemic targets, Obtain A1c early
- Controlled carbohydrate meal plan / dietary consults
- Patient education plan & resources
- Hypoglycemia protocol
- Coordinated BG monitoring / nutrition / insulin
- DC oral agents, insulin preferred
- Insulin regimens for conditions e.g. steroids, TF
- Dosing guidance: starting doses, **titration algorithms**

INPATIENT HYPERGLYCEMIA MANAGEMENT OF THE NON-PREGNANT ADULT

Target inpatient blood glucose levels: 100-180 [1]

Consider a diabetes/ endocrine or medicine consult.

Step 1: Discontinue non-insulin antihyperglycemic agents[2]

Step 2: Calculate the estimated total daily dose (TDD) of insulin patient may require; consider adjusting this up or down based on pt's home regimen and their A1C:

- Standard (pt w/ normal body habitus): 0.4 units/kg/day
- If pt very lean, on hemodialysis or very sensitive to insulin (hypoglycemia risk factors): 0.3 units/kg/day
- If pt overweight: 0.5 units/kg/day
- If pt obese, on steroids, or known to be insulin-resistant: 0.6 units/kg/day (or more)
- If transitioning off of an iv insulin infusion, call pharmacy for assistance and take the average hourly rate over the last 6 hours and multiply by 20:
  - -if pt was receiving nutrition (tube feeds, TPN, D5 > 50 mL/hr or eating), this is the estimated TDD
  - -if insignificant nutrition during the last 6 hours, double the number to determine estimated TDD

Step 3: Determine the *distribution* of the TDD calculated above based on nutrition regimen.

If pt eating or receiving bolus tube feeds[3]:
Check blood glucose qac and qhs
Basal insulin: glargine (Lantus) -- 0.5 x TDD, Given once daily
Nutritional insulin: lispro (Humalog) -- 0.16 x TDD, Give with each meal
Correction insulin, in addition to nutritional insulin: use CPOE default values (adjust if necessary)

If pt receiving continuous infusions of tube feeds or parenteral nutrition[4]:
Check blood glucose q6h
Basal insulin: glargine (Lantus) -- 0.5 x TDD, dosed once a day
Nutritional insulin: regular insulin -- 0.125 x TDD, given q6h
Correction insulin, in addition to nutritional insulin: use CPOE default values (adjust if necessary)

If pt NPO (or nearly NPO, taking Zero Carb clear liquids only)[5]:
Check glucose qac/hs or q6h
Basal insulin: glargine (Lantus) -- 0.5 x TDD, dosed once a day
Nutritional insulin: none (discontinue previous)
Correction insulin: recommend regular insulin scale q 6 hours if pt NPO > 24hrs, otherwise lispro is OK
Consider starting low-dose dextrose infusion (D_5½NS at 75mL/hr)

Step 4: Re-evaluate & adjust the TDD daily based on the glycemic control of the previous 24h:

- If any glucose > 180, and no threat of hypoglycemia, increase TDD by 10-20%
- If glucose consistently > 180-200, increase TDD by 30%
- If any episodes hypoglycemia (FS < 70), decrease TDD by 20% and consider starting D51/2NS at 75cc/hr

UC San Diego Health System

See reverse for special situations[6] *& more information about footnoted items*

Insulin Terminology:
Basal insulin: long-acting insulin required **at all times** in patients with Type 1 diabetes (and in most patients with Type 2 diabetes) to maintain euglycemia, ***even when NPO*** *(hepatic gluconeogenesis can serve as a continuous source of blood glucose).*

Nutritional insulin: scheduled short-acting insulin given with a meal, to prevent the glycemic spike that occurs due to carbohydrate ingestion (*given even when the pre-meal blood sugar is in the normal range*). Also refers to scheduled insulin given to cover the carbohydrate load from tube feeds or parenteral nutrition.

Correction insulin: short-acting insulin meant to lower high blood sugars given in addition to scheduled nutritional insulin, also given to treat hyperglycemia in NPO patients. If correction insulin dose is consistently required, consider increasing TDD insulin.

1- Target blood glucose range
For patients on insulin, pre-meal blood glucose target is 100-140 mg/dL with a random blood glucose target of less than 180 mg/dL. Less stringent targets may be appropriate in patients with severe comorbidities (i.e., end-stage disease or in whom hypoglycemia is a significant concern.)

2- Stopping oral medications
Oral anti-hyperglycemic agents and injectable non-insulin therapies are not indicated for the management of inpatient hyperglycemia.
Adjustments in these oral medications take too long to be effective in the hospital and most oral medications have significant side effects or contraindications in the hospital setting.

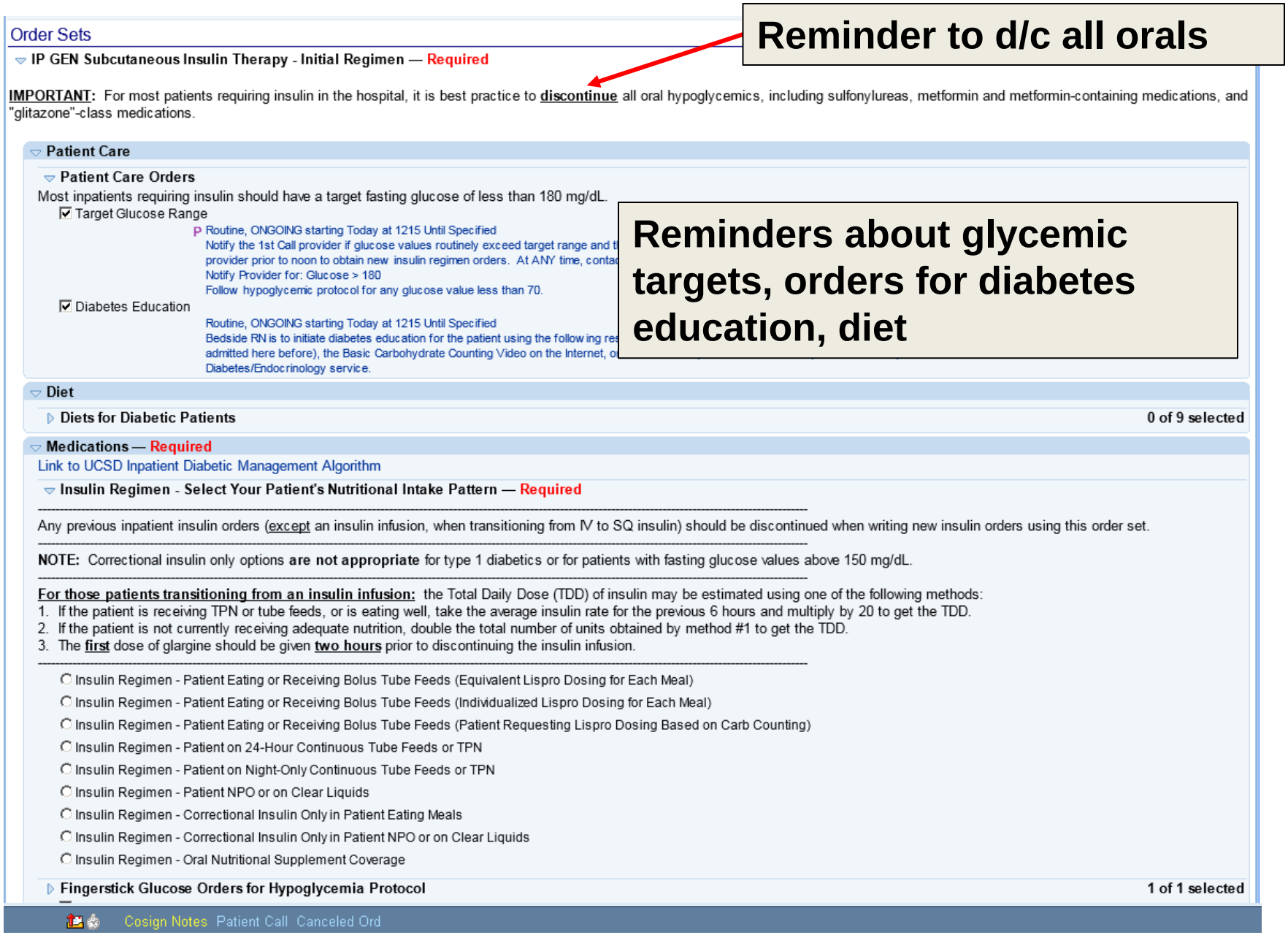
3- For patients eating meals or receiving bolus tube feeds
Glargine insulin is the most physiologic basal insulin and is recommended in these patients. Lispro insulin is more appropriate than regular insulin for nutritional doses due to its shorter, more predictable half-life and correspondence with meal times. Using the subcutaneous insulin orderset will allow for adjusted doses based on percent nutritional intake.

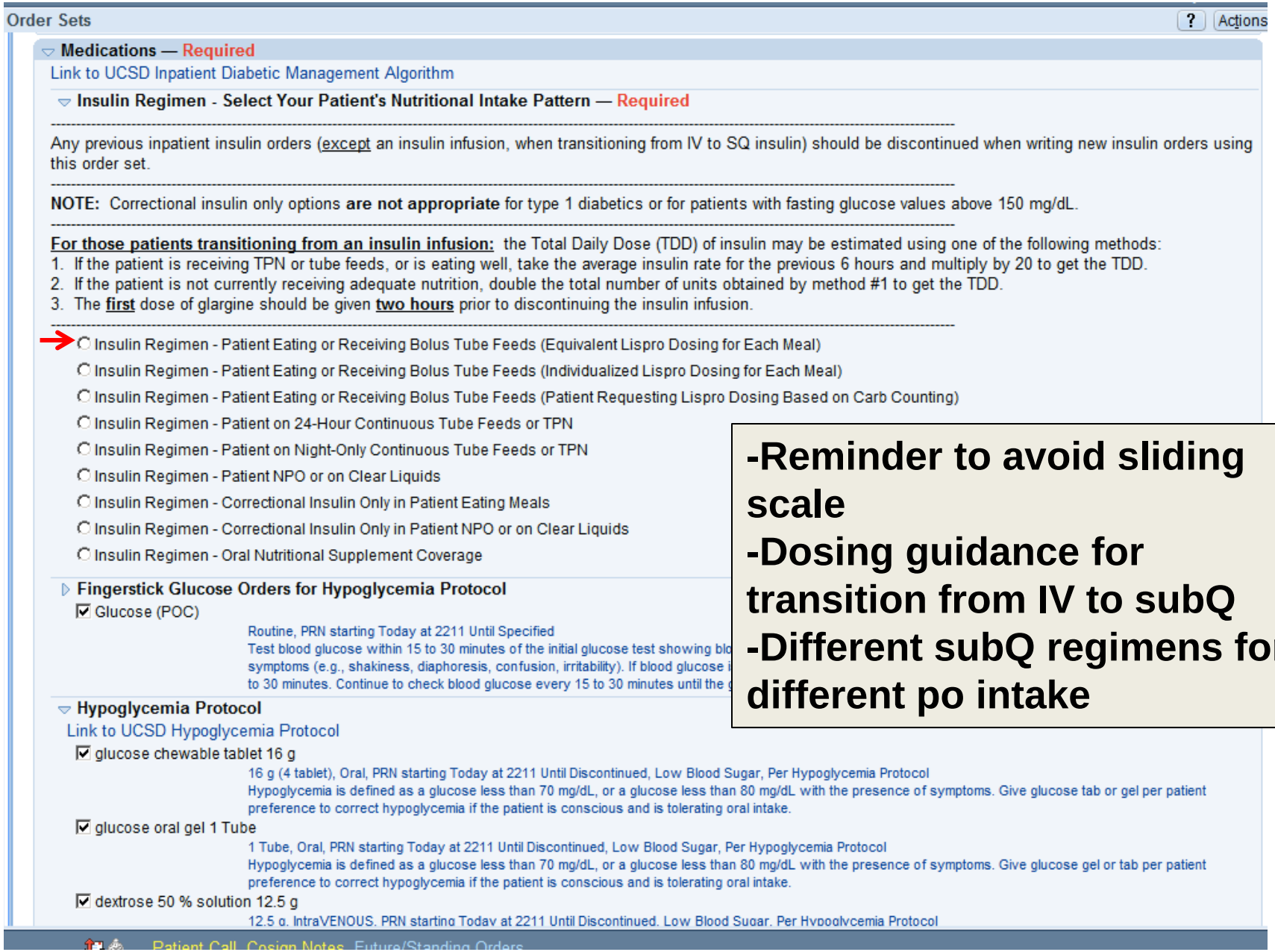
4- For patients receiving continuous enteral or parenteral nutrition
A. Consider using an insulin infusion for optimal control in this setting. Keep insulin separate from TPN until a stable dose is reached.
B. Glargine insulin is the most physiologic basal insulin and is recommended in these patients. Regular insulin is recommended as the nutritional insulin. Because of its longer half-life, it is better suited to continuous nutritional sources and can be dosed q6h I nstead of q4h.
C. If the tube feeds or parenteral nutrition are held or interrupted, the nutritional regular insulin doses should also be held. See: "Nutrition on Hold Unexpectedly Guideline."

5- For the NPO patient
Glargine insulin is the most physiologic basal insulin and is recommended in these patients. Nutritional or scheduled short-acting insulin should not be given to patients without a nutritional source. Correction insulin should be used to correct hyperglycemia when a patient is NPO. If NPO greater than 24 hours, regular insulin is recommended.

6- Special Situations
A. If patient is receiving nocturnal tube feeds, utilize the Nocturnal Tube Feeding orderset with scheduled regular insulin coverage.
B. If transitioning off of IV insulin infusion, see Step 2 of chart, call pharmacy for assistance, utilize the insulin drip calculator, and/or reference "Transition from IV to SQ Insulin Protocol."

7– Discharge Planning
A. Consider Endocrine/Diabetes consult for diabetes management and education.
B. Reference "Transition Guide: Inpatient to Outpatient Regimen" when determining discharge medications/home regimen.


Order Sets
IP GEN Subcutaneous Insulin Therapy - Initial Regimen — Required
IMPORTANT: For most patients requiring insulin in the hospital, it is best practice to discontinue all oral hypoglycemics, including sulfonylureas, metformin and metformin-containing medications, and "glitazone"-class medications.
Patient Care
Patient Care Orders
Most inpatients requiring insulin should have a target fasting glucose of less than 180 mg/dL.
Target Glucose Range
P Routine, ONGOING starting Today at 1215 Until Specified
Notify the 1st Call provider if glucose values routinely exceed target range and t
provider prior to noon to obtain new insulin regimen orders. At ANY time, contac
Notify Provider for: Glucose > 180
Follow hypoglycemic protocol for any glucose value less than 70.
Diabetes Education
Routine, ONGOING starting Today at 1215 Until Specified
Bedside RN is to initiate diabetes education for the patient using the follow ing res
admitted here before), the Basic Carbohydrate Counting Video on the Internet, o
Diabetes/Endocrinology service.
Diet
Diets for Diabetic Patients
0 of 9 selected
Medications — Required
Link to UCSD Inpatient Diabetic Management Algorithm
Insulin Regimen - Select Your Patient's Nutritional Intake Pattern — Required
Any previous inpatient insulin orders (except an insulin infusion, when transitioning from IV to SQ insulin) should be discontinued when writing new insulin orders using this order set.
NOTE: Correctional insulin only options are not appropriate for type 1 diabetics or for patients with fasting glucose values above 150 mg/dL.
For those patients transitioning from an insulin infusion: the Total Daily Dose (TDD) of insulin may be estimated using one of the following methods:
1. If the patient is receiving TPN or tube feeds, or is eating well, take the average insulin rate for the previous 6 hours and multiply by 20 to get the TDD.
2. If the patient is not currently receiving adequate nutrition, double the total number of units obtained by method #1 to get the TDD.
3. The first dose of glargine should be given two hours prior to discontinuing the insulin infusion.
Insulin Regimen - Patient Eating or Receiving Bolus Tube Feeds (Equivalent Lispro Dosing for Each Meal)
Insulin Regimen - Patient Eating or Receiving Bolus Tube Feeds (Individualized Lispro Dosing for Each Meal)
Insulin Regimen - Patient Eating or Receiving Bolus Tube Feeds (Patient Requesting Lispro Dosing Based on Carb Counting)
Insulin Regimen - Patient on 24-Hour Continuous Tube Feeds or TPN
Insulin Regimen - Patient on Night-Only Continuous Tube Feeds or TPN
Insulin Regimen - Patient NPO or on Clear Liquids
Insulin Regimen - Correctional Insulin Only in Patient Eating Meals
Insulin Regimen - Correctional Insulin Only in Patient NPO or on Clear Liquids
Insulin Regimen - Oral Nutritional Supplement Coverage
Fingerstick Glucose Orders for Hypoglycemia Protocol
1 of 1 selected
Cosign Notes Patient Call Canceled Ord
Reminder to d/c all orals
Reminders about glycemic targets, orders for diabetes education, diet



-Reminder to avoid sliding scale
-Dosing guidance for transition from IV to subQ
-Different subQ regimens for different po intake

Correction Insulin

These are the different scales written out

Low Dose Correction

Glucose Range	QAC	QHS
< 70 mg/dL	See Hypoglycemia Protocol	
70 - 150 mg/dL	0 units	0 units
151 - 200 mg/dL	1 units	0 units
201 - 250 mg/dL	2 units	1 units
251 - 300 mg/dL	3 units	2 units
301 - 350 mg/dL	4 units	3 units
351 - 400 mg/dL	5 units	4 units
> 400 mg/dL	6 units	5 units

1:50 >150 qac and > 200 qhs

Moderate Dose Correction

Glucose Range	QAC	QHS
< 70 mg/dL	See Hypoglycemia Protocol	
70 - 150 mg/dL	0 units	0 units
151 - 175 mg/dL	1 units	0 units
176 - 200 mg/dL	2 units	0 units
201 - 225 mg/dL	3 units	1 units
226 - 250 mg/dL	4 units	2 units
251 - 275 mg/dL	5 units	3 units
> 275 mg/dL	6 units	4 units

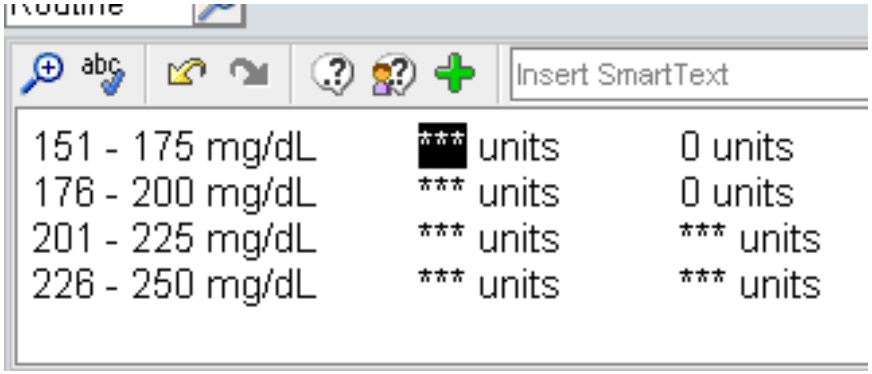
1:25 >150 qac and > 200 qhs

High Dose Correction

Glucose Range	QAC	QHS
< 70 mg/dL	See Hypoglycemia Protocol	
70 - 150 mg/dL	0 units	0 units
151 - 175 mg/dL	3 units	0 units
176 - 200 mg/dL	4 units	0 units
201 - 225 mg/dL	5 units	4 units
226 - 250 mg/dL	6 units	5 units
251 - 300 mg/dL	8 units	6 units
> 300 mg/dL	10 units	7 units

1:25 >150, starting at 3 qac and >200, starting at 4 qhs

Provider Specified Correction



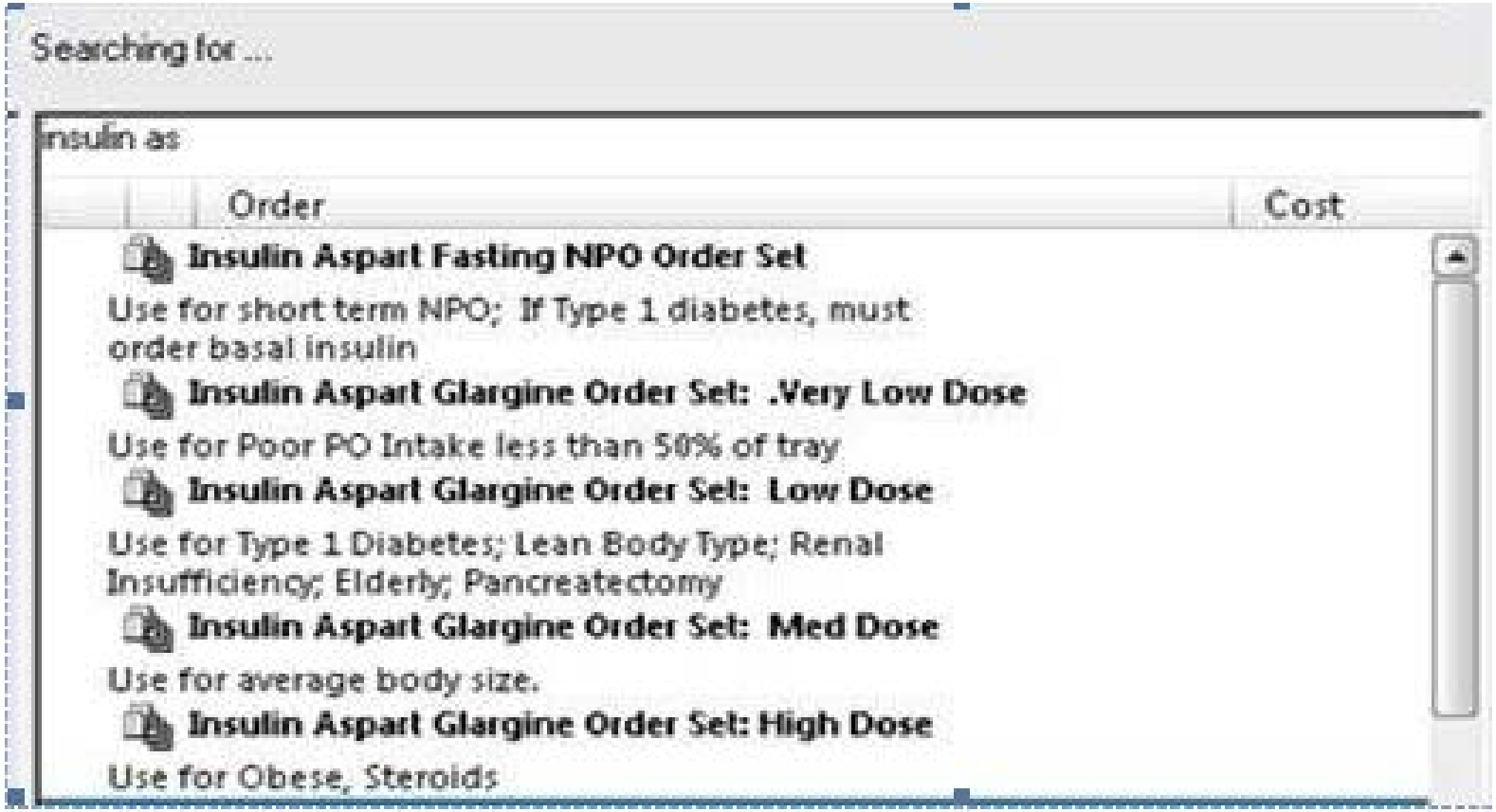
Cerner SubQ Insulin Order Set

Organized into Basal-Bolus therapy

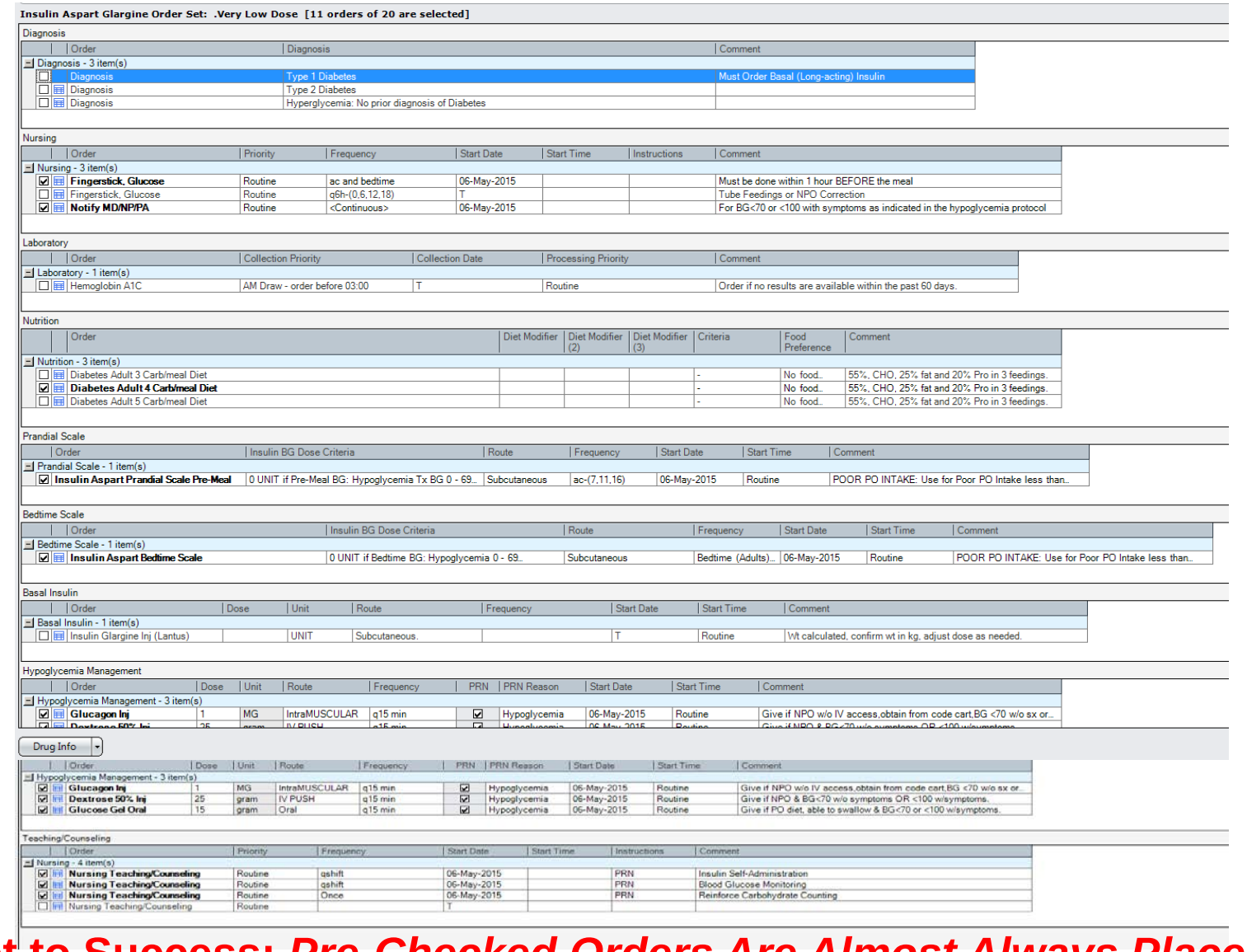
MEDICATION(S)	
Daily Insulin: Target therapy for goal of BG 100-180.	
.	
Basal Insulin: All the time insulin, covers sugar that the body makes.	
Indication: Diabetics already on insulin and/or insulin naive diabetic patients with BG>180.	
For continuation of home regimen. Select order below:	
insulin glargine (LANTUS)	unit(s), inj soln, SUB-Q, Every Bedtime, Routine, Note: Hold if BG<100. Notify MD for dose adjustment. DO NOT HOLD for NPO.
Use weight based dosing in an insulin naive patient, select order below:	
Weight based glargine-type 2 diabetics on oral hypoglycemics	
.	
Nutritional: Food insulin, covers sugar taken in. Standing order before meals.	
Indication: Diabetics already on insulin and/or insulin naive diabetic patients with a single BG>250 or two consecutive BG>180 despite basal insulin.	
For continuation of a home regimen, select the order below:	
insulin lispro (HUMALOG)	unit(s), inj soln, SUB-Q, TID Before Meals, Routine, Note: Hold if BG<100. Notify MD for dose adjustment. HOLD if NPO.
For weight based dosing in an insulin naive patient, select the order below:	
Weight based lispro-type 2 diabetics on oral hypoglycemics	
.	
Correctional: Sliding scale, covers leftover sugar production.	
Review dose daily and titrate regimen accordingly:	
Patient is eating:	
insulin lispro (HUMALOG - sliding scale)	2-10 unit(s), inj soln, SUB-Q, TID Before Meals, PRN, Routine, Note: NOTIFY MD OF GLUCOSE>400.
Patient is NPO:	
insulin regular (HUMULIN R - sliding scale)	2-10 unit(s), inj soln, SUB-Q, Q6 HR, PRN, Routine, Note: NOTIFY MD OF GLUCOSE>400.

Reminds Prescriber of What Orders to Include:

NYPH Basal/Bolus Order Sets



NYPH Basal/Bolus Prandial Order Set



Insulin Aspart Glargine Order Set: .Very Low Dose [11 orders of 20 are selected]

Diagnosis

	Order	Diagnosis	Comment
Diagnosis - 3 item(s)			
☐	Diagnosis	Type 1 Diabetes	Must Order Basal (Long-acting) Insulin
☐	Diagnosis	Type 2 Diabetes	
☐	Diagnosis	Hyperglycemia: No prior diagnosis of Diabetes	

Nursing

	Order	Priority	Frequency	Start Date	Start Time	Instructions	Comment
Nursing - 3 item(s)							
☑	**Fingerstick, Glucose**	Routine	ac and bedtime	06-May-2015			Must be done within 1 hour BEFORE the meal
☐	Fingerstick, Glucose	Routine	q6h-(0,6,12,18)	T			Tube Feedings or NPO Correction
☑	**Notify MD/NP/PA**	Routine	<Continuous>	06-May-2015			For BG<70 or <100 with symptoms as indicated in the hypoglycemia protocol

Laboratory

	Order	Collection Priority	Collection Date	Processing Priority	Comment
Laboratory - 1 item(s)					
☐	Hemoglobin A1C	AM Draw - order before 03:00	T	Routine	Order if no results are available within the past 60 days.

Nutrition

	Order	Diet Modifier	Diet Modifier (2)	Diet Modifier (3)	Criteria	Food Preference	Comment
Nutrition - 3 item(s)							
☐	Diabetes Adult 3 Carb/meal Diet				-	No food..	55%, CHO, 25% fat and 20% Pro in 3 feedings.
☑	**Diabetes Adult 4 Carb/meal Diet**				-	No food..	55%, CHO, 25% fat and 20% Pro in 3 feedings.
☐	Diabetes Adult 5 Carb/meal Diet				-	No food..	55%, CHO, 25% fat and 20% Pro in 3 feedings.

Prandial Scale

	Order	Insulin BG Dose Criteria	Route	Frequency	Start Date	Start Time	Comment
Prandial Scale - 1 item(s)							
☑	**Insulin Aspart Prandial Scale Pre-Meal**	0 UNIT if Pre-Meal BG: Hypoglycemia Tx BG 0 - 69..	Subcutaneous	ac-(7,11,16)	06-May-2015	Routine	POOR PO INTAKE: Use for Poor PO Intake less than..

Bedtime Scale

	Order	Insulin BG Dose Criteria	Route	Frequency	Start Date	Start Time	Comment
Bedtime Scale - 1 item(s)							
☑	**Insulin Aspart Bedtime Scale**	0 UNIT if Bedtime BG: Hypoglycemia 0 - 69..	Subcutaneous	Bedtime (Adults)...	06-May-2015	Routine	POOR PO INTAKE: Use for Poor PO Intake less than..

Basal Insulin

	Order	Dose	Unit	Route	Frequency	Start Date	Start Time	Comment
Basal Insulin - 1 item(s)								
☐	Insulin Glargine Inj (Lantus)		UNIT	Subcutaneous.		T	Routine	Wt calculated, confirm wt in kg, adjust dose as needed.

Hypoglycemia Management

	Order	Dose	Unit	Route	Frequency	PRN	PRN Reason	Start Date	Start Time	Comment
Hypoglycemia Management - 3 item(s)										
☑	**Glucagon Inj**	1	MG	IntraMUSCULAR	q15 min	☑	Hypoglycemia	06-May-2015	Routine	Give if NPO w/o IV access,obtain from code cart,BG <70 w/o sx or...
☑	**Dextrose 50% Inj**	25	gram	IV PUSH	q15 min	☑	Hypoglycemia	06-May-2015	Routine	Give if NPO & BG<70 w/o symptoms OR <100 w/symptoms.
☑	**Glucose Gel Oral**	15	gram	Oral	q15 min	☑	Hypoglycemia	06-May-2015	Routine	Give if PO diet, able to swallow & BG<70 or <100 w/symptoms.

Drug Info

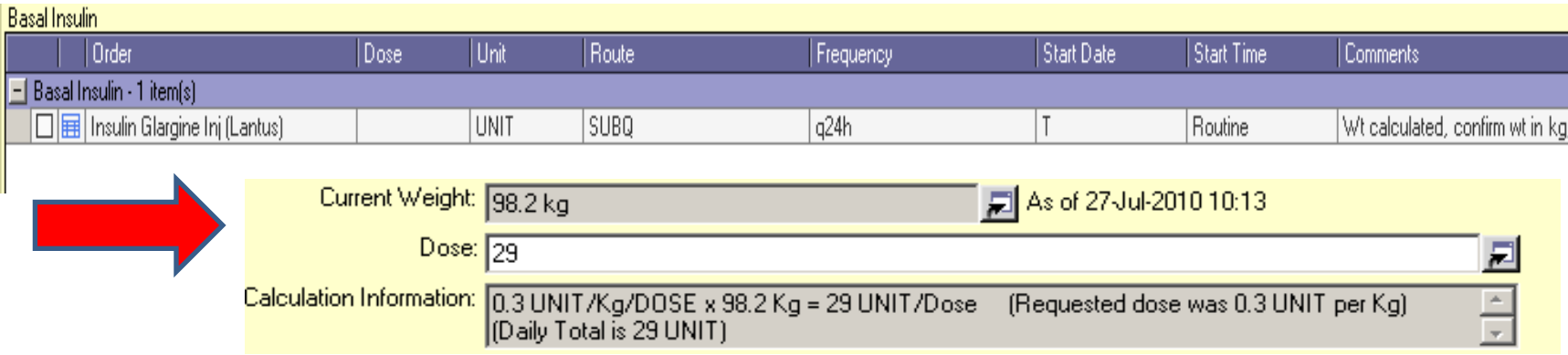
	Order	Dose	Unit	Route	Frequency	PRN	PRN Reason	Start Date	Start Time	Comment
Hypoglycemia Management - 3 item(s)										
☑	**Glucagon Inj**	1	MG	IntraMUSCULAR	q15 min	☑	Hypoglycemia	06-May-2015	Routine	Give if NPO w/o IV access,obtain from code cart,BG <70 w/o sx or...
☑	**Dextrose 50% Inj**	25	gram	IV PUSH	q15 min	☑	Hypoglycemia	06-May-2015	Routine	Give if NPO & BG<70 w/o symptoms OR <100 w/symptoms.
☑	**Glucose Gel Oral**	15	gram	Oral	q15 min	☑	Hypoglycemia	06-May-2015	Routine	Give if PO diet, able to swallow & BG<70 or <100 w/symptoms.

Teaching/Counseling

	Order	Priority	Frequency	Start Date	Start Time	Instructions	Comment
Nursing - 4 item(s)							
☑	**Nursing Teaching/Counseling**	Routine	qshift	06-May-2015		PRN	Insulin Self-Administration
☑	**Nursing Teaching/Counseling**	Routine	qshift	06-May-2015		PRN	Blood Glucose Monitoring
☑	**Nursing Teaching/Counseling**	Routine	Once	06-May-2015		PRN	Reinforce Carbohydrate Counting
☐	Nursing Teaching/Counseling	Routine		T			

Secret to Success: *Pre-Checked Orders Are Almost Always Placed!*

Basal Insulin is Auto-Calculated in Order Sets



NPO: no auto-*basal for type 2, suggest .10 u/kg to start*

Very Low Dose	.10 u/kg
Low Dose	.15 u/kg
Med Dose	.20 u/kg
High Dose	.30 u/kg

STEP 4: Assess Blood Glucoses At Least Daily

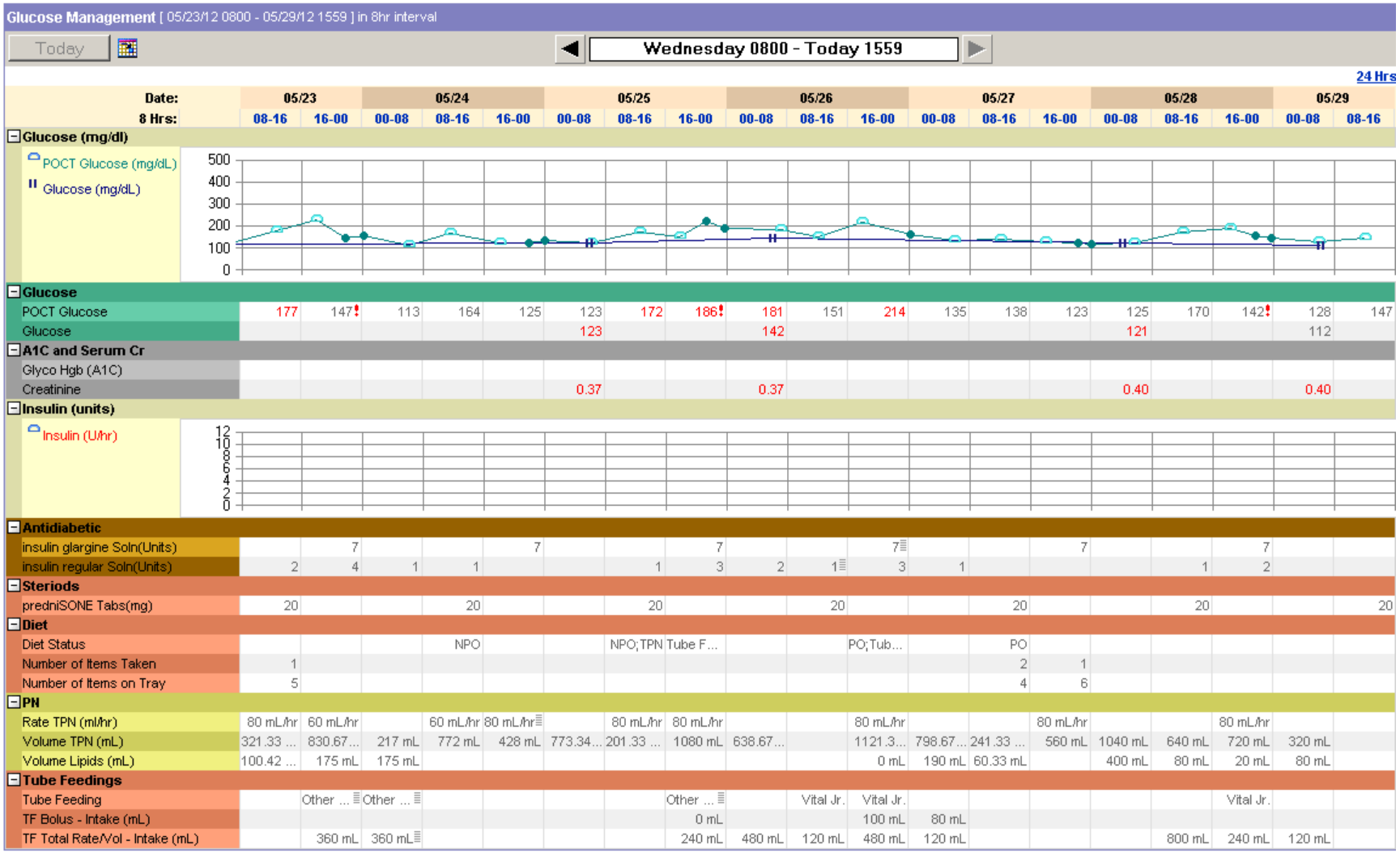
- Blood glucose targets can only be achieved with daily insulin adjustments as needed

- ***There is no "autopilot" insulin regimen for a hospitalized patient!***

Daily Adjustments

- Having all necessary data *in one place is* KEY
- Many EMR's have **glucose management page** where information can be consolidated
- Minimize number of places provider must go to to gather information to make informed clinical decision**: BGs & Insulin Usage**

UCSD Glucose Management Page (EPIC)

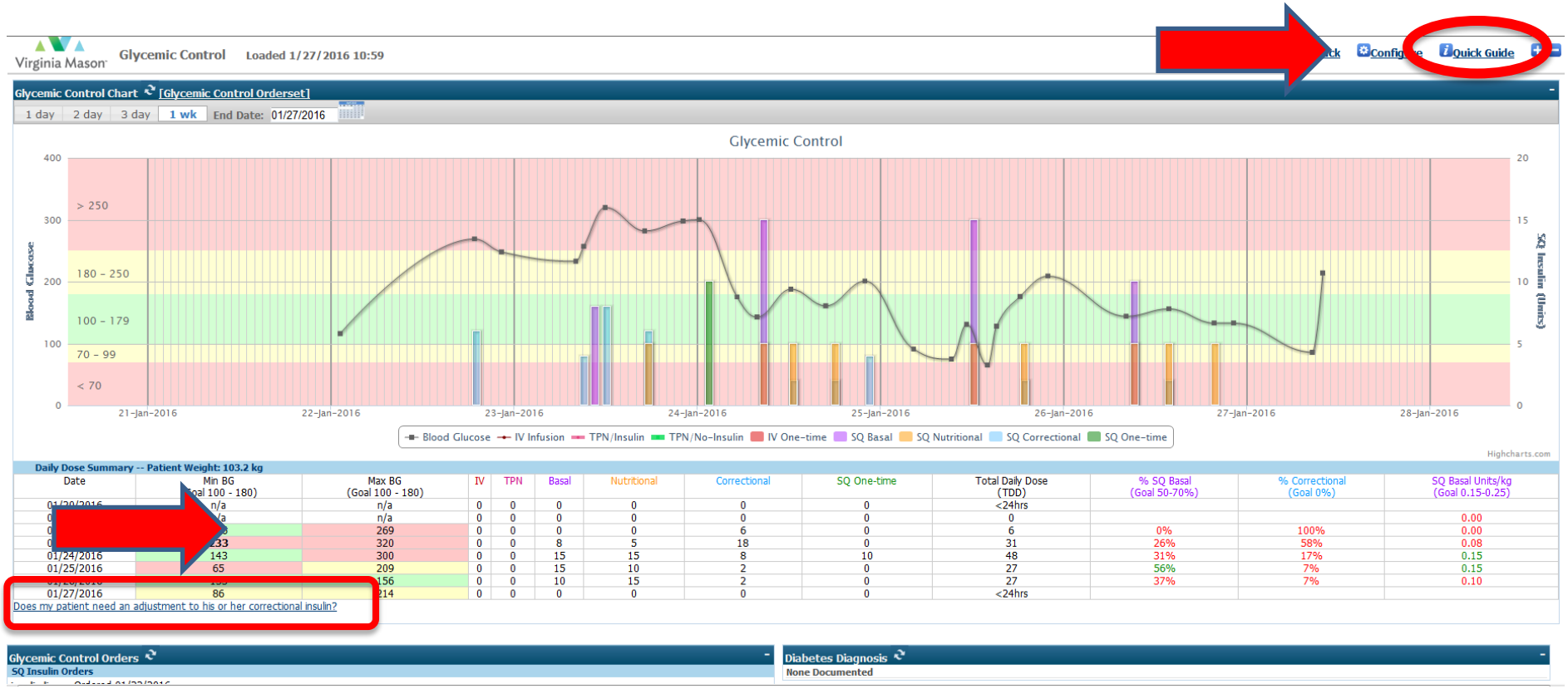


Glucose Management [05/23/12 0800 - 05/29/12 1559] in 8hr interval

Today | Wednesday 0800 - Today 1559 | 24 Hrs

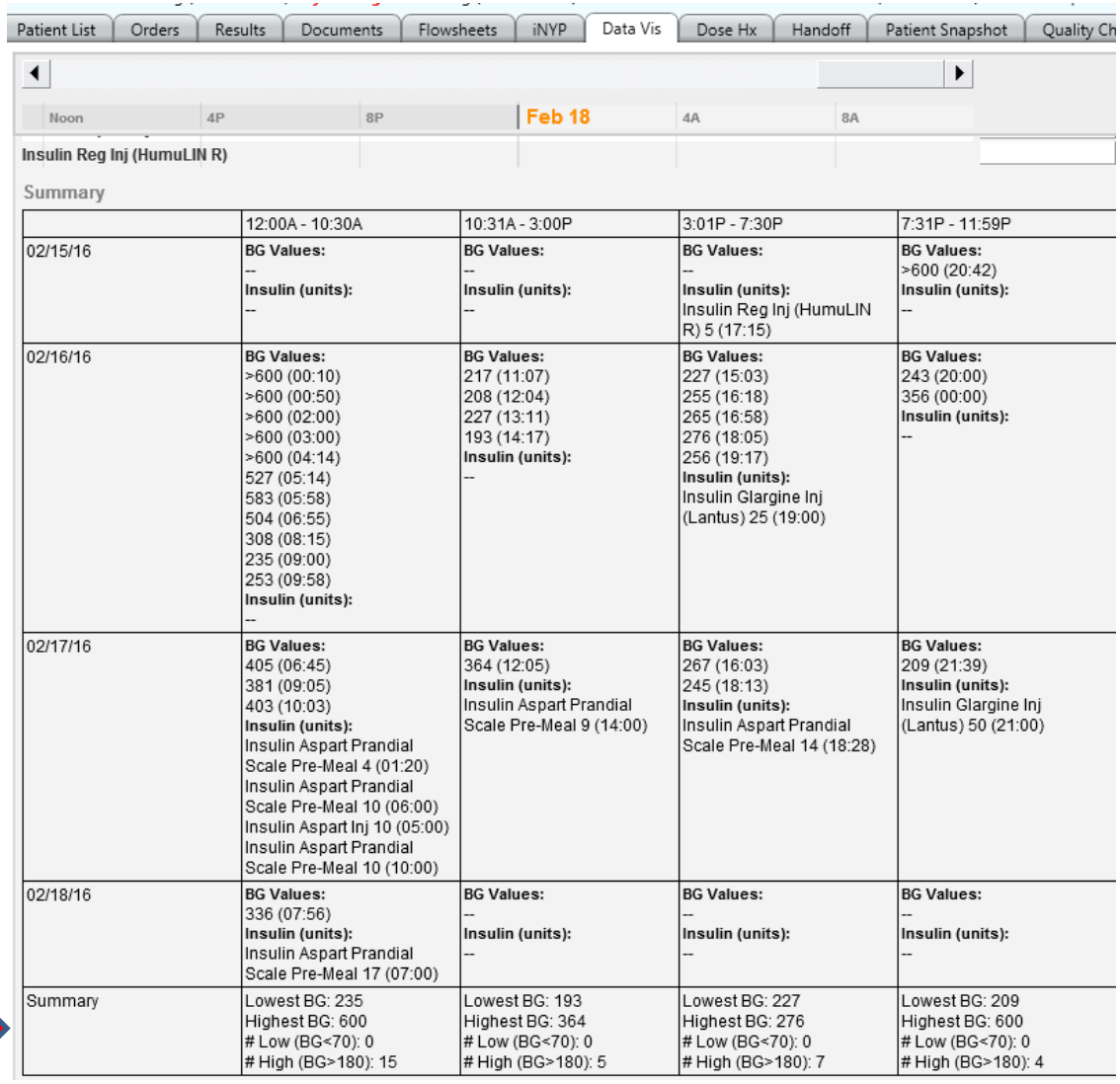
Date:	05/23		05/24			05/25			05/26			05/27			05/28			05/29	
8 Hrs:	08-16	16-00	00-08	08-16	16-00	00-08	08-16	16-00	00-08	08-16	16-00	00-08	08-16	16-00	00-08	08-16	16-00	00-08	08-16
Glucose (mg/dl)																			
POCT Glucose (mg/dL) / Glucose (mg/dL)																			
Glucose																			
POCT Glucose	177	147!	113	164	125	123	172	186!	181	151	214	135	138	123	125	170	142!	128	147
Glucose						123			142						121			112	
A1C and Serum Cr																			
Glyco Hgb (A1C)																			
Creatinine						0.37			0.37						0.40			0.40	
Insulin (units)																			
Insulin (U/hr)																			
Antidiabetic																			
insulin glargine Soln(Units)		7			7			7			7			7			7		
insulin regular Soln(Units)	2	4	1	1			1	3	2	1	3	1				1	2		
Steriods																			
predniSONE Tabs(mg)	20			20			20			20			20			20			20
Diet																			
Diet Status				NPO			NPO;TPN	Tube F...			PO;Tub...		PO						
Number of Items Taken	1												2	1					
Number of Items on Tray	5												4	6					
PN																			
Rate TPN (ml/hr)	80 mL/hr	60 mL/hr		60 mL/hr	80 mL/hr		80 mL/hr	80 mL/hr			80 mL/hr			80 mL/hr			80 mL/hr		
Volume TPN (mL)	321.33 ...	830.67...	217 mL	772 mL	428 mL	773.34...	201.33 ...	1080 mL	638.67...		1121.3...	798.67...	241.33 ...	560 mL	1040 mL	640 mL	720 mL	320 mL	
Volume Lipids (mL)	100.42 ...	175 mL	175 mL								0 mL	190 mL	60.33 mL		400 mL	80 mL	20 mL	80 mL	
Tube Feedings																			
Tube Feeding		Other ...	Other ...					Other ...		Vital Jr.	Vital Jr.						Vital Jr.		
TF Bolus - Intake (mL)								0 mL			100 mL	80 mL							
TF Total Rate/Vol - Intake (mL)		360 mL	360 mL					240 mL	480 mL	120 mL	480 mL	120 mL				800 mL	240 mL	120 mL	

VMMC MPage (Cerner)



1. **There is a reference guide in the top right for technical support and clinical decision support on dose titration.**
2. **There is a calculator for your insulin correction factor with recommendations in the bottom left corner.**

NYPH Insulin & BG View (Sunrise)



Patient List | Orders | Results | Documents | Flowsheets | iNYP | Data Vis | Dose Hx | Handoff | Patient Snapshot | Quality Ch

Noon | 4P | 8P | Feb 18 | 4A | 8A

Insulin Reg Inj (HumuLIN R)

Summary

	12:00A - 10:30A	10:31A - 3:00P	3:01P - 7:30P	7:31P - 11:59P
02/15/16	**BG Values:** -- **Insulin (units):** --	**BG Values:** -- **Insulin (units):** --	**BG Values:** -- **Insulin (units):** Insulin Reg Inj (HumuLIN R) 5 (17:15)	**BG Values:** >600 (20:42) **Insulin (units):** --
02/16/16	**BG Values:** >600 (00:10) >600 (00:50) >600 (02:00) >600 (03:00) >600 (04:14) 527 (05:14) 583 (05:58) 504 (06:55) 308 (08:15) 235 (09:00) 253 (09:58) **Insulin (units):** --	**BG Values:** 217 (11:07) 208 (12:04) 227 (13:11) 193 (14:17) **Insulin (units):** --	**BG Values:** 227 (15:03) 255 (16:18) 265 (16:58) 276 (18:05) 256 (19:17) **Insulin (units):** Insulin Glargine Inj (Lantus) 25 (19:00)	**BG Values:** 243 (20:00) 356 (00:00) **Insulin (units):** --
02/17/16	**BG Values:** 405 (06:45) 381 (09:05) 403 (10:03) **Insulin (units):** Insulin Aspart Prandial Scale Pre-Meal 4 (01:20) Insulin Aspart Prandial Scale Pre-Meal 10 (06:00) Insulin Aspart Inj 10 (05:00) Insulin Aspart Prandial Scale Pre-Meal 10 (10:00)	**BG Values:** 364 (12:05) **Insulin (units):** Insulin Aspart Prandial Scale Pre-Meal 9 (14:00)	**BG Values:** 267 (16:03) 245 (18:13) **Insulin (units):** Insulin Aspart Prandial Scale Pre-Meal 14 (18:28)	**BG Values:** 209 (21:39) **Insulin (units):** Insulin Glargine Inj (Lantus) 50 (21:00)
02/18/16	**BG Values:** 336 (07:56) **Insulin (units):** Insulin Aspart Prandial Scale Pre-Meal 17 (07:00)	**BG Values:** -- **Insulin (units):** --	**BG Values:** -- **Insulin (units):** --	**BG Values:** -- **Insulin (units):** --
Summary	Lowest BG: 235 Highest BG: 600 # Low (BG<70): 0 # High (BG>180): 15	Lowest BG: 193 Highest BG: 364 # Low (BG<70): 0 # High (BG>180): 5	Lowest BG: 227 Highest BG: 276 # Low (BG<70): 0 # High (BG>180): 7	Lowest BG: 209 Highest BG: 600 # Low (BG<70): 0 # High (BG>180): 4

Summary

NYPH Insulin Titration Algorithm

Step 1

WHICH INSULIN NEEDS ADJUSTMENT:	
If AM fasting BG is too high or low:	Adjust Basal Insulin
If pre-lunch, pre-dinner or bedtime is too high or low:	Adjust Bolus Insulin

HOW TO ADJUST:	
If BG is less than 50: If BG is less than 70:	Deduct 50% Deduct 20%
If BG is 70-100:	Deduct 10%
If BG is 180-250: If BG is >250:	Add 10% Add 20%

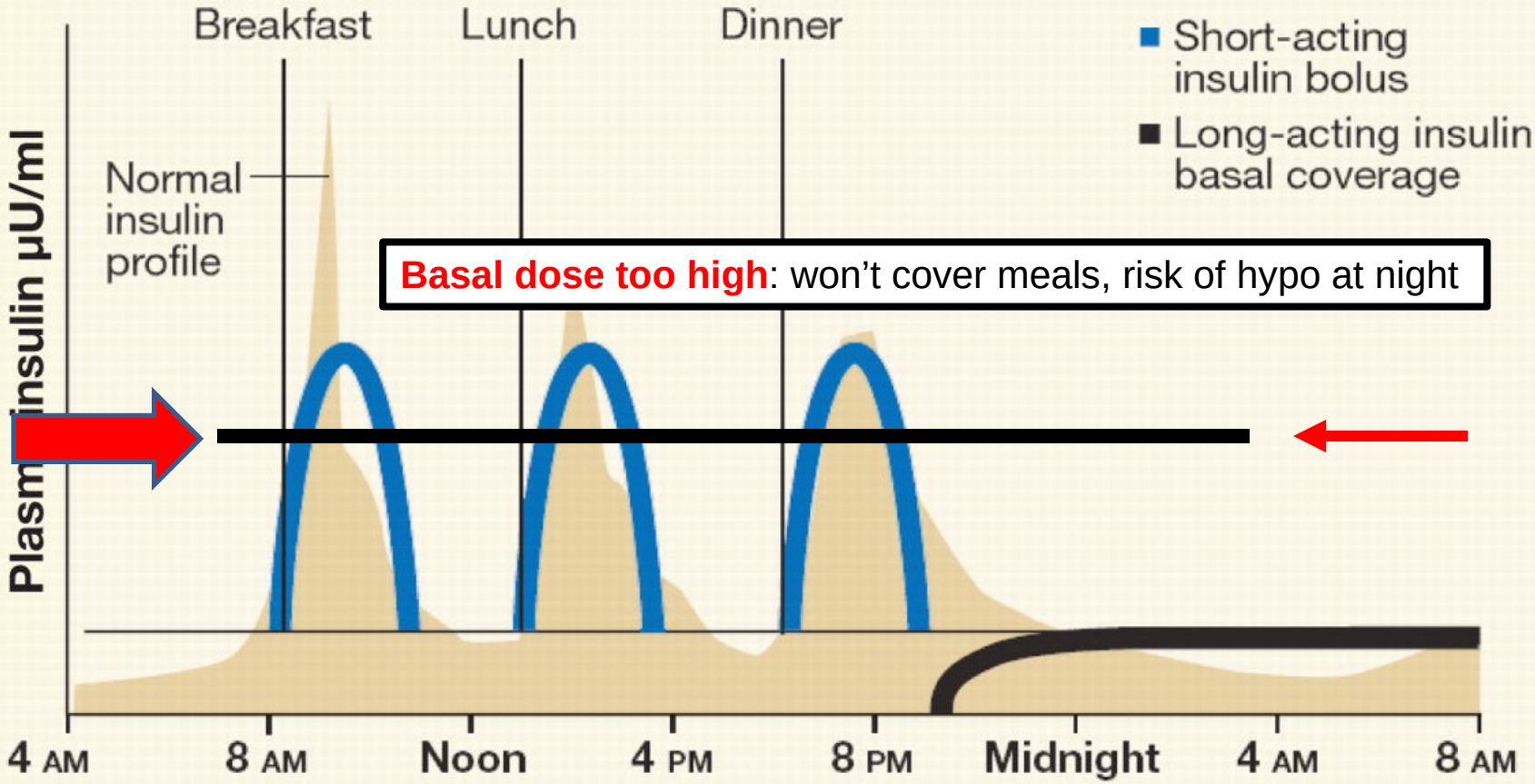
NYPH Insulin Titration Algorithm

Step 2

Increasing Rapid Acting Insulin Doses when *High Dose Order Set* Is Not Enough

Prandial Rapid Acting Insulin			
	High Dose Aspart Doses	***High Dose +10% For BGs 180-250 mg/dl***	**High +20% For BGs > 250 mg/dl**
70-100	**2**	**3**	**4**
101-150	**6**	**7**	**8**
151-200	**8**	**9**	**10**
201-250	**10**	**11**	**12**
251-300	**12**	**13**	**14**
301-350	**14**	**15**	**17**
351-400	**16**	**18**	**19**
> 400	**18**	**20**	**22**
Bed Time Rapid Acting Insulin			
70-199	**0**	**0**	**0**
200-250	**0**	**0**	**0**
251-300	**0**	**2**	**3**
301-350	**4**	**5**	**6**
351-400	**6**	**7**	**8**
> 400	**8**	**9**	**10**

Basal/bolus regimen mimics normal insulin profile



Magaji V , Johnston *J M Clin Diabetes* 2011;29:3-9

Insulin Dosing Summary

Problem	Pearls
Keep ratio ~50:50 basal:bolus	**Add more nutritional** insulin when **daytime BG >180** despite appropriate weight based/basal insulin
Too large a percentage dose increase	**Avoid increases in excess of 20-30%** unless initial dose is significantly less than weight based
No insulin dose adjustment after episodes of hypoglycemia	If a patient is **hypoglycemic**, a downward adjustment of at least one form of insulin is usually necessary

Thank you!

- Questions…?