Simple steps to Meet Inpatient Glycemic Control Goals

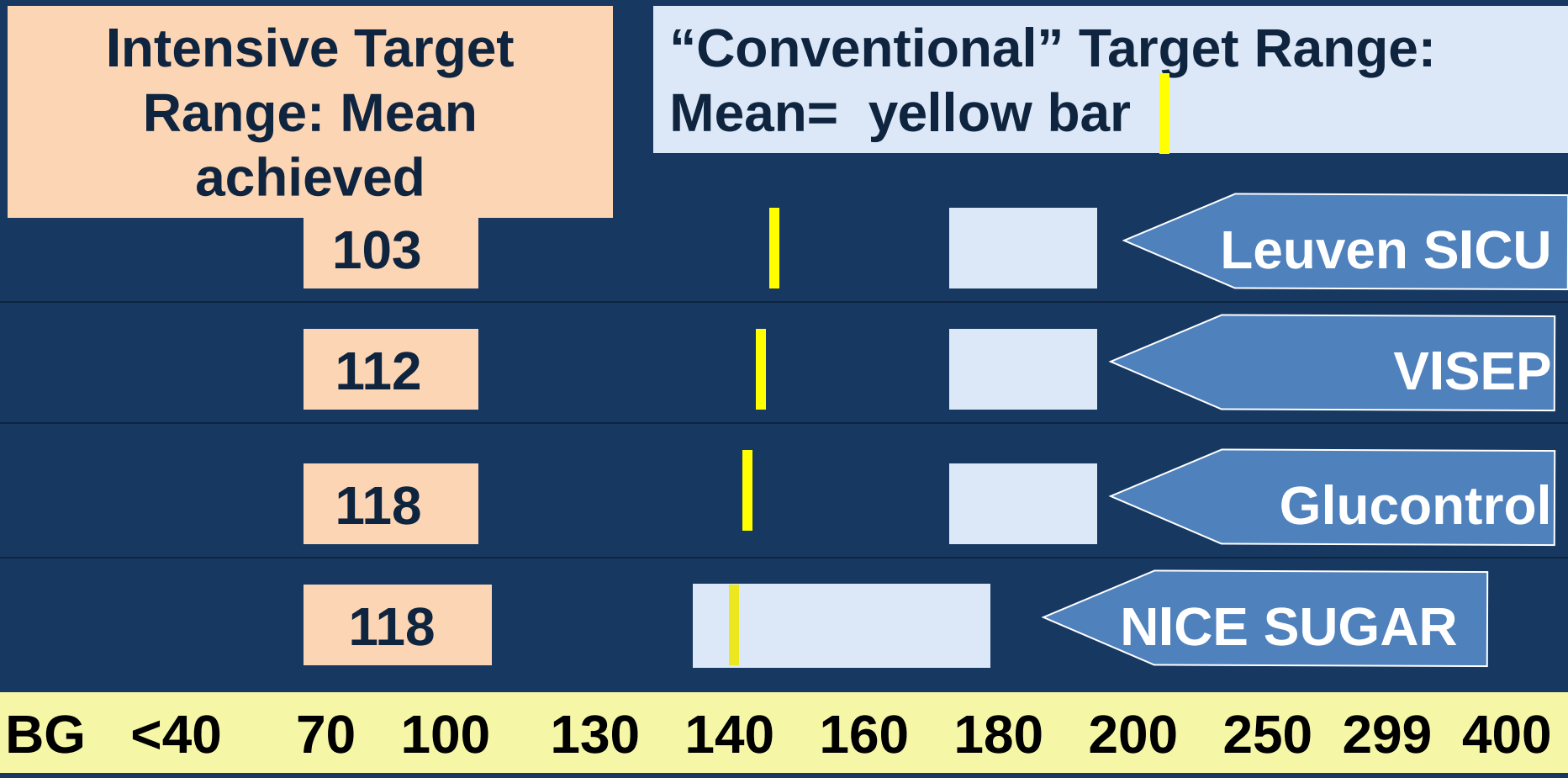
Cheryl W. O’Malley, MD, FACP, FHM

Overview

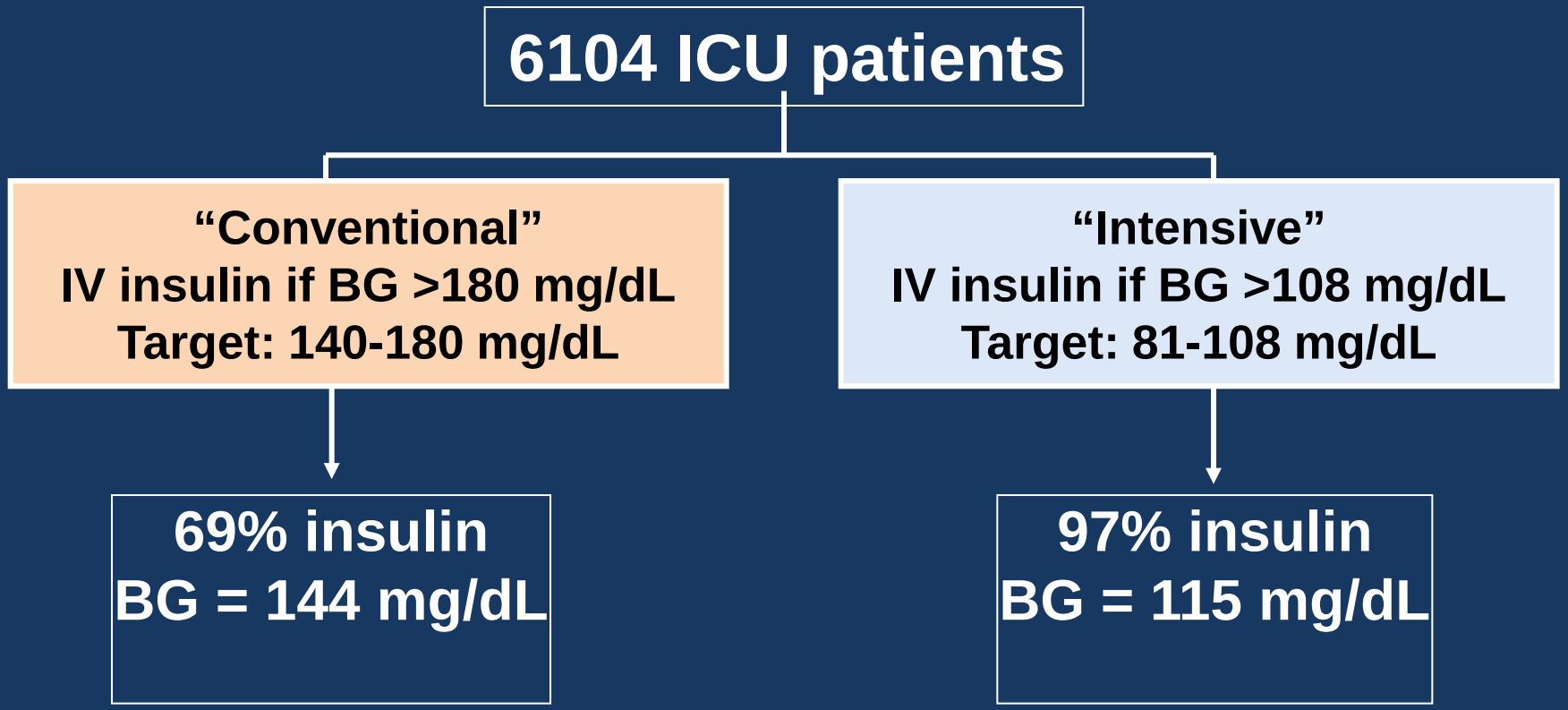
1. Know the blood glucose targets for hospitalized adults with hyperglycemia.
2. Explain the reasons why basal/bolus/correction insulin is the preferred inpatient regimen for hospitalized adults.
3. Know the different types of insulin and their time of onset and action.
4. Calculate a patient’s initial doses of basal/bolus insulin and know how to make daily adjustments based on their blood sugar values.
5. Know how to manage a patient’s blood sugars while they are NPO or when tube feeds are initiated.
6. Know when and how to make adjustments to the home regimen based on their blood glucose control prior to admission, resources and hospital requirements.

Know the blood glucose targets for hospitalized adults with hyperglycemia.

RCT Glycemic Control Targets in Critically Ill Patients *References on final slide



NICE-SUGAR Study: Design



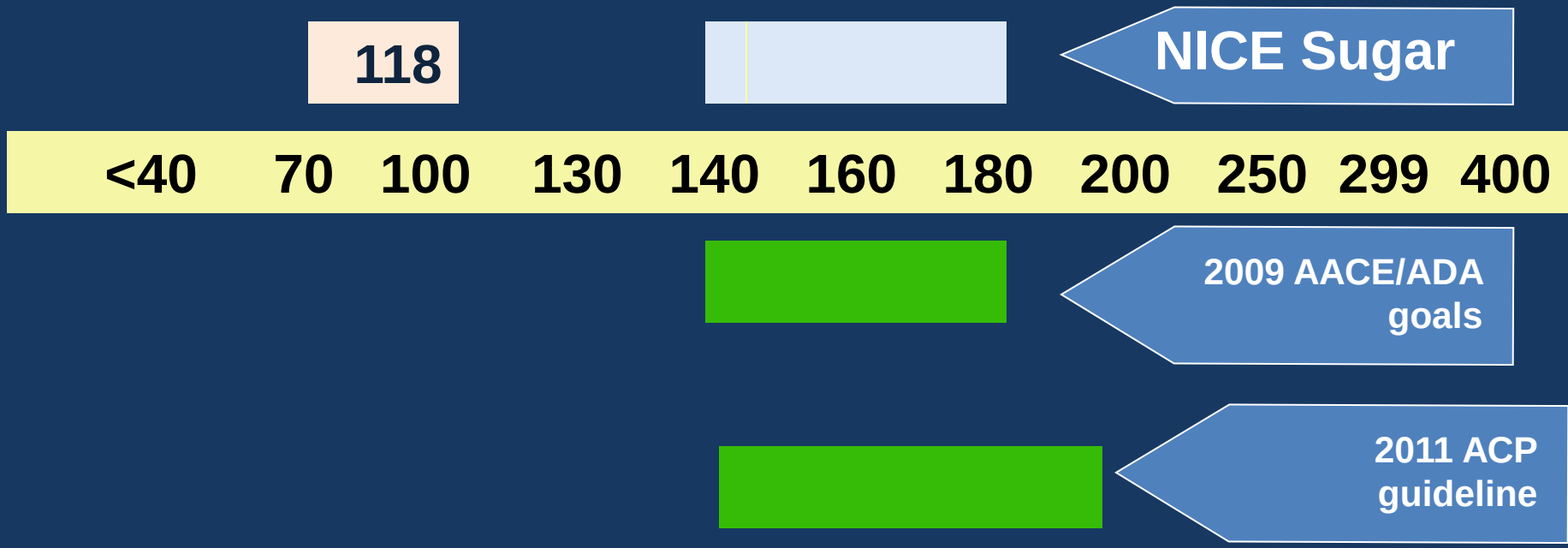
NICE-SUGAR Study Investigators, et al. *N Engl J Med.* 2009.

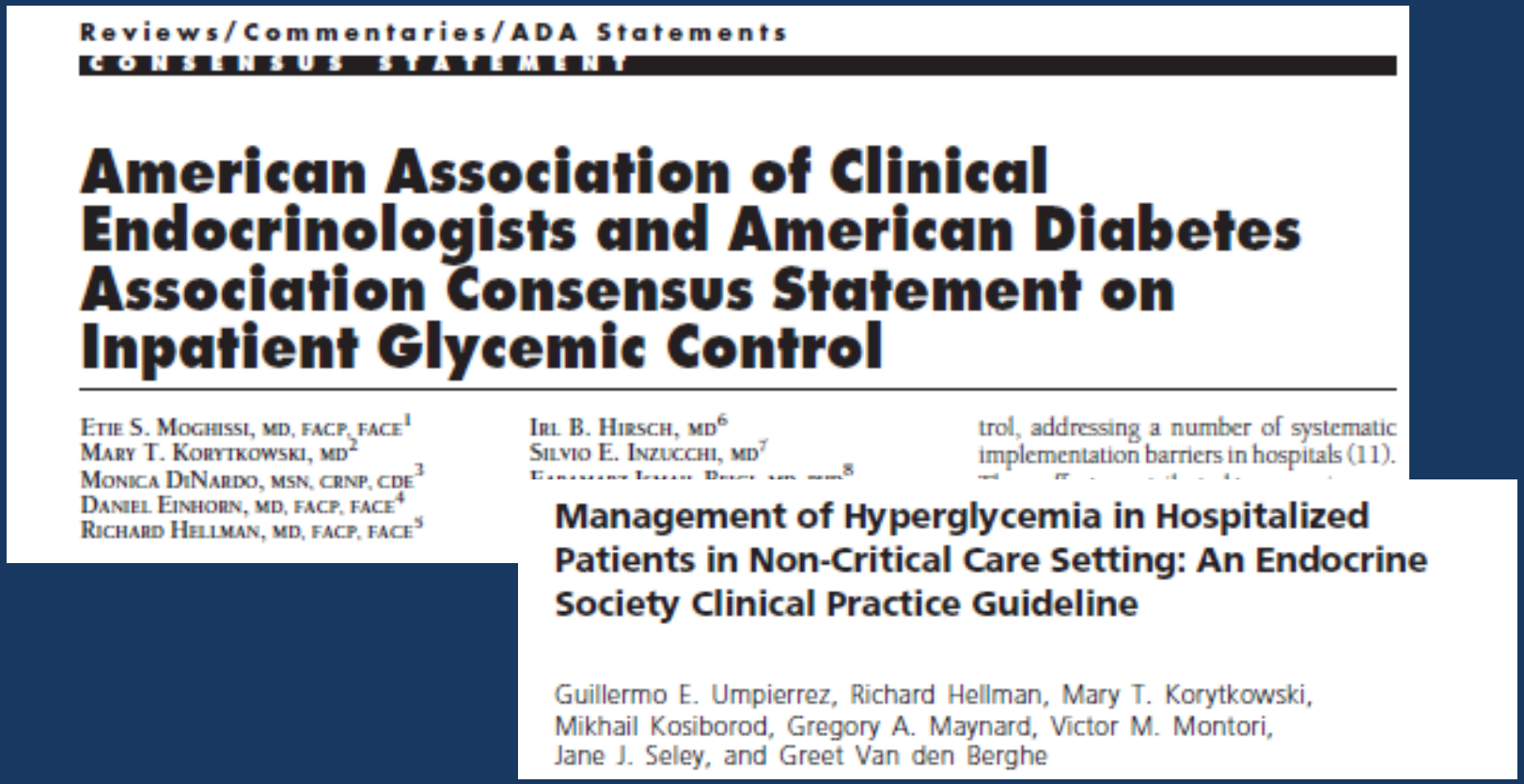
NICE-SUGAR

- Intensive control vs conventional control
  - Mortality 27.5% vs 24.9%; *P* = 0.02
  - ARR=27.5%-24.9%= 2.6% ➔NNH = 38
  - Severe hypoglycemia (BG ≤40 mg/dl) 6.8% vs 0.5%; P<0.001
- No significant difference between the two treatment groups in the median number of days in the ICU or hospital

The NICE-SUGAR Study Investigators. *N Engl J Med.* 2009;360:1283-1297.

Current Recommended Targets for ICU= 140-180 mg/dL





Reviews/Commentaries/ADA Statements

CONSENSUS STATEMENT

American Association of Clinical Endocrinologists and American Diabetes Association Consensus Statement on Inpatient Glycemic Control

Etie S. Moghissi, MD, FACP, FACE[1]
Mary T. Korytkowski, MD[2]
Monica DiNardo, MSN, CRNP, CDE[3]
Daniel Einhorn, MD, FACP, FACE[4]
Richard Hellman, MD, FACP, FACE[5]
Irl B. Hirsch, MD[6]
Silvio E. Inzucchi, MD[7]

trol, addressing a number of systematic implementation barriers in hospitals (11).

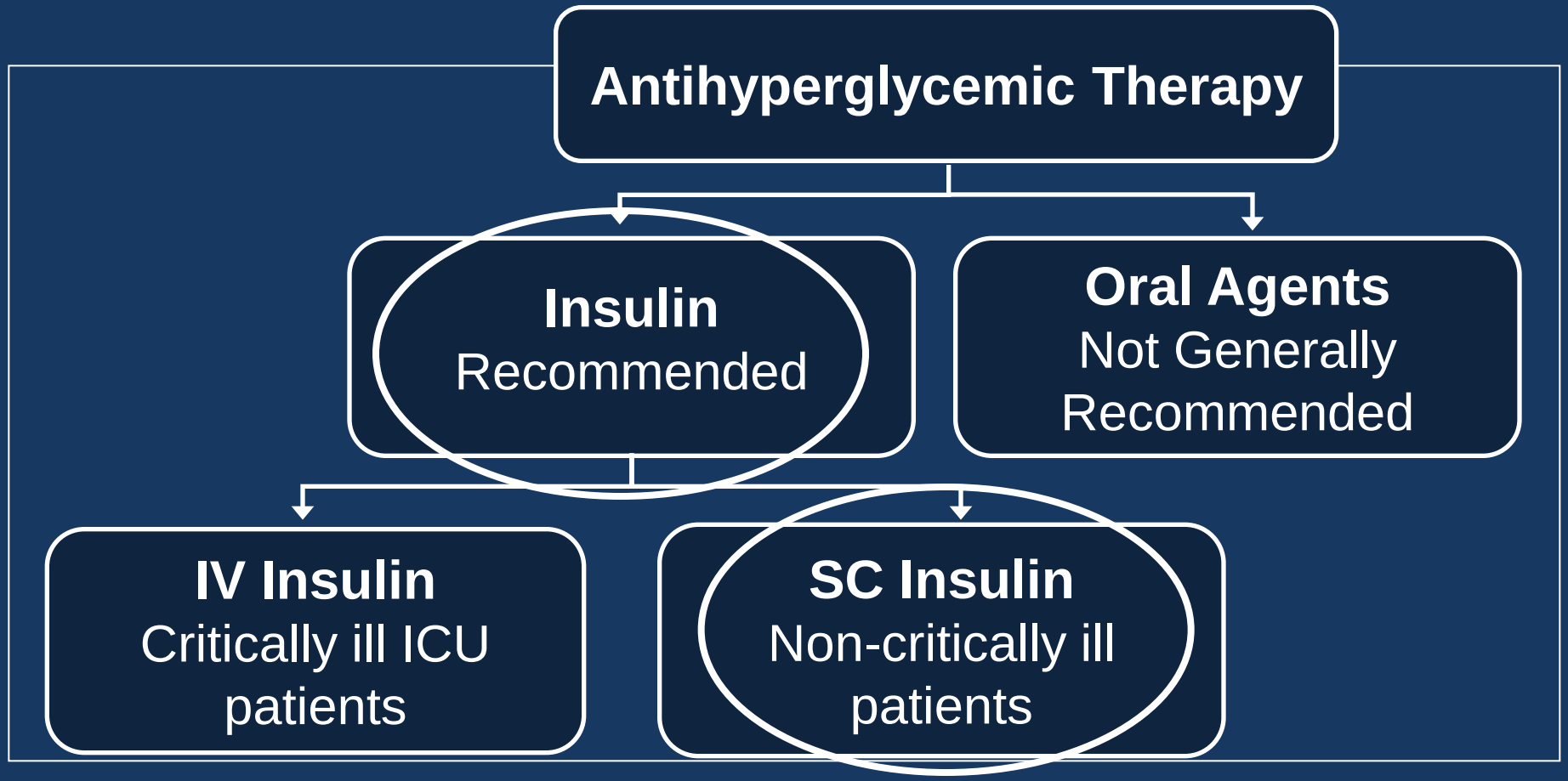
Management of Hyperglycemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline

Guillermo E. Umpierrez, Richard Hellman, Mary T. Korytkowski, Mikhail Kosiborod, Gregory A. Maynard, Victor M. Montori, Jane J. Seley, and Greet Van den Berghe

- "For the majority of noncritically ill patients treated with insulin, the premeal BG target should generally be <140 mg/dl in conjunction with random BG <180 mg/dl.

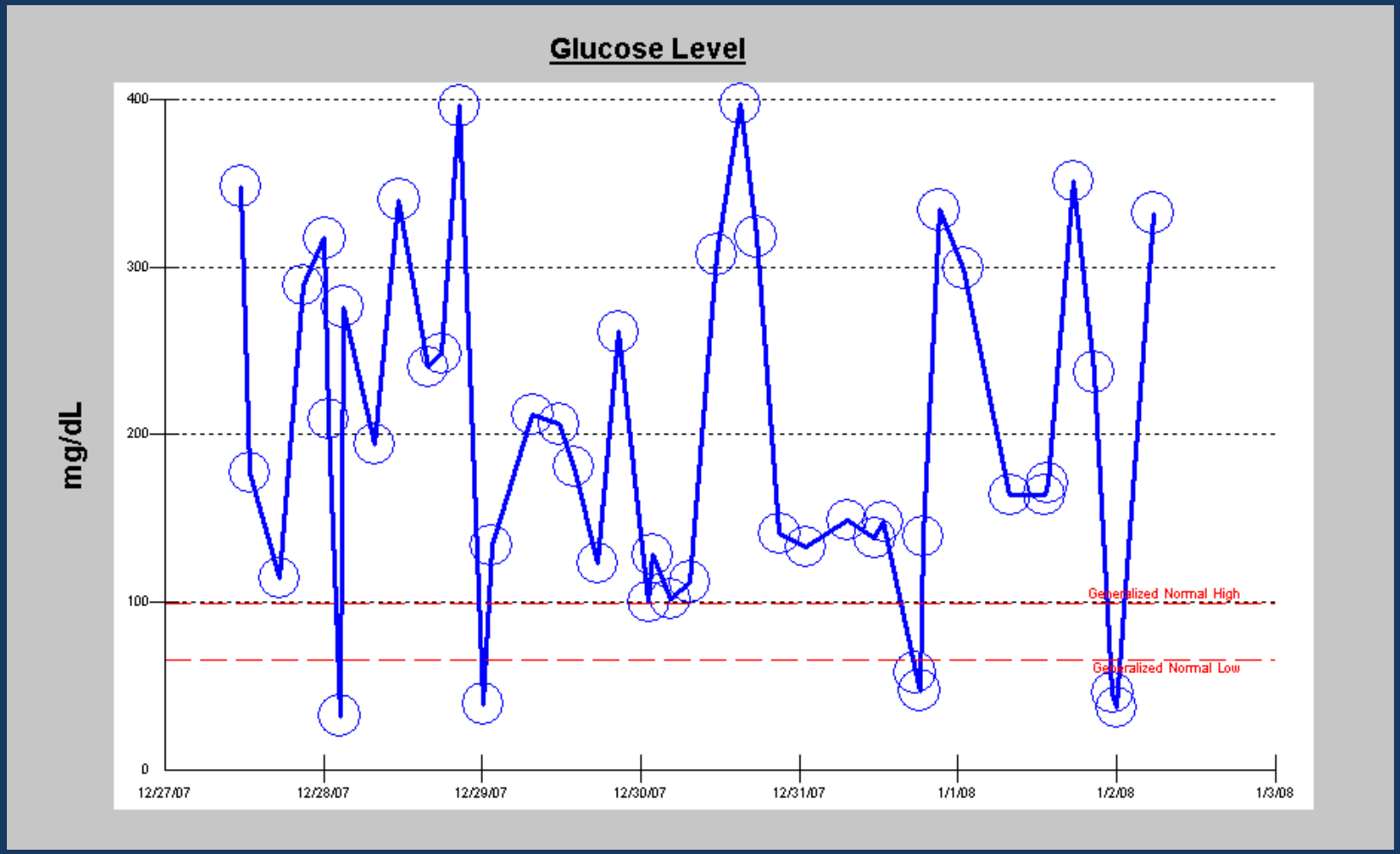
–DIABETES CARE, VOLUME 32, NUMBER 6, JUNE 2009
–J Clin Endocrinol Metab 97: 16–38, 2012

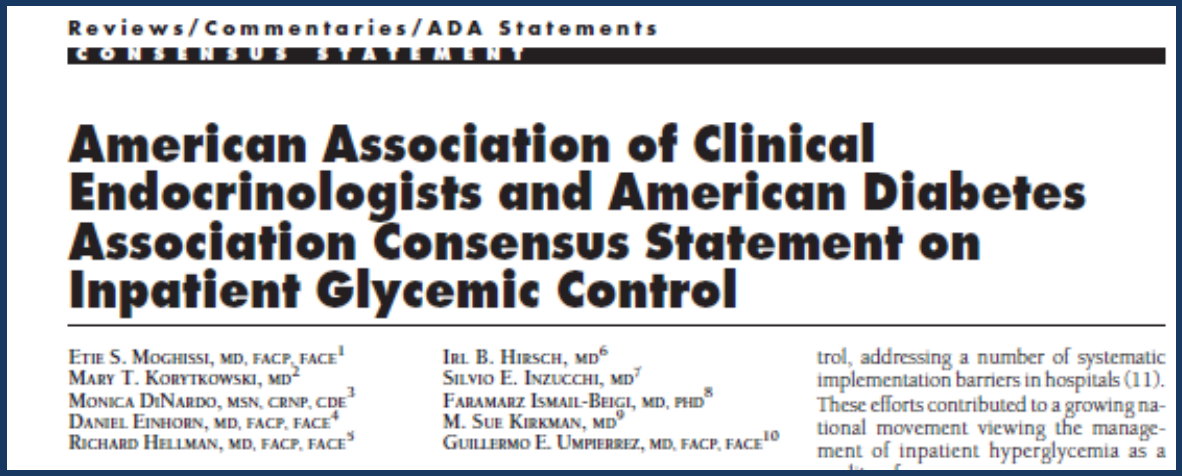
Recommendations for Managing Inpatient Hyperglycemia



Clement S, et al. *Diabetes Care.* 2004; Moghissi ES, et al. *Endocr Pract.* 2009.

Does this look familiar?





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Farahmarz Ismail-Beigi, MD, PHD[8]
M. Sue Kirkman, MD[9]
Guillermo E. Umpierrez, MD, FACP, FACE[10]

trol, addressing a number of systematic implementation barriers in hospitals (11). These efforts contributed to a growing national movement viewing the management of inpatient hyperglycemia as a

- Non-critically ill patients: “Scheduled subcutaneous administration of insulin, with basal, nutritional, and correction components, is the preferred method for achieving and maintaining glucose control.”

–DIABETES CARE, VOLUME 32, NUMBER 6, JUNE 2009

Know the different types of insulin and their time of onset and action.

Human Insulins and Analogs

Insulin type	Onset	Peak	Duration
Rapid acting: Lispro (humalog) Aspart *(novolog)* Glulisine *(apidra)*	~15 minutes	1-2 hours	4-6 hours
Short acting: Human regular novolin-R humulin-R	30-60 minutes	2-4 hours	6-8 hours
Intermediate: Human NPH novolin-N humulin-N	2-4 hours	8 hours	12-20 hours
Long acting Glargine Detimir*	2-4 hours	minimal peak	~24 hours

Human Insulins and Analogs
Typical Times of Action

Insulin type	Onset	Peak	Duration
Lispro (humalog) Aspart *(novolog)* Glulisine *(apidra)*	~15 minutes	1-2 hours	4-6 hours
Human regular novolin-R humulin-R **30%**	60 minutes	2-4 hours	6-8 hours
Human NPH novolin-N humulin-N **70%**	4 hours	4-10 hours	12-20 hours
Glargine Detemir	2-4 hours	minimal peak	~24 hours

=70/30

Explain the reasons why basal/bolus/correction insulin is the preferred inpatient regimen for hospitalized adults.

Physiologic Insulin Replacement: Basal – Bolus Regimens

Aspart
Lispro
Glulisine
Regular

50% Bolus Insulin

50% Basal Insulin

Total Daily Dose (TDD)

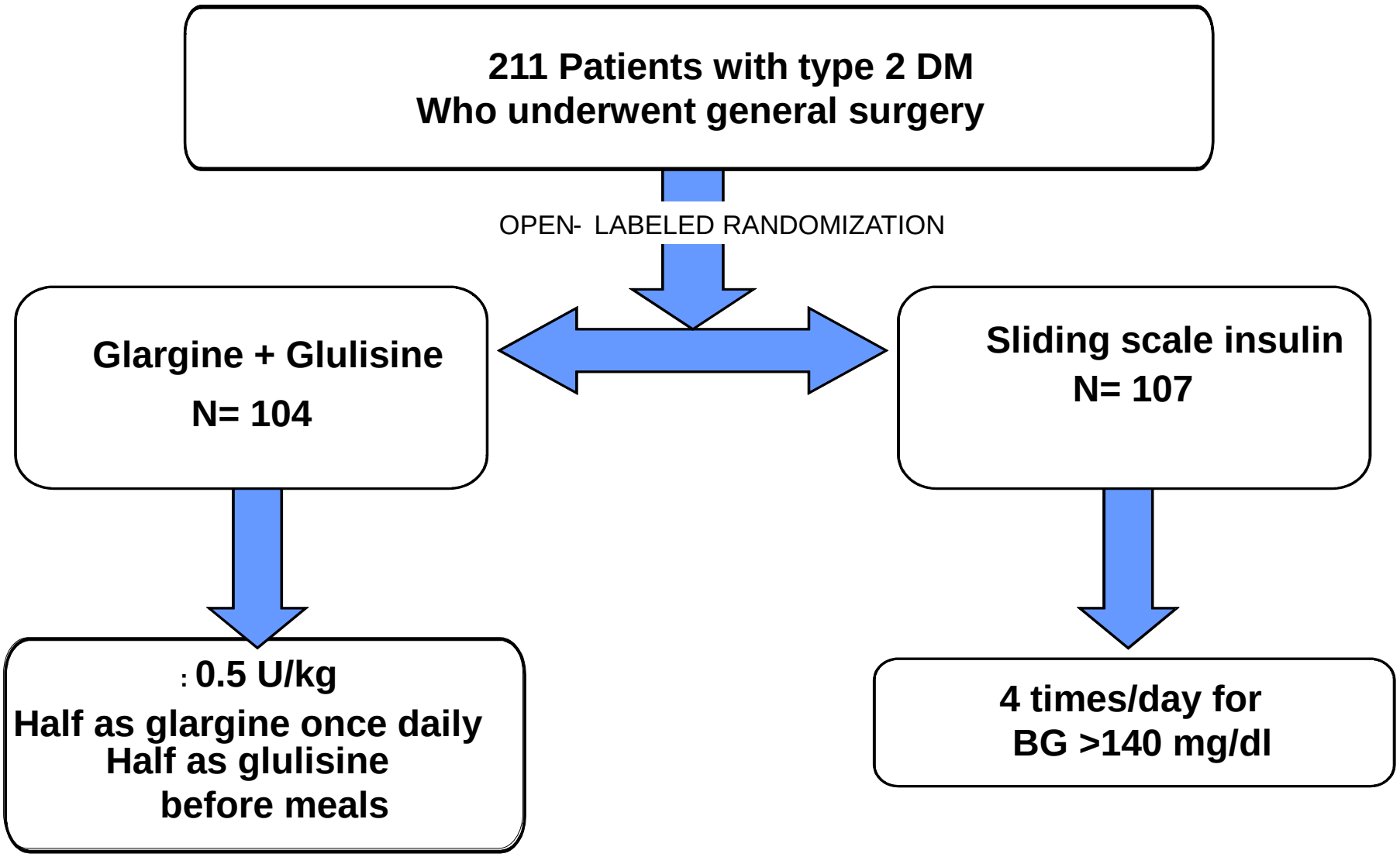
Glargine
Detemir
NPH

RABBIT-2 Trial: Basal / Bolus arm

- **Patients:** Type 2 DM, non-surgical X at least 3 months on diet or orals (*aka "insulin naïve")*
- **Regimen:** D/C oral antidiabetic drugs on admission
- Starting total daily dose (TDD):
  - 0.4 U/kg/d x BG between 140-200 mg/dL
  - 0.5 U/kg/d x BG between 201-400 mg/dL
- TDD adjusted daily +/- 20% for BG >140 or < 70
- 50% of TDD as insulin glargine and half as rapid-acting insulin (glulisine)

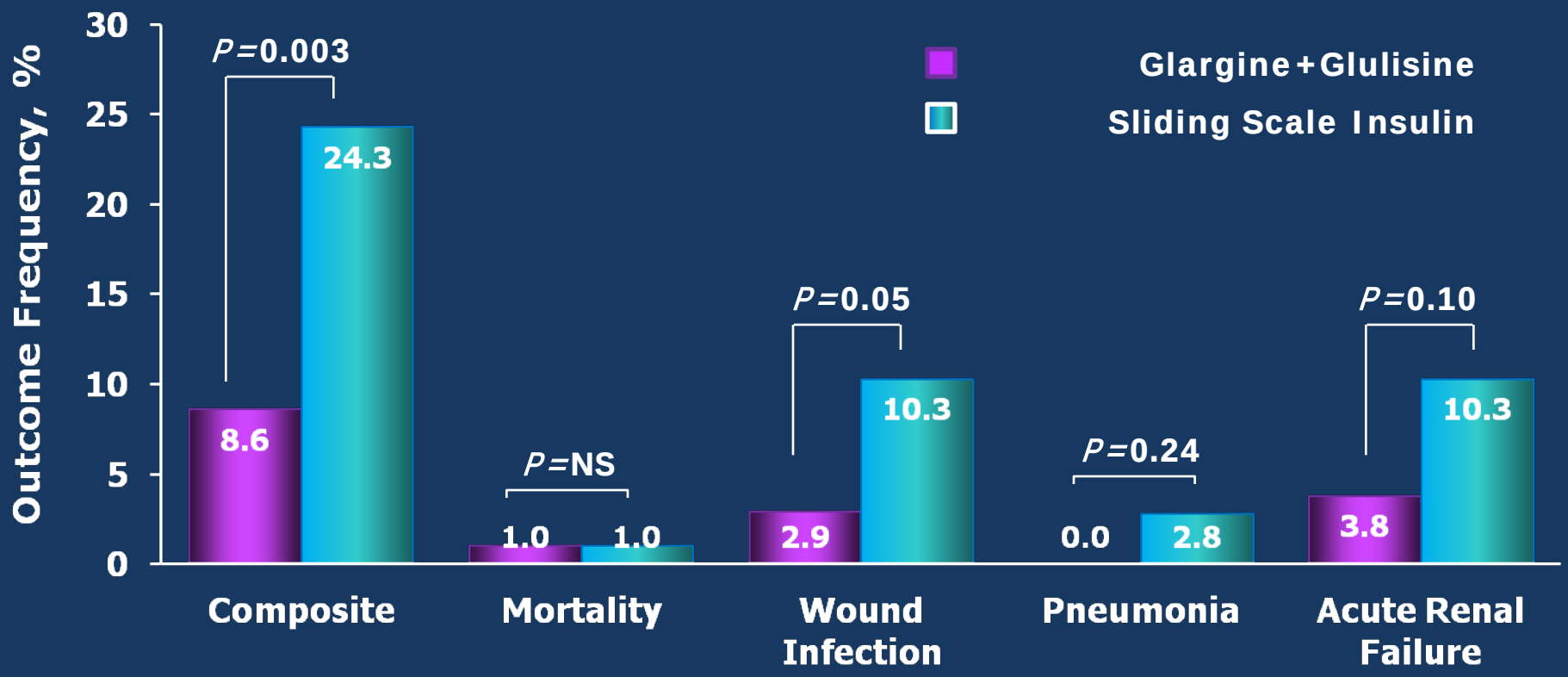
Umpierrez et al, Diabetes Care 30:2181–2186, 2007

Rabbit 2 Surgery Trial



Umpierrez et al, Diabetes Care 34 (2):1–6, 2011

Postoperative Complications



* Composite of hospital complications: wound infection, pneumonia, respiratory failure, acute renal failure, and bacteremia.

Umpierrez et al, Diabetes Care 34 (2):1–6, 2011

Correction only:

- Controlled BG on admit with:
  - Low dose oral agents at home
  - Hypoglycemia at home
  - Worsening liverand renal function.

OR

Basal +bolus (Nutrition +correction):

1. On insulin at home
2. Uncontrolled DM (admission BG, history at home ORHgbA1c
3. Not at goal on slidingscale

Calculate a patient’s initial doses of basal/bolus insulin and know how to make daily adjustments based on their blood sugar values.

3 Steps to using basal/bolus insulin in the hospital

1. Determine total daily insulin dose
2. Divide up to 50% basal insulin, 50% bolus
3. Adjust daily

Step 1: Calculate Starting total daily dose (TDD):

1. IV requirements
2. Home dose— (consider reduction by 25%)
3. Weight based 0.2-0.5 units/kg/day
    1. Most recent guides say 0.2-0.5
    2. Rabbit trials 0.3-0.5
        - 0.3 ESRD or elderly (>70 y.o.)
        - 0.4 units/kg/day if admit BG 140-200
        - 0.5 units/kg/day if admit BG >200

******Do not use "sliding scale" as a dose finding strategy***

Step 2: Divide into Scheduled Basal vs. Nutritional Insulin

- 40-50% should generally be basal
- Remaining 50-60% divided evenly and given to cover nutritional intake

Steroids

- If IV continous will be high all day, once a day po, high late afternoon/evening
- Keep thinking TDD
  - Cause more post prandial hyperglycemia
  - Change ratio to 30% basal/70% nutritional

Step 3: Adjust Doses DailyDaily Adjustment

- Blood glucose targets can only be achieved via continuous management of the insulin program
- ***There is no "autopilot" insulin regimen for a hospitalized patient!***

RABBIT 2 Surgery Titration

Fasting BG	Adjustment
100-140 mg/dL	No change
140-180 mg/dl	Increase TDD by 10% daily
>180 mg/dl	Increase TDD by 20% daily
70-99 mg/dl	Decrease TDD by 10%
<70 mg/dl	Decrease by 20%

* Note: only increase the doses if NONE were <100mg/dl.

My Suggestions for Daily Adjustment

1. Any less than 100 mg/dL or > 180?
2. Add up previous day's TDD
   - Include amount given as supplemental insulin
   - Adjust up or down by depending on degree of hypo- and hyperglycemia
   - Adjust for other factors (renal function, steroid dose, nutritional intake, severity of illness)
3. Divide new TDD into basal and nutritional components
   - Split 50/50 OR
   - Adjust basal and nutritional separately, depending on AM fasting vs. late day sugars
   - Watch out for too much basal

Case 1

- 72 y.o. woman admitted with pneumonia. BMI 23, weight 57 kg Cr 2.7. BG high at home, no lows. At home on Glargine 5 units q hs admission BG 267 mg/dL (didn't take her insulin today) with recent HbA1c 10.9, What are your admission orders?
  A. sliding scale
  B. TDD of 5, glargine 3 units and humalog 1 with meals
  C. Glargine 5 units + ss
  D. Weight based 0.3 units/kg/day= TDD 17 units a day with 8 glargine and 3 humalog with meals

Step 1: Calculate Starting total daily dose (TDD):

1. IV requirements
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3. Weight based 0.2-0.5 units/kg/day
    1. Most recent guides say 0.2-0.5
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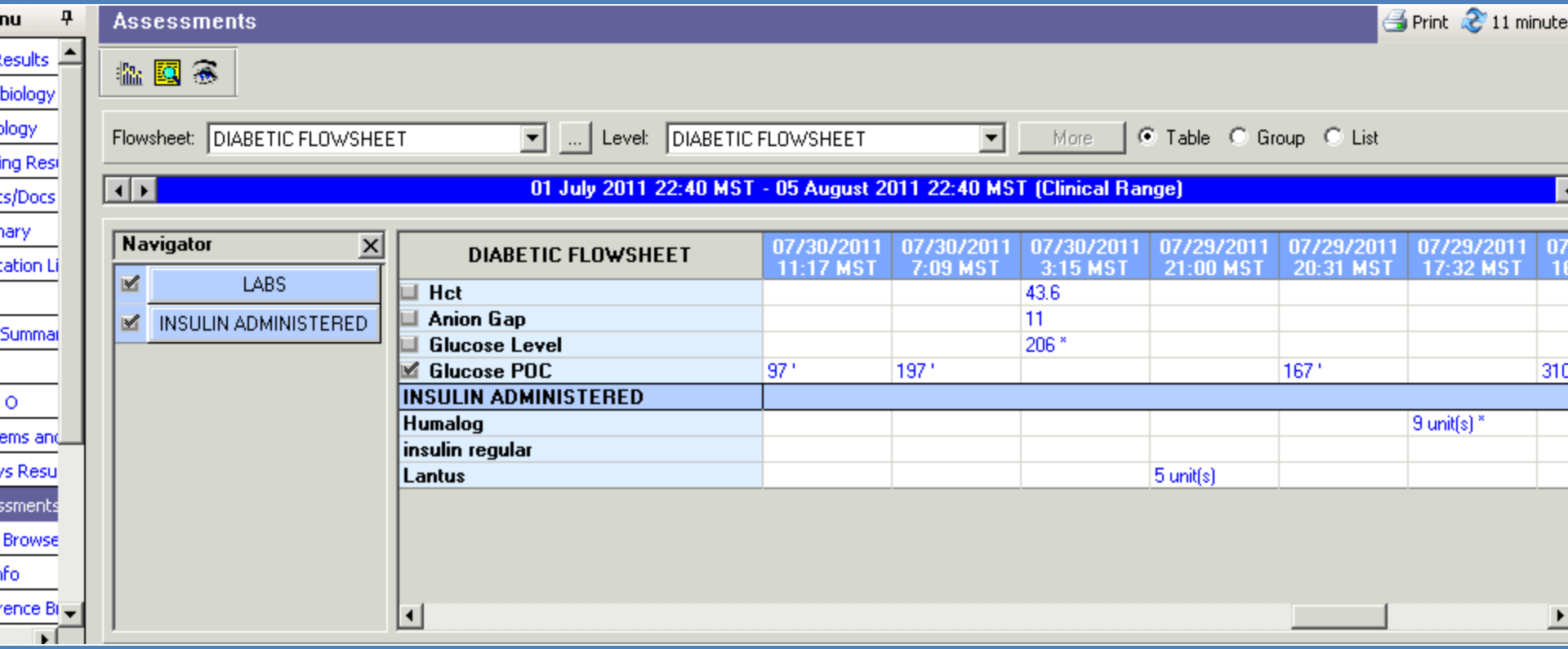
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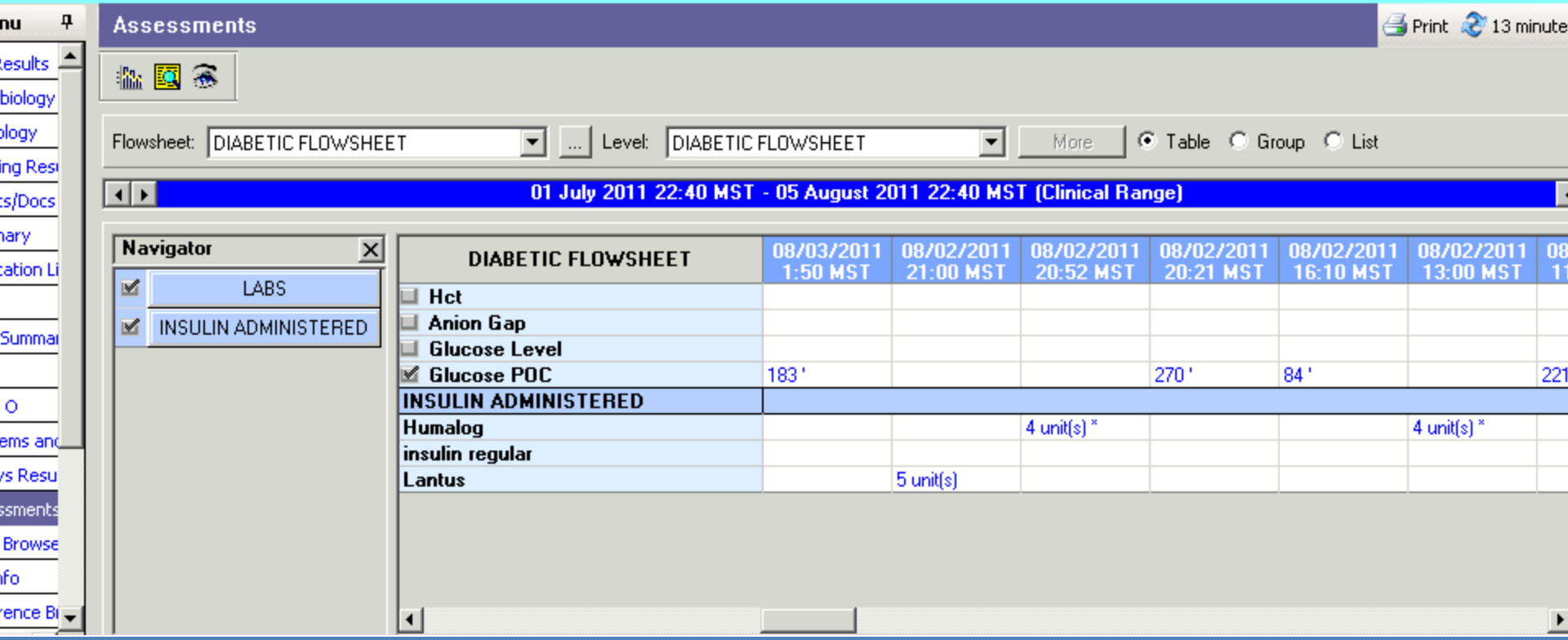
Level: DIABETIC FLOWSHEET
More
Table
Group
List
01 July 2011 22:40 MST - 05 August 2011 22:40 MST (Clinical Range)
Navigator
LABS
INSULIN ADMINISTERED
DIABETIC FLOWSHEET
07/30/2011 11:17 MST
07/30/2011 7:09 MST
07/30/2011 3:15 MST
07/29/2011 21:00 MST
07/29/2011 20:31 MST
07/29/2011 17:32 MST
Hct
43.6
Anion Gap
11
Glucose Level
206 *
Glucose POC
97 '
197 '
167 '
INSULIN ADMINISTERED
Humalog
9 unit(s) *
insulin regular
Lantus
5 unit(s)

Sliding scale + 5 units glargine for 5 days.



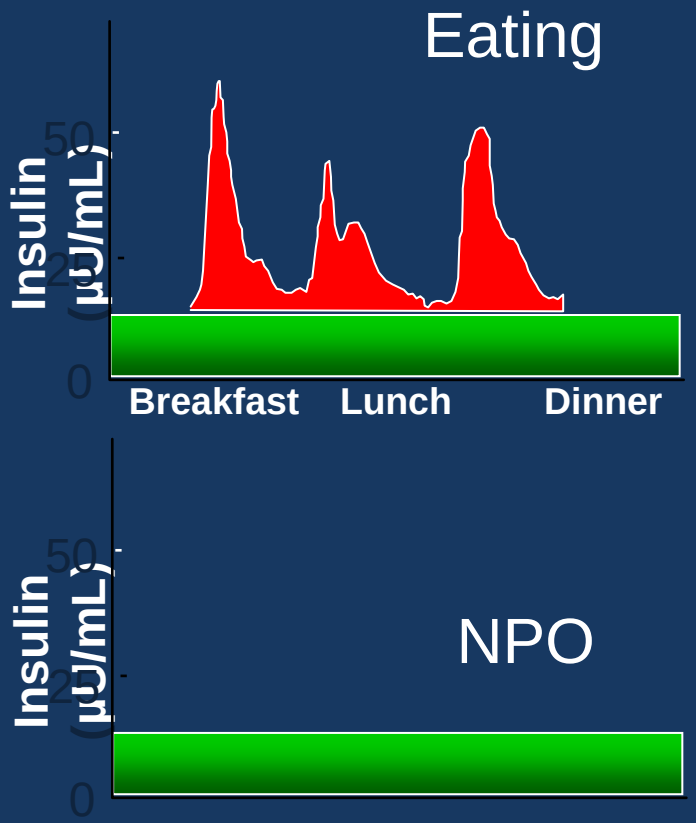
Case 1 Learning points

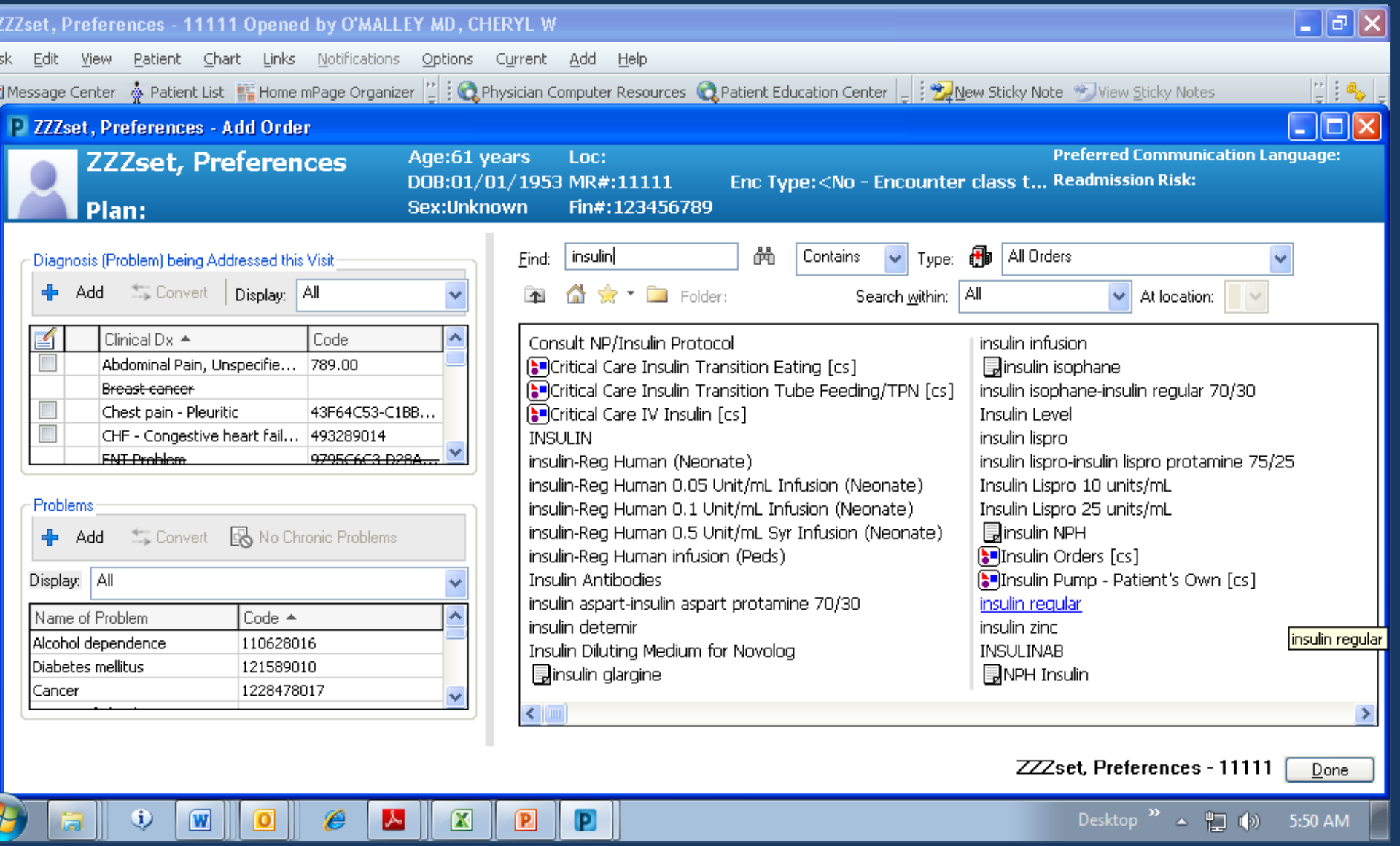
- If the home TDD is really only 5, ok to start there
- Use HbA1c to know if home dose was right
- Increase the doses daily!
- 0.3 X 57=17→8 glargine, 3 lispro with each meal

Know how to manage a patient's blood sugars while they are NPO or when tube feeds are initiated.

Notes on being NPO

- If NPH is your basal, need to reduce dose by 50% to avoid hypoglycemic from the insulin peak
- If glargine is your basal AND it is dosed at 50% of the TDD then NO NEED TO ADJUST for NPO
- Meal insulin orders instruct RN to hold if eating <50% of the meal or on full liquids. No need to hold back ordering.

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sk Edit View Patient Chart Links Notifications Options Current Add Help
Message Center Patient List Home mPage Organizer Physician Computer Resources Patient Education Center New Sticky Note View Sticky Notes
ZZZset, Preferences - Add Order
ZZZset, Preferences
Plan:
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DOB:01/01/1953 MR#:11111
Sex:Unknown Fin#:123456789
Enc Type:<No - Encounter class t...
Preferred Communication Language:
Readmission Risk:
Diagnosis (Problem) being Addressed this Visit
Add Convert Display: All
Clinical Dx Code
Abdominal Pain, Unspecifie... 789.00
Breast cancer
Chest pain - Pleuritic 43F64C53-C1BB...
CHF - Congestive heart fail... 493289014
ENT Problem 9795C6C3-D28A...
Problems
Add Convert No Chronic Problems
Display: All
Name of Problem Code
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Diabetes mellitus 121589010
Cancer 1228478017
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Contains
Type: All Orders
Folder:
Search within: All
At location:
Consult NP/Insulin Protocol
Critical Care Insulin Transition Eating [cs]
Critical Care Insulin Transition Tube Feeding/TPN [cs]
Critical Care IV Insulin [cs]
INSULIN
insulin-Reg Human (Neonate)
insulin-Reg Human 0.05 Unit/mL Infusion (Neonate)
insulin-Reg Human 0.1 Unit/mL Infusion (Neonate)
insulin-Reg Human 0.5 Unit/mL Syr Infusion (Neonate)
insulin-Reg Human infusion (Peds)
Insulin Antibodies
insulin aspart-insulin aspart protamine 70/30
insulin detemir
Insulin Diluting Medium for Novolog
insulin glargine
insulin infusion
insulin isophane
insulin isophane-insulin regular 70/30
Insulin Level
insulin lispro
insulin lispro-insulin lispro protamine 75/25
Insulin Lispro 10 units/mL
Insulin Lispro 25 units/mL
insulin NPH
Insulin Orders [cs]
Insulin Pump - Patient's Own [cs]
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insulin zinc
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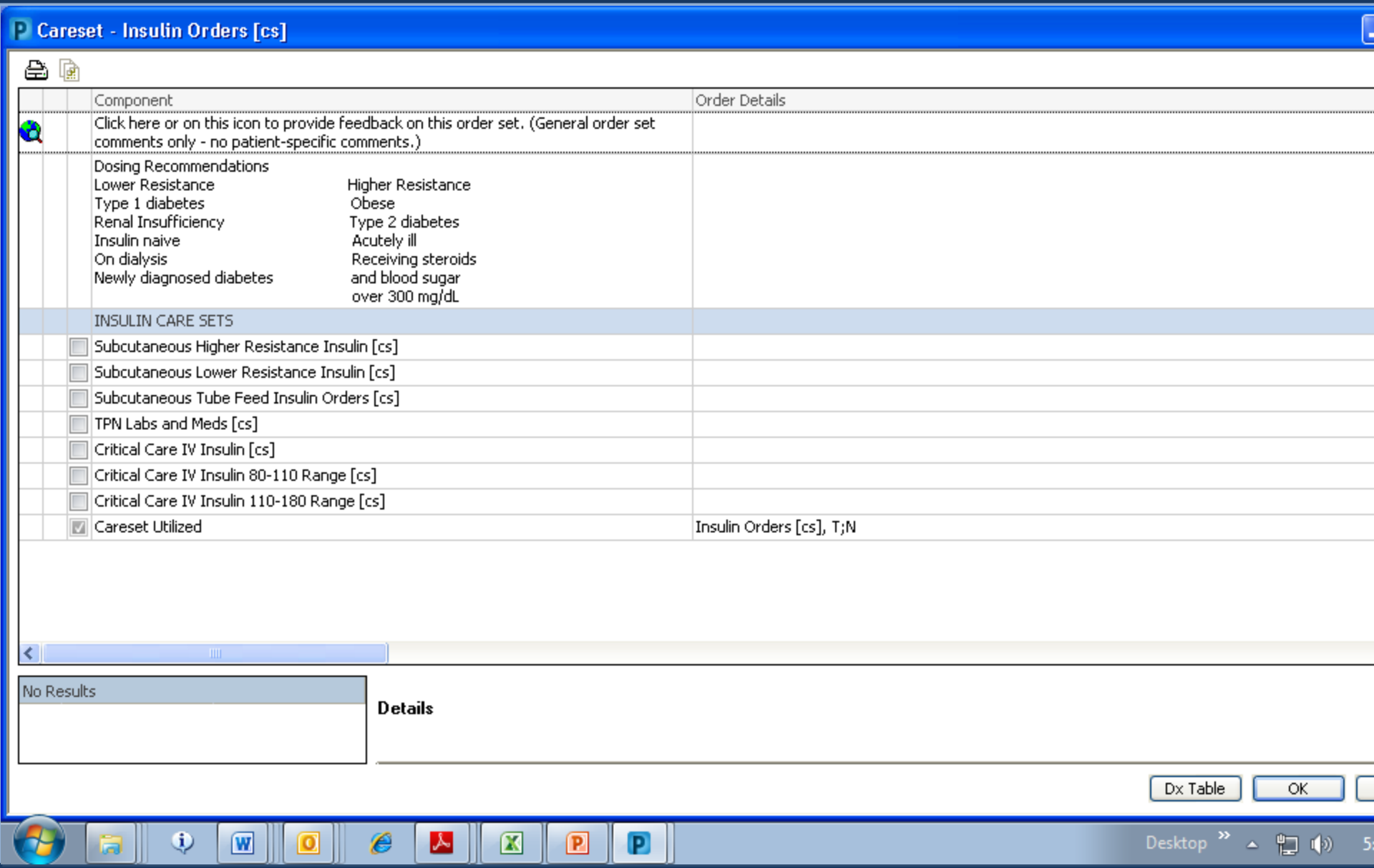
Careset - Insulin Orders [cs]
Component
Order Details
Click here or on this icon to provide feedback on this order set. (General order set comments only - no patient-specific comments.)
Dosing Recommendations
Lower Resistance
Type 1 diabetes
Renal Insufficiency
Insulin naive
On dialysis
Newly diagnosed diabetes
Higher Resistance
Obese
Type 2 diabetes
Acutely ill
Receiving steroids
and blood sugar
over 300 mg/dL
INSULIN CARE SETS
Subcutaneous Higher Resistance Insulin [cs]
Subcutaneous Lower Resistance Insulin [cs]
Subcutaneous Tube Feed Insulin Orders [cs]
TPN Labs and Meds [cs]
Critical Care IV Insulin [cs]
Critical Care IV Insulin 80-110 Range [cs]
Critical Care IV Insulin 110-180 Range [cs]
Careset Utilized
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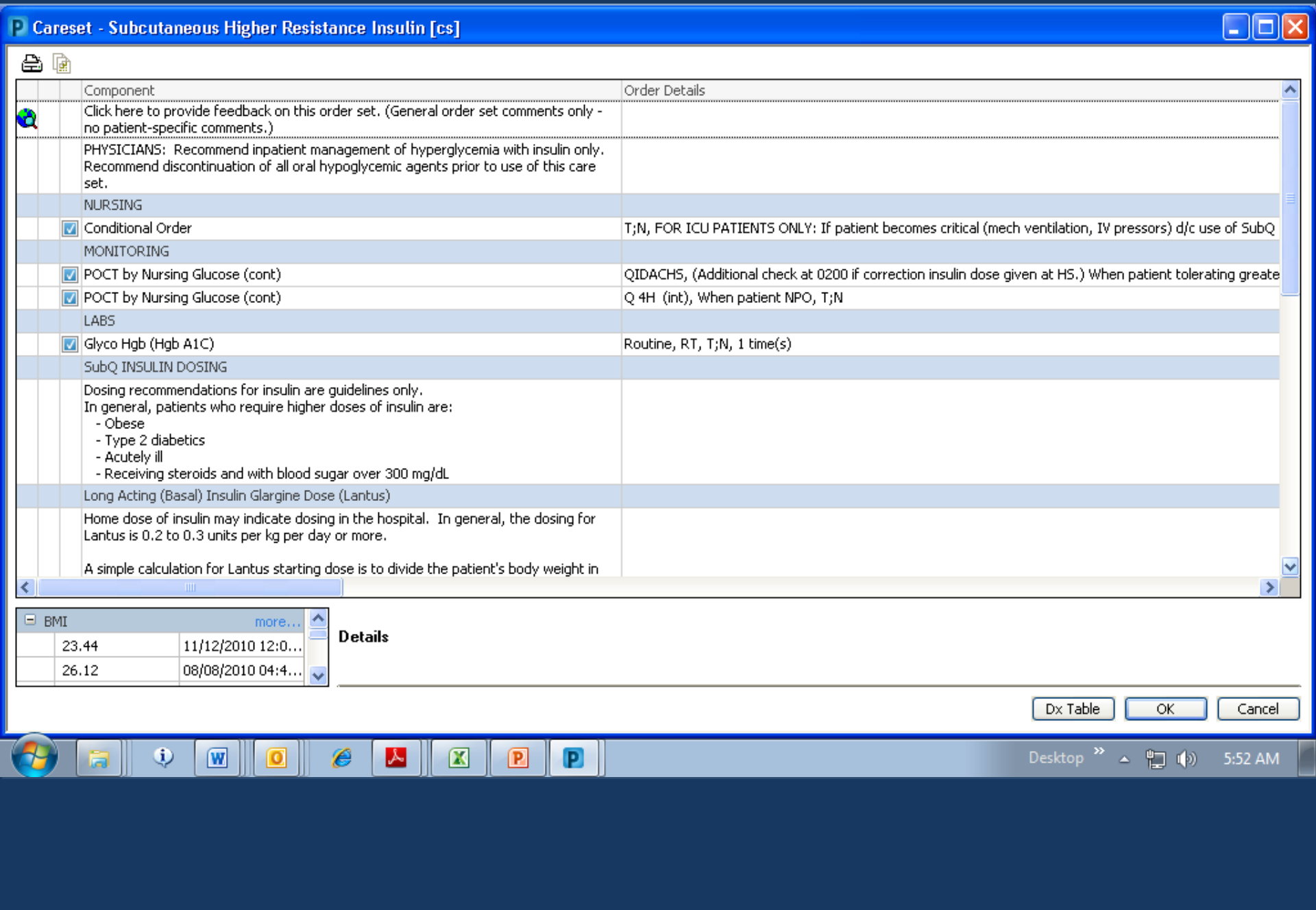
Careset - Subcutaneous Higher Resistance Insulin [cs]
Component
Order Details
Click here to provide feedback on this order set. (General order set comments only - no patient-specific comments.)
PHYSICIANS: Recommend inpatient management of hyperglycemia with insulin only. Recommend discontinuation of all oral hypoglycemic agents prior to use of this care set.
NURSING
Conditional Order
T;N, FOR ICU PATIENTS ONLY: If patient becomes critical (mech ventilation, IV pressors) d/c use of SubQ
MONITORING
POCT by Nursing Glucose (cont)
QIDACHS, (Additional check at 0200 if correction insulin dose given at HS.) When patient tolerating greate
POCT by Nursing Glucose (cont)
Q 4H (int), When patient NPO, T;N
LABS
Glyco Hgb (Hgb A1C)
Routine, RT, T;N, 1 time(s)
SubQ INSULIN DOSING
Dosing recommendations for insulin are guidelines only.
In general, patients who require higher doses of insulin are:
- Obese
- Type 2 diabetics
- Acutely ill
- Receiving steroids and with blood sugar over 300 mg/dL
Long Acting (Basal) Insulin Glargine Dose (Lantus)
Home dose of insulin may indicate dosing in the hospital. In general, the dosing for Lantus is 0.2 to 0.3 units per kg per day or more.
A simple calculation for Lantus starting dose is to divide the patient's body weight in
BMI
more...
23.44
11/12/2010 12:0...
26.12
08/08/2010 04:4...
Details
Dx Table
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Cancel
Desktop
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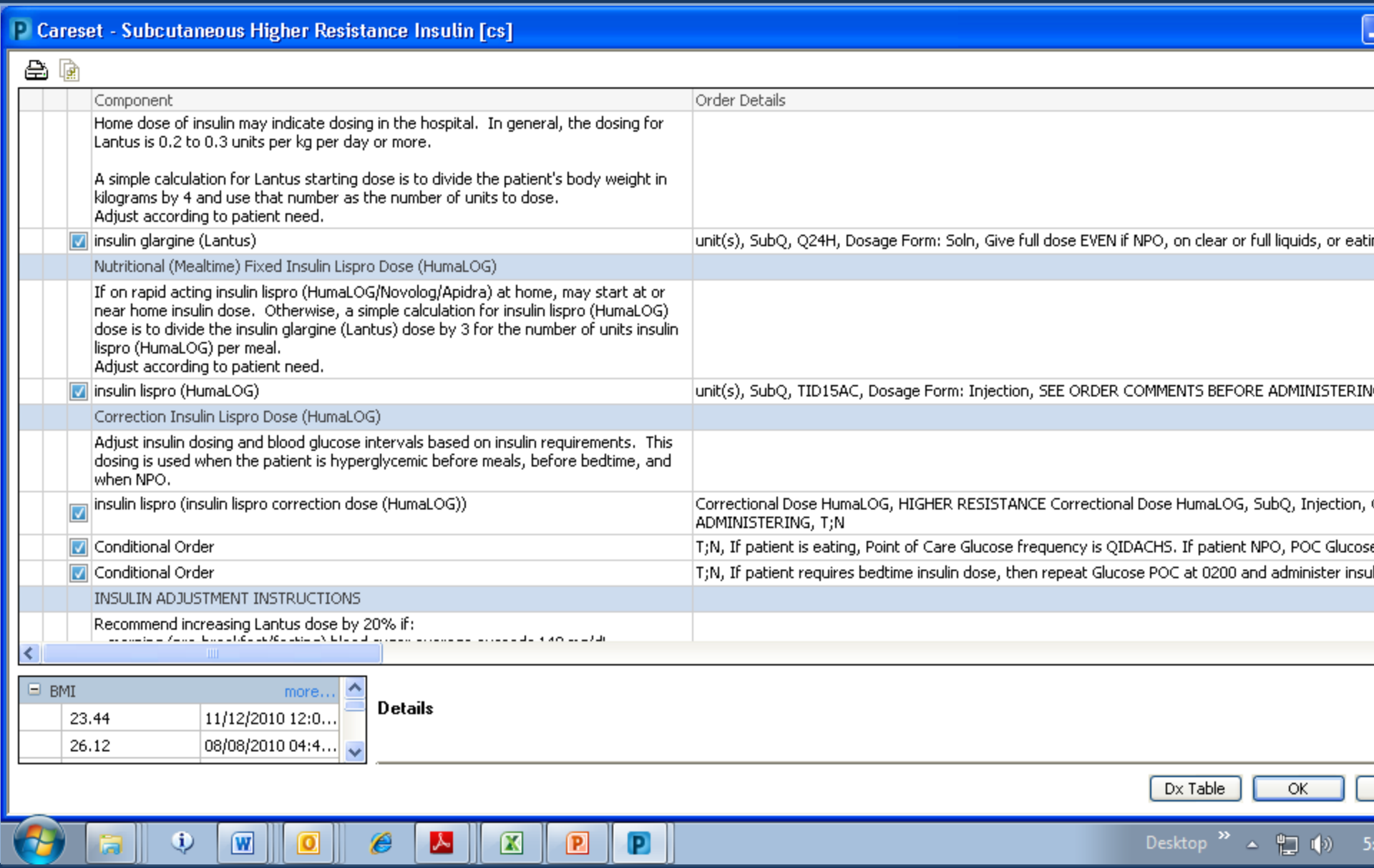
Careset - Subcutaneous Higher Resistance Insulin [cs]
Component
Order Details
Home dose of insulin may indicate dosing in the hospital. In general, the dosing for Lantus is 0.2 to 0.3 units per kg per day or more.
A simple calculation for Lantus starting dose is to divide the patient's body weight in kilograms by 4 and use that number as the number of units to dose.
Adjust according to patient need.
insulin glargine (Lantus)
unit(s), SubQ, Q24H, Dosage Form: Soln, Give full dose EVEN if NPO, on clear or full liquids, or eati
Nutritional (Mealtime) Fixed Insulin Lispro Dose (HumaLOG)
If on rapid acting insulin lispro (HumaLOG/Novolog/Apidra) at home, may start at or near home insulin dose. Otherwise, a simple calculation for insulin lispro (HumaLOG) dose is to divide the insulin glargine (Lantus) dose by 3 for the number of units insulin lispro (HumaLOG) per meal.
Adjust according to patient need.
insulin lispro (HumaLOG)
unit(s), SubQ, TID15AC, Dosage Form: Injection, SEE ORDER COMMENTS BEFORE ADMINISTERIN
Correction Insulin Lispro Dose (HumaLOG)
Adjust insulin dosing and blood glucose intervals based on insulin requirements. This dosing is used when the patient is hyperglycemic before meals, before bedtime, and when NPO.
insulin lispro (insulin lispro correction dose (HumaLOG))
Correctional Dose HumaLOG, HIGHER RESISTANCE Correctional Dose HumaLOG, SubQ, Injection,
ADMINISTERING, T;N
Conditional Order
T;N, If patient is eating, Point of Care Glucose frequency is QIDACHS. If patient NPO, POC Glucose
Conditional Order
T;N, If patient requires bedtime insulin dose, then repeat Glucose POC at 0200 and administer insul
INSULIN ADJUSTMENT INSTRUCTIONS
Recommend increasing Lantus dose by 20% if:
BMI
more...
23.44
11/12/2010 12:0...
26.12
08/08/2010 04:4...
Details
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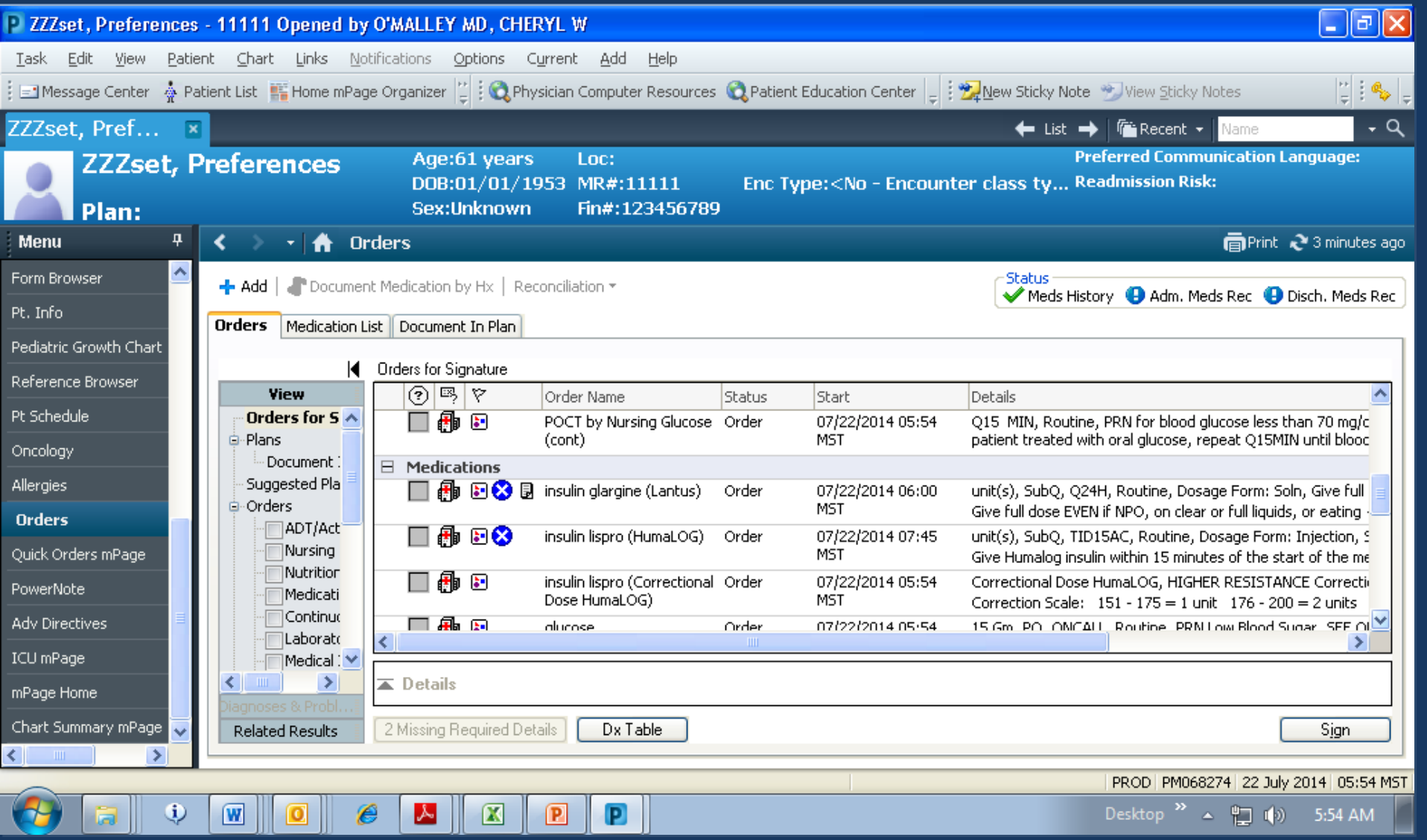
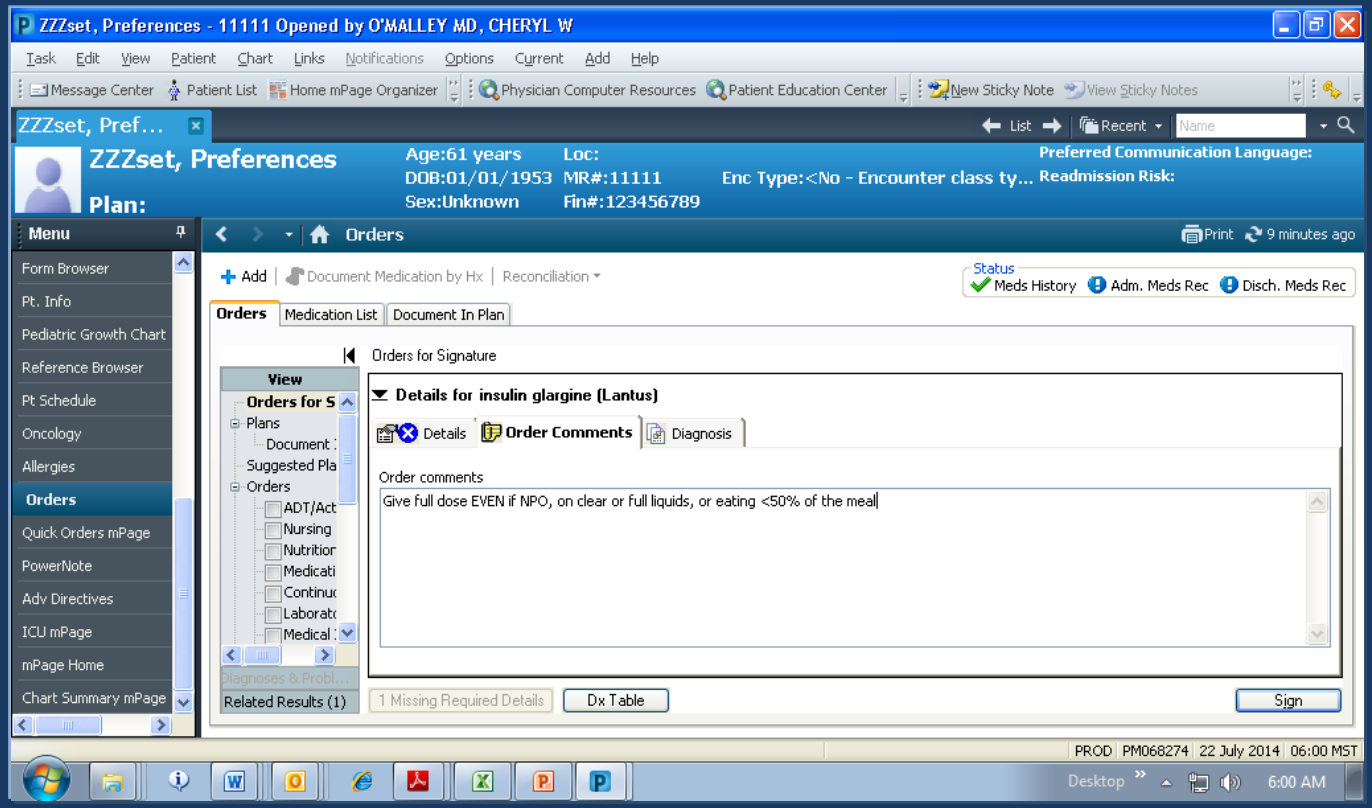
OK
Desktop

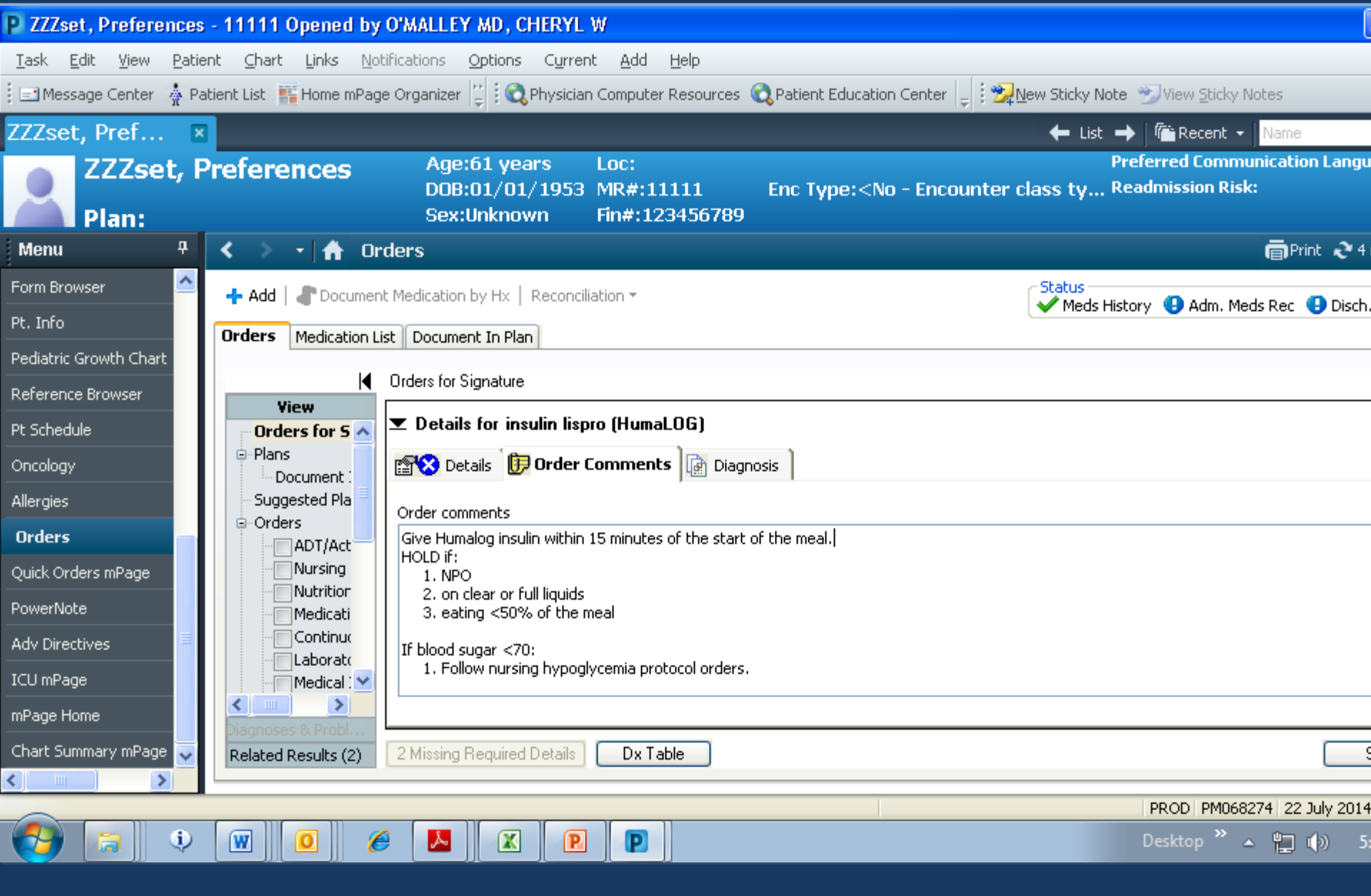
Much easier to order initial meal doses at time of order set initiation:
**Doses held if NPO or eating <50% meal (order comments)



Glargine full dose given if NPO



Standing orders to adjust if NPO



Case 6

- 59 y.o. 90 kg, BMI 39, s/p renal transplant admitted with emesis, diarrhea and sepsis from a urinary source. BG 230. Admitted to med-surg.
- Home med : 70/30 50 units qam and qpm. Well controlled, no lows. Last HbA1c 7

A. sliding scale for high resistance for 24 hours

B. Glargine 50 units + high resistance

C. TDD 100 units→ 50 glargine 16 humalog AC

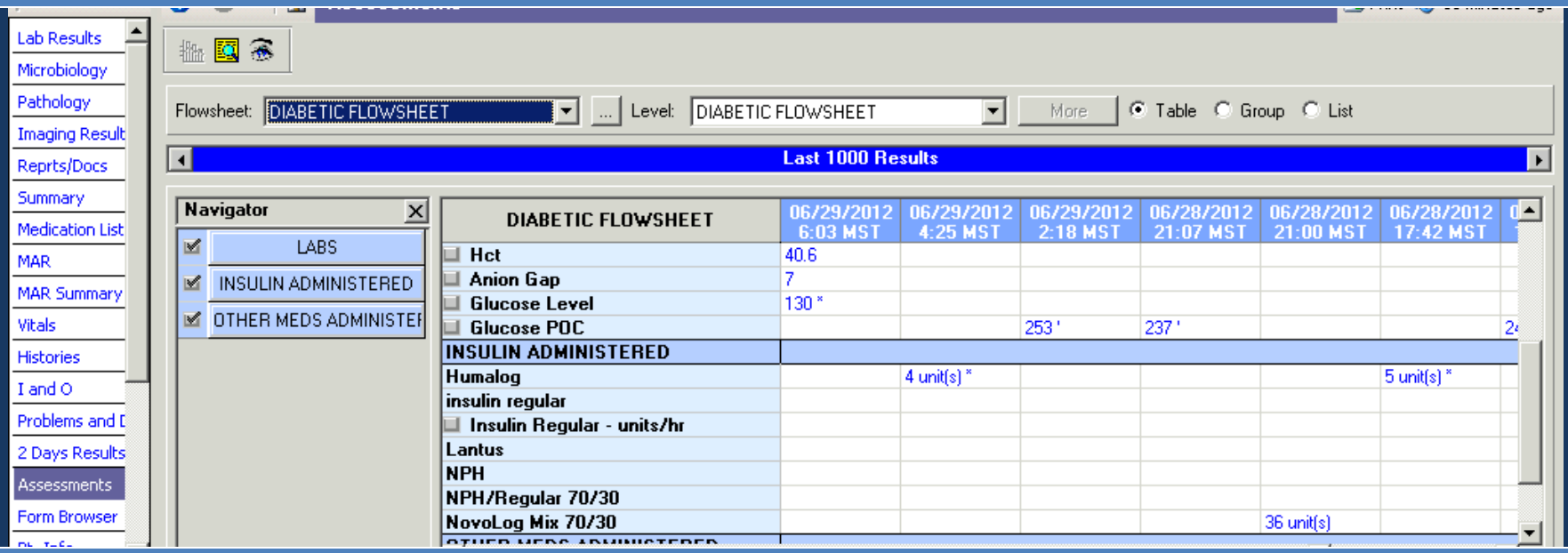
D. Continue 70/30 50 units bid

Step 1: Calculate Starting total daily dose (TDD):

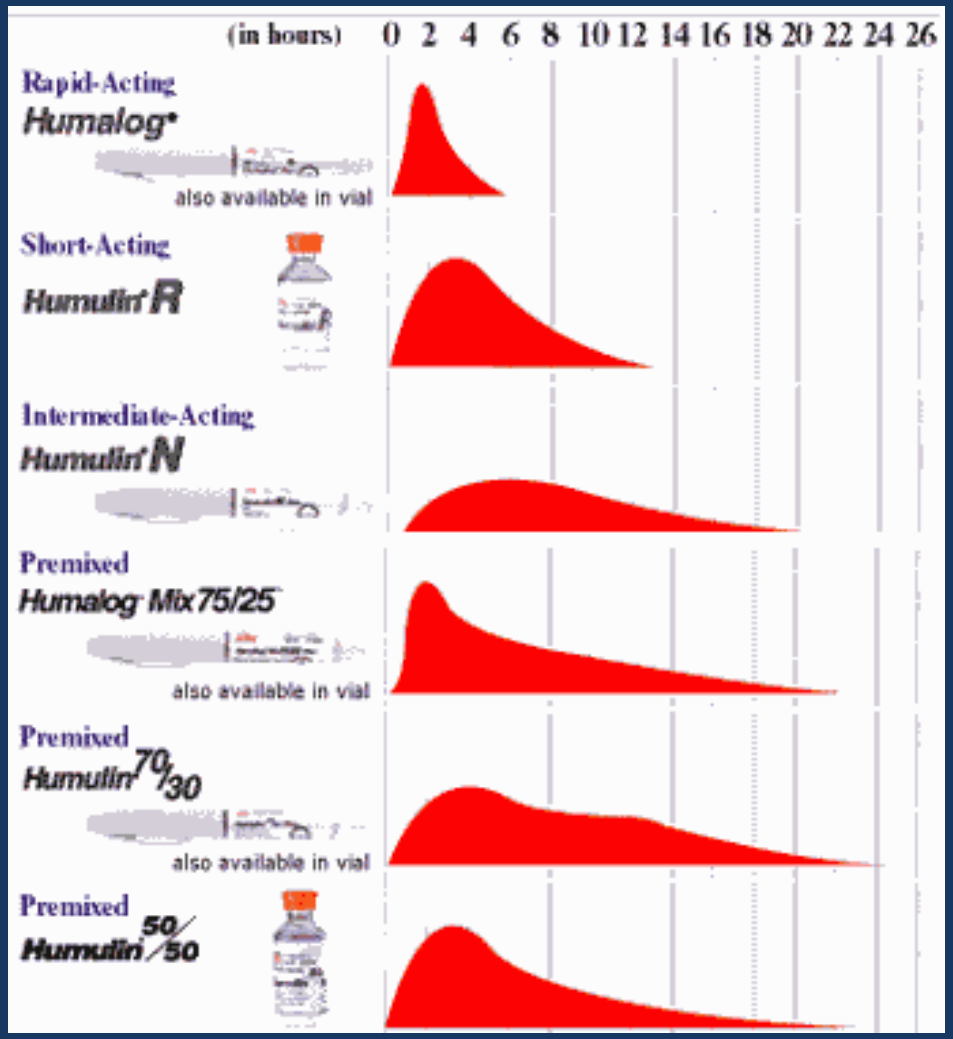
1. IV requirements
2. Home dose— (consider reduction by 25%)
3. Weight based 0.2-0.5 units/kg/day
    1. Most recent guides say 0.2-0.5
    2. Rabbit trials 0.3-0.5
        - 0.3 ESRD or elderly (>70 y.o.)
        - 0.4 units/kg/day if admit BG 140-200
        - 0.5 units/kg/day if admit BG >200

******Do not use "sliding scale" as a dose finding strategy***

Case 7: How many units of rapid acting insulin did he get at bedtime?



Insulin types and action



Insulin types are confusing

- Look them up
- Verify the name with the pharmacy
- Does it make sense
- Don’t use them in the hospital…use the ones the nurses know
- Think about the discharge plan for discharge, NOT for there regimen inpatient!

Take home points

- DO NOT USE split mixed insulins in the hospital!
- DO NOT use regular insulin subcutaneous here at BGSMC (probably not at the VA either)
- If you EVER use anything other than glargine + humalog you better have a plan, know the action

Know when and how to make adjustments to the home regimen based on their blood glucose control prior to admission, resources and hospital requirements

But my patient won’t be able to afford/manage/comply/etc with basal/bolus as an outpatient

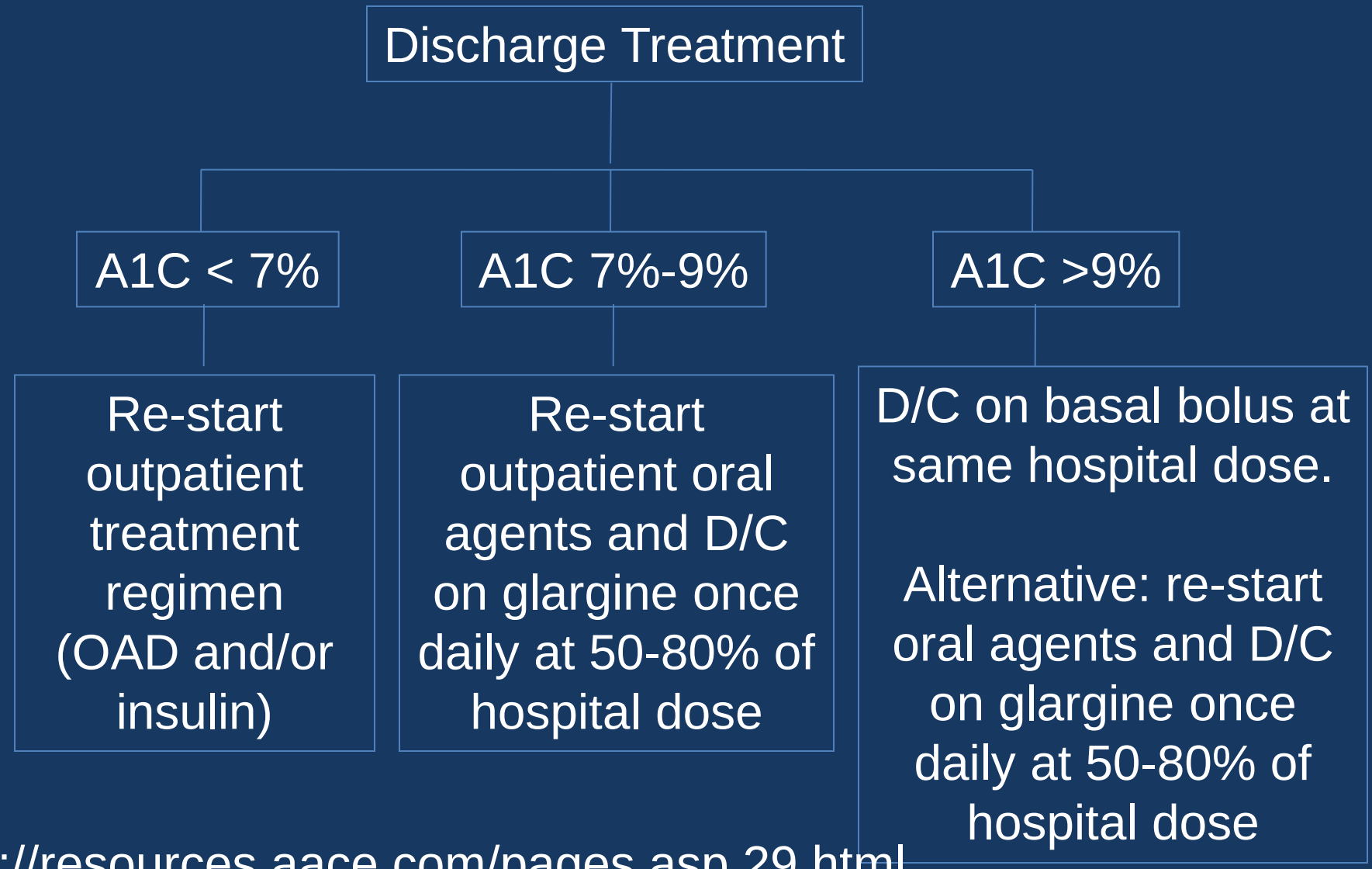
Achieving safe and effective transitions to home

- The admission HbA1c to indicate the patient's glycemic status *before they became ill*
  - ≤ 5.7 = normal glucose metabolism
  - 5.7 - 6.4 = 'pre-diabetes'(high risk for DM)
  - ≥ 6.5 = diabetes
  - ≥ 8.0 = poorly controlled diabetes

Factors Used for Selecting Discharge Therapy for Patients with Known Diabetes

- Control at home and admission HbA_{1C}
- Home regimen prior to admission
- Admission reason: Hypoglycemia, Acute MI, Related to hyperglycemia (DKA, HHS, etc.)
- Physical limitations
- New co-morbidities that may limit prior oral therapy
- Hypoglycemia risk factors
- Treatment goals (I.e. hospice)
- Frequency of self monitoring
- Financial $$$$

Discharge Treatment Algorithm: AACE



http://resources.aace.com/pages.asp.29.html

AACE/ACE Diabetes Algorithm *For Glycemic Control*

A1C Goal ≤ 6.5%*

LIFESTYLE MODIFICATION

A1C 6.5 – 7.5%**

Monotherapy

MET † | DPP4 [1] | GLP-1 | TZD [2] | AGI [3]

*2 - 3 Mos.****

Dual Therapy

- MET + GLP-1 or DPP4 [1]
- MET + TZD [2]
- MET + Glinide or SU [5]
- TZD + GLP-1 or DPP4 [1]
- MET + Colesevelam
- MET + AGI [3]

*2 - 3 Mos.****

Triple Therapy

- MET + GLP-1 or DPP4 [1] + TZD [2]
- MET + GLP-1 or DPP4 [1] + Glinide or SU [4,7]

*2 - 3 Mos.****

INSULIN ± Other Agent(s) [6]

A1C 7.6 – 9.0%

Dual Therapy [8]

- MET + GLP-1 or DPP4 [1]
- MET + TZD [2]
- MET + SU or Glinide [4,5]

*2 - 3 Mos.****

Triple Therapy [9]

- MET + GLP-1 or DPP4 [1] + TZD [2]
- MET + GLP-1 or DPP4 [1] + SU [7]
- MET + TZD [2] + SU [7]

*2 - 3 Mos.****

INSULIN ± Other Agent(s) [6]

A1C > 9.0%

Drug Naive | *Under Treatment*

Symptoms | *No Symptoms*

INSULIN ± Other Agent(s) [6]

- MET + GLP-1 or DPP4 [1] ± SU [7]
- MET + TZD [2]
- MET + GLP-1 or DPP4 [1] ± TZD [2]

INSULIN ± Other Agent(s) [6]

AACE/ACE Algorithm for Glycemic Control Committee

Cochairpersons:
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Stanley S. Schwartz, MD, FACE

* May not be appropriate for all patients

** For patients with diabetes and A1C < 6.5%, pharmacologic Rx may be considered

*** If A1C goal not achieved safely

† Preferred initial agent

1 DPP4 if ↑PPG and ↑FPG or GLP-1 if ↑↑PPG

2 TZD if metabolic syndrome and/or nonalcoholic fatty liver disease (NAFLD)

3 AGI if ↑PPG

4 Glinide if ↑PPG or SU if ↑FPG

5 Low-dose secretagogue recommended

6 a) Discontinue insulin secretagogue with multidose insulin
b) Can use pramlintide with prandial insulin

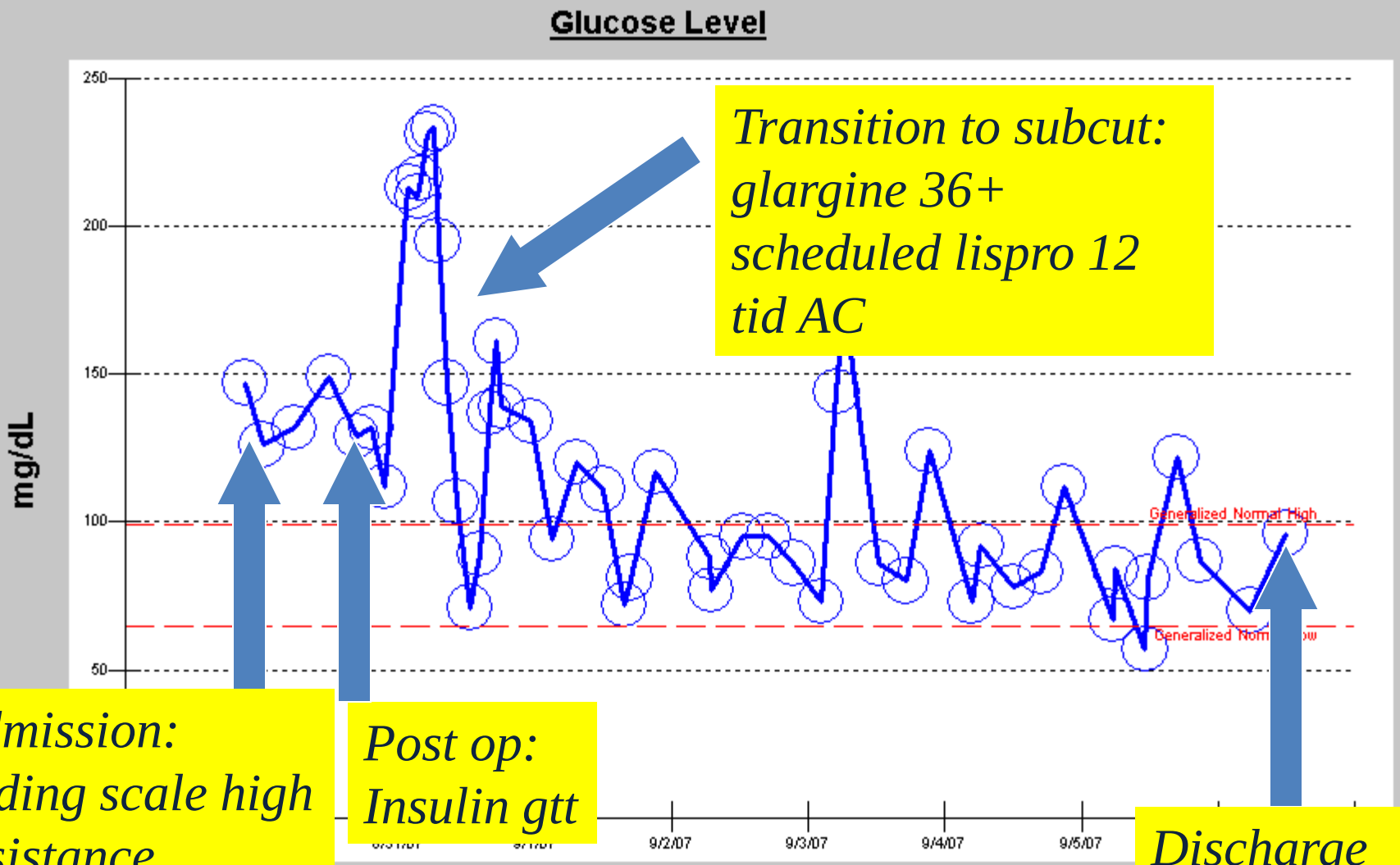
7 Decrease secretagogue by 50% when added to GLP-1 or DPP-4

8 If A1C < 8.5%, combination Rx with agents that cause hypoglycemia should be used with caution

9 If A1C > 8.5%, in patients on Dual Therapy, insulin should be considered

Available at **www.aace.com/pub**

Case 8


Glucose Level
mg/dL
250
200
150
100
50
Generalized Normal High
9/2/07
9/3/07
9/4/07
9/5/07
Transition to subcut: glargine 36+ scheduled lispro 12 tid AC
Admission: sliding scale high resistance
Post op: Insulin gtt
Discharge

Case 8 Follow Up

- HgbA1c 13.4%
- Discharged on
  - Metformin 500 bid, instructed to increase to 1000 mg bid in one week if not too much gi side effects
  - Glipizide 5 mg bid
  - Glargine 30 units q hs
  - Diabetes education given
- HgbA1c 6.8% 2.5 months later!

Selecting Discharge Therapy
Take Home Messages

- Good to do something but don't get too aggressive because the time after discharge is high risk for hypoglycemia
- Once daily basal insulin with or without oral agents is a good initial strategy
- Keep metformin and get to goal dose unless contraind
- Tailor glycemic target to individual
- Endocrine is a great help

Why basal/bolus/correction?

- Achieves better glycemic control than sliding scale (RABBBIT trials)→ Improved surgical outcomes
- More flexible for
  - Rapid changes in eating status
  - Varying insulin resistance
- Order sets can/are built to improve safety
- Nurses and staff will know 2 types of insulin really well
- We aren’t using their d/c regimen while inpatient anyway

Additional Resources for Physician Education

- American Association of Clinical Endocrinology Inpatient glycemic control resource center:https://www.aace.com/education/igrc
- Society of Hospital Medicine Glycemic Control Resource Room: http://www.hospitalmedicine.org/ResourceRoomRedesign/GlycemicControl.cfm
- Johns Hopkins Consultative Medicine Essentials for Hospitalists: http://www.jhcape.com or shmconsults.com
- Quantia MD **What is involved in the practical management of blood sugars postoperatively?**
  - http://quantiamd.com/player/rqdjtgk?cid=53
- Quantia MD **What is involved in the practical management of insulin preoperatively?**
  - http://quantiamd.com/player/rumyejs?cid=53

Questions

Cheryl.OMalley@bannerhealth.com

Practice, Practice, Practice

Case 2

- 46 y.o. 95 kg, BMI 35, Admitted for diabetic foot ulcer, Cr 1.5, no recent hypoglycemia at home, no recent HgbA1c. Admit BG 215 didn't take meds today
- Home med : glargine 52 units daily + Glipizide 10 mg daily. Hold glipizide and ….

A. Sliding scale for BMI >30 until determine his dose

B. Glargine 52 units + ss high resistant

C. TDD 52 units→ 25 glargine 8 humalog AC

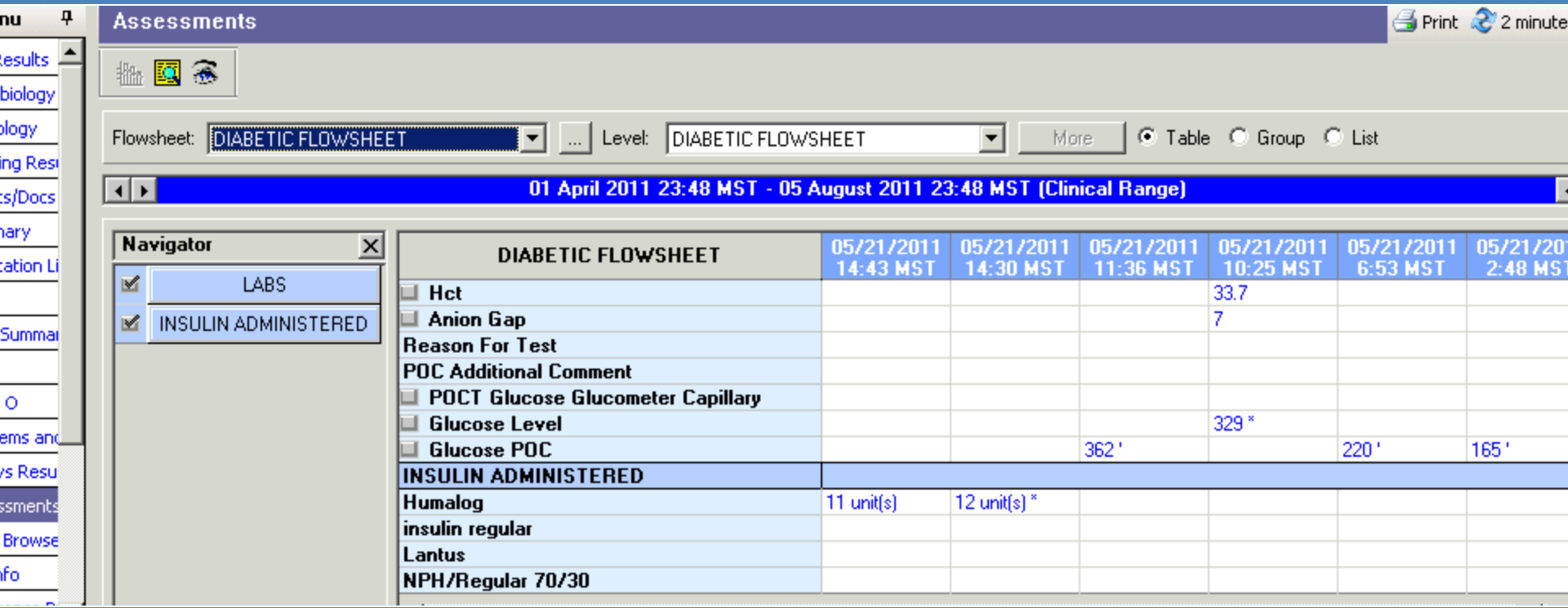
D. TDD 18 units (0.2 units/kg)→glargine 9, 3 humalog AC

E. Glargine 10 units + ss high resistant

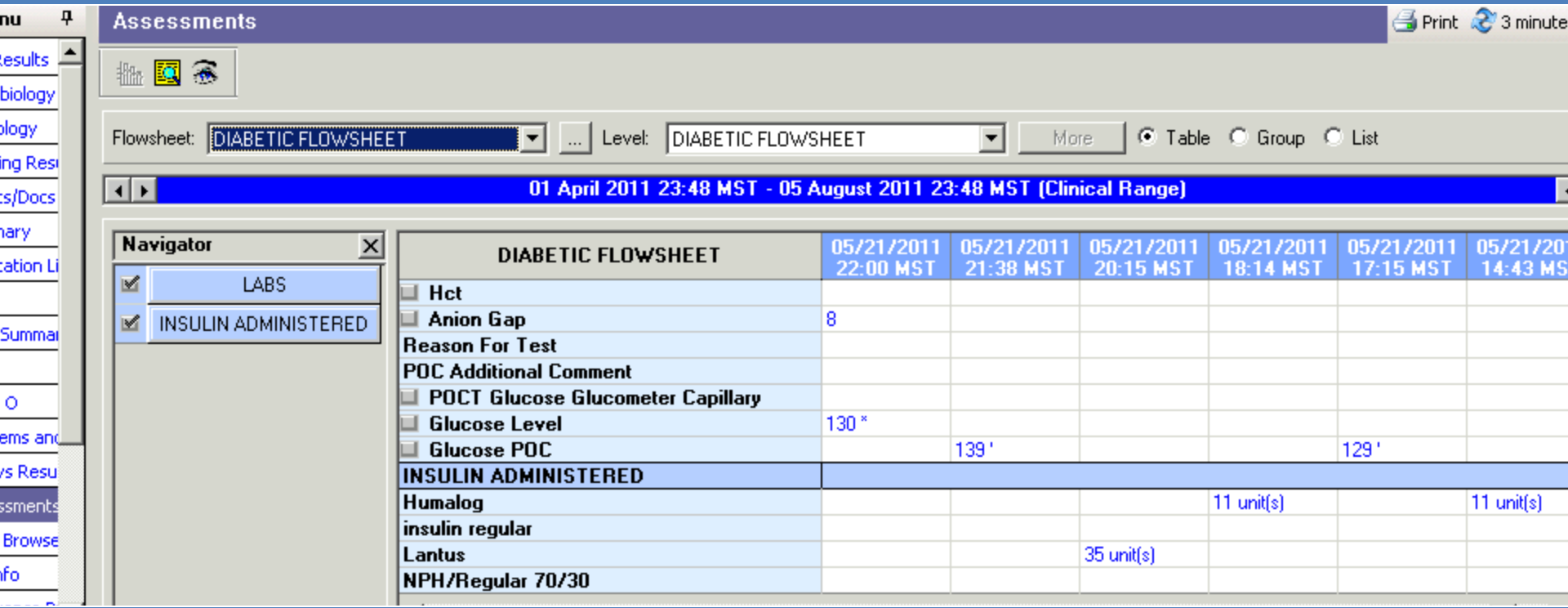
Answer

- Answer c.
- Her home TDD is 52 units and she has no risk factors for hypoglycemia
- By doing 50/50 you will build in a cushion in case the 52 is an overestimate.

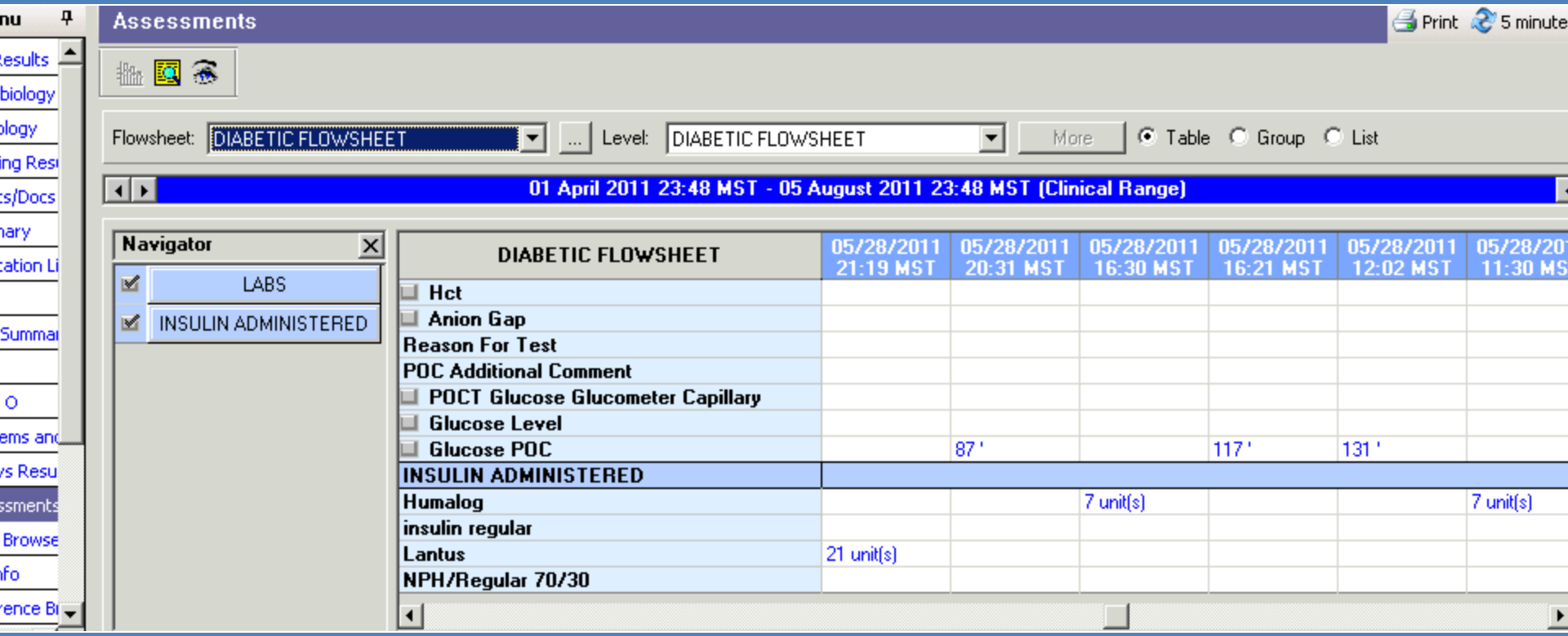
Sliding Scale

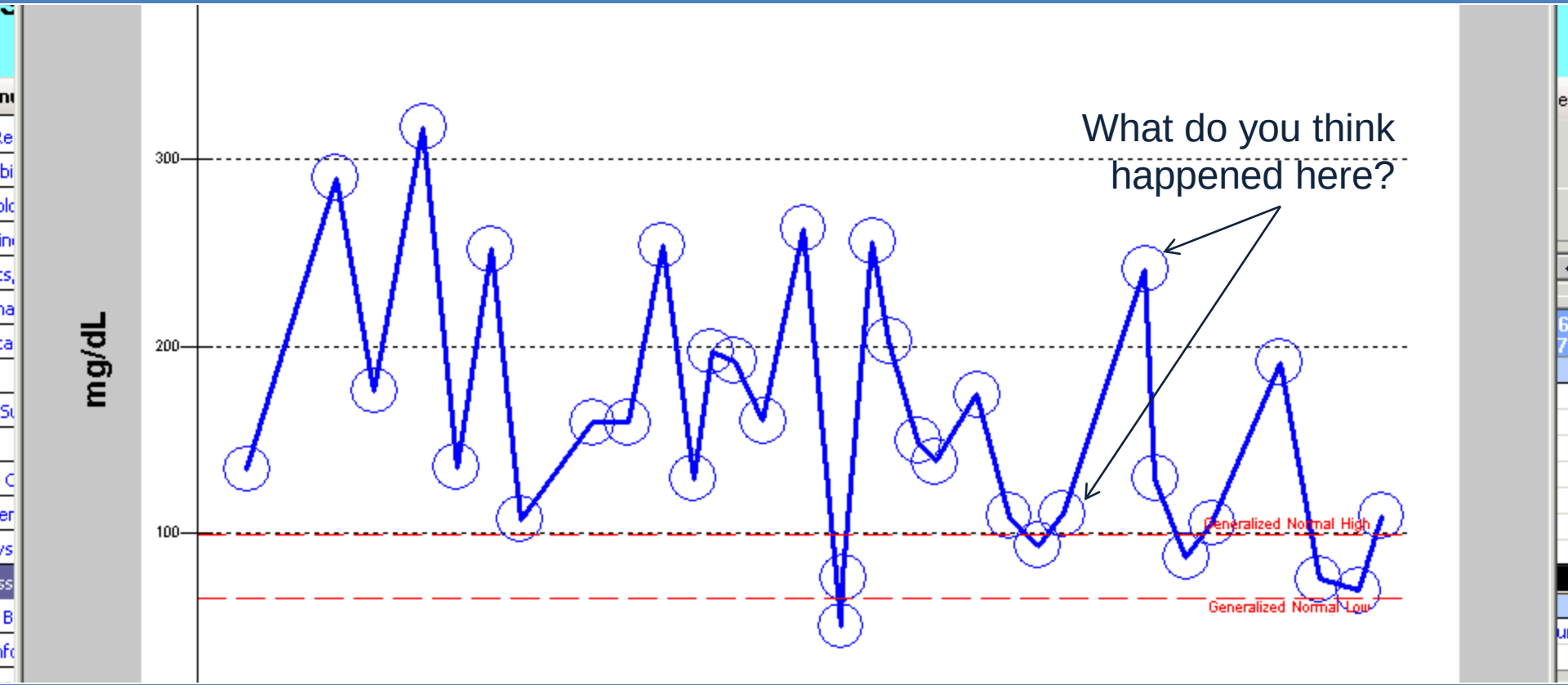


Basal/Bolus


Assessments
Print
3 minute
Flowsheet: DIABETIC FLOWSHEET
Level: DIABETIC FLOWSHEET
More
Table
Group
List
01 April 2011 23:48 MST - 05 August 2011 23:48 MST (Clinical Range)
Navigator
LABS
INSULIN ADMINISTERED
DIABETIC FLOWSHEET
05/21/2011 22:00 MST
05/21/2011 21:38 MST
05/21/2011 20:15 MST
05/21/2011 18:14 MST
05/21/2011 17:15 MST
Hct
Anion Gap
8
Reason For Test
POC Additional Comment
POCT Glucose Glucometer Capillary
Glucose Level
130 *
Glucose POC
139 '
129 '
INSULIN ADMINISTERED
Humalog
11 unit(s)
11 unit(s)
insulin regular
Lantus
35 unit(s)
NPH/Regular 70/30

Basal/Bolus


Assessments
Print
5 minute
Flowsheet: DIABETIC FLOWSHEET
Level: DIABETIC FLOWSHEET
More
Table
Group
List
01 April 2011 23:48 MST - 05 August 2011 23:48 MST (Clinical Range)
Navigator
LABS
INSULIN ADMINISTERED
DIABETIC FLOWSHEET
05/28/2011 21:19 MST
05/28/2011 20:31 MST
05/28/2011 16:30 MST
05/28/2011 16:21 MST
05/28/2011 12:02 MST
Hct
Anion Gap
Reason For Test
POC Additional Comment
POCT Glucose Glucometer Capillary
Glucose Level
Glucose POC
87 '
117 '
131 '
INSULIN ADMINISTERED
Humalog
7 unit(s)
7 unit(s)
insulin regular
Lantus
21 unit(s)
NPH/Regular 70/30


What do you think happened here?
mg/dL
300
200
100
Generalized Normal High
Generalized Normal Low

Answer

- Scheduled nutritional insulin was held inappropriately
- Based on this review, you wouldn’t want to increase the insulin the next day, just to reinforce why we are giving it in a scheduled rather than reactive manner.

Case 2.5

- 46 y.o. 95 kg, BMI 35,
  "placed in obs" for Chest pain.
- Cr 1.5, no recent hypoglycemia at home, no recent HgbA1c. Admit BG 215 didn't take meds today
- Home med : glargine 52 units daily + Glipizide 10 mg daily. Hold glipizide and ….

A. Sliding scale for BMI >30 until determine his dose

B. Glargine 52 units + glipizide 10 + ss high resistant

C. TDD 52 units→ 25 glargine 8 humalog AC

D. Glargine 10 units + ss high resistant

Answer

- B or C are acceptable with the plan to resume home regimen at d/c. Since very short stay with obs, is eating and no new contraindication, can keep home regimen

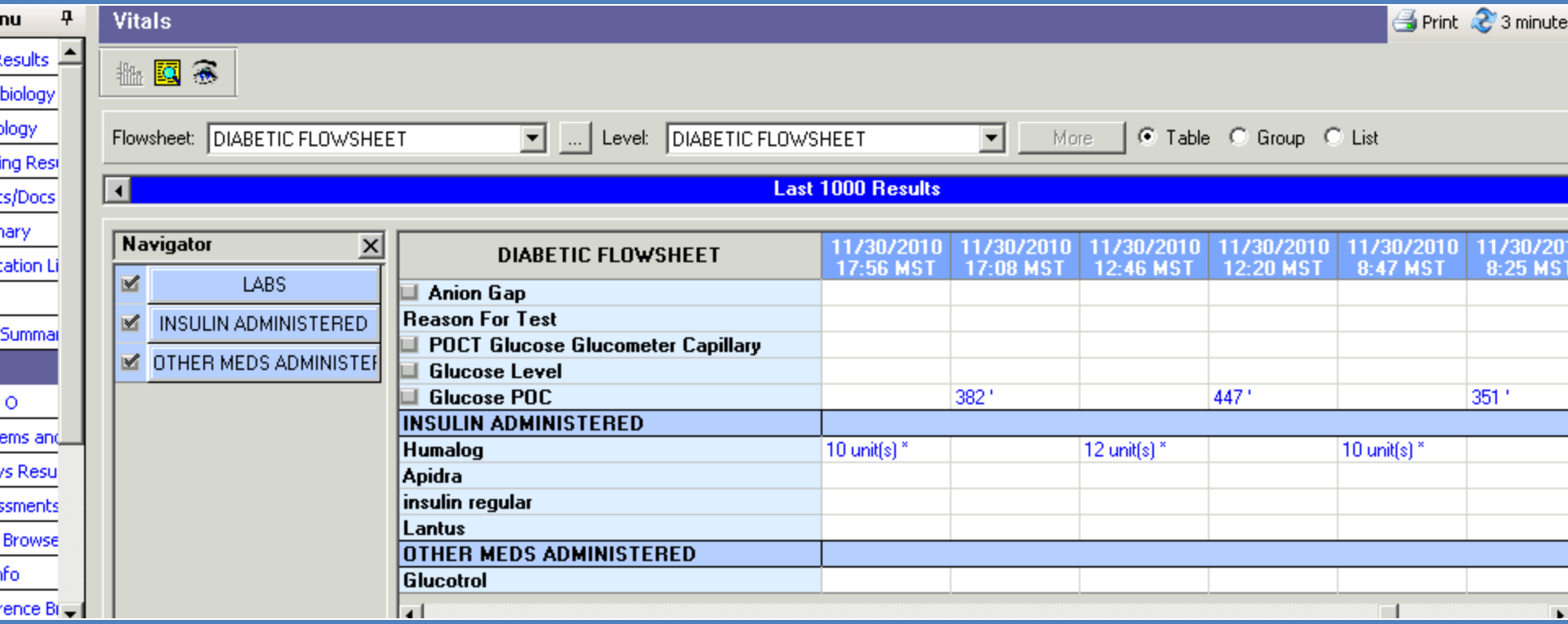
Case 3

- 55 y.o.
- 50 kg, BMI 20, Cr 3.5
- Home med glipizide 5 mg po daily no hypoglycemia, BG running high
- Admitted for renal transplant rejection and planning on treatment with solumedrol

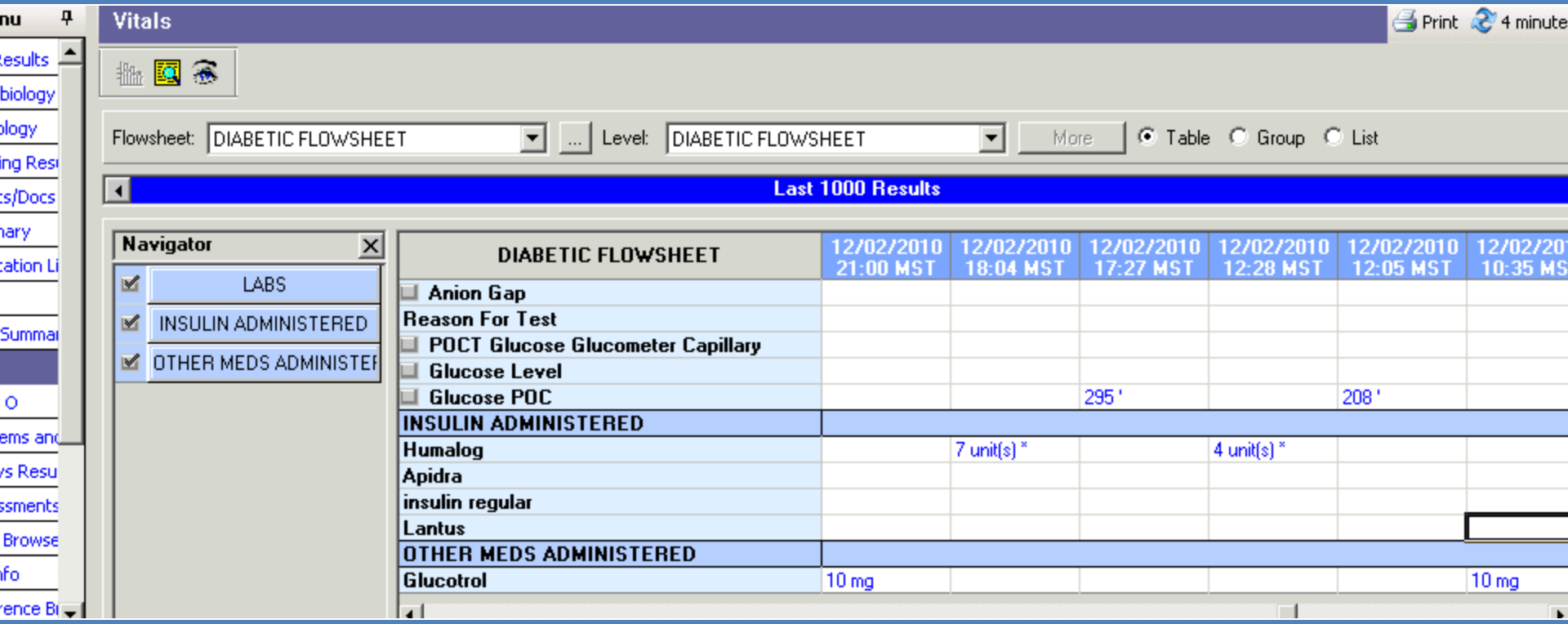
Answer

- Recommended starting dose would be 0.2-0.3 units/kg, she weighs 50 kg→10-15 units TDD
- 50/50 basal/nutritional = 5-7 unit glargine + 2 units with meals
- 30% basal/70% meal→ for hyperglycemia with steroids this is an option

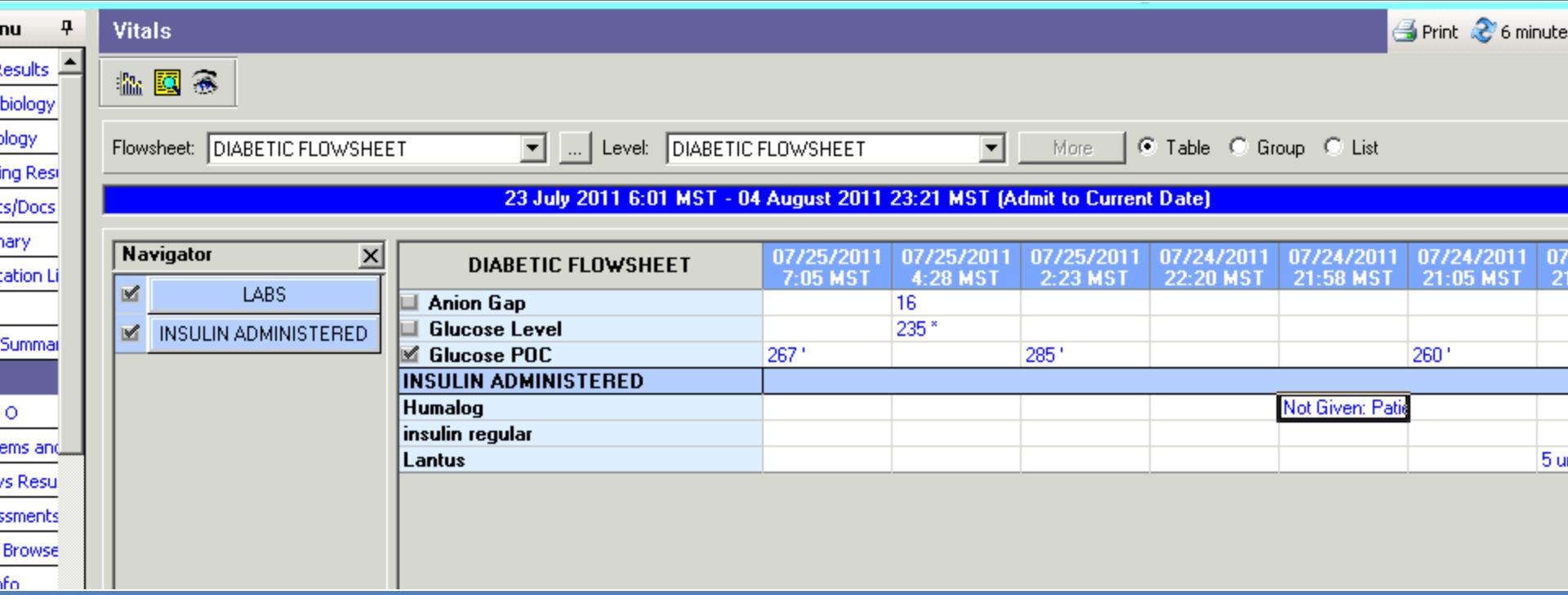
Sliding Scale only for 4 days with BG 400s



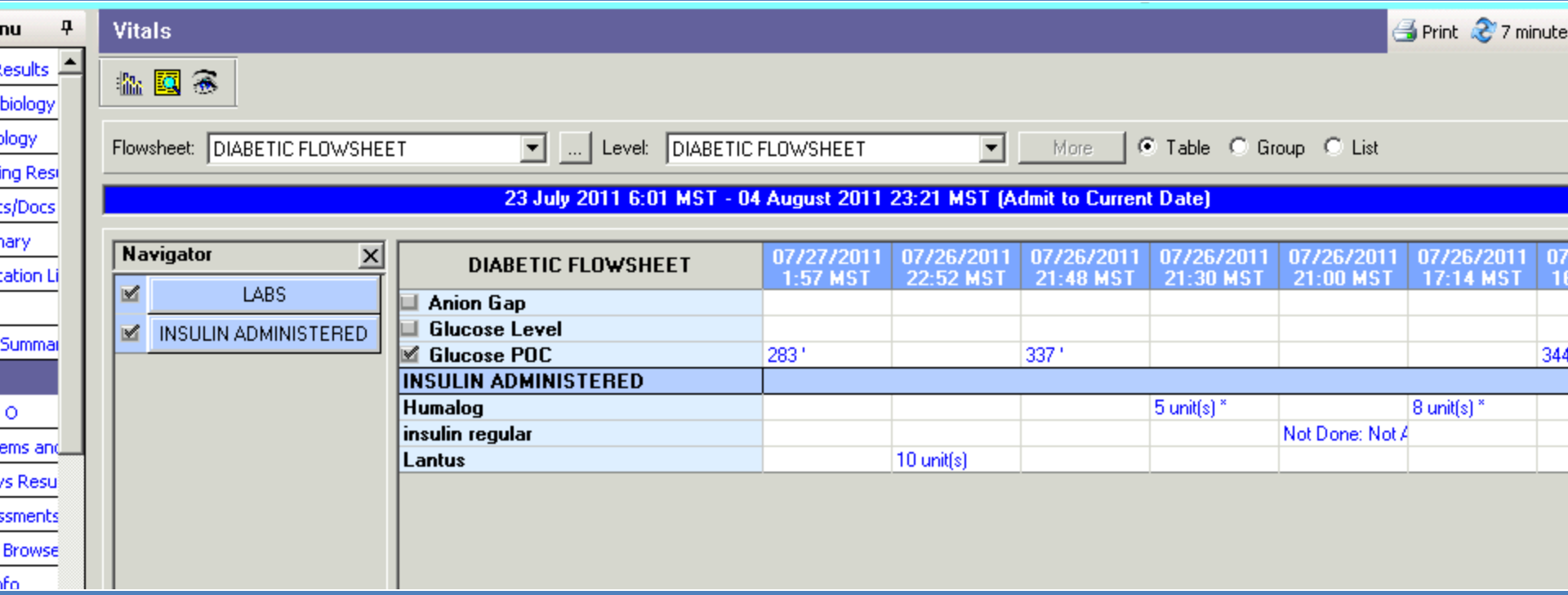
Sulfonylurea + ss



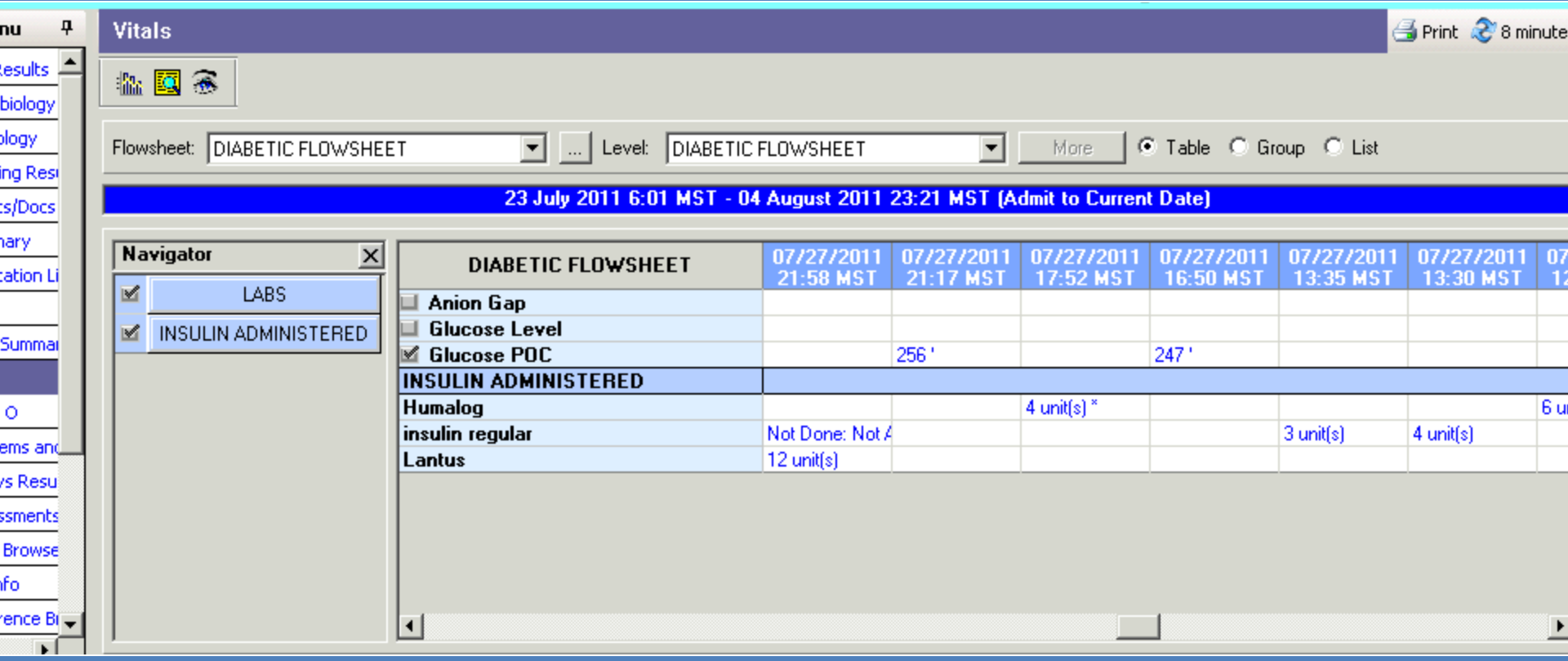
5 glargine + ss



10 glargine + ss



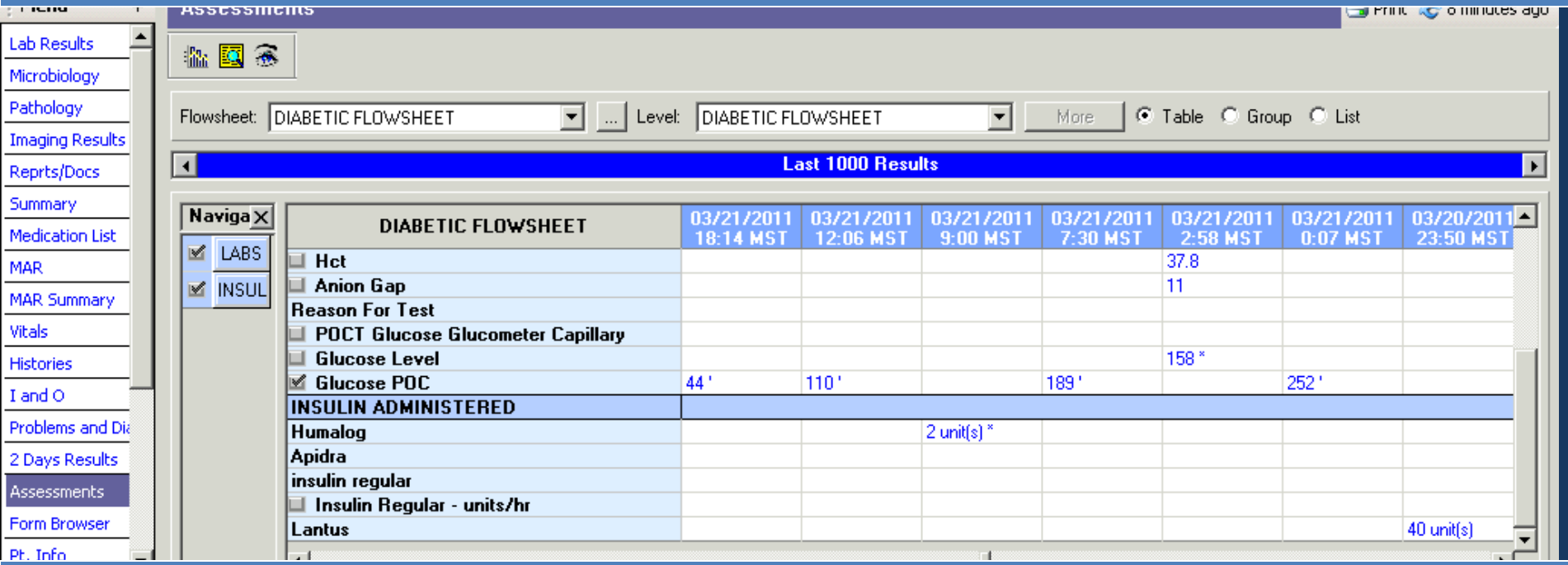
Kept lantus 10 and added regular insulin with meals + lispro ss



Steroids

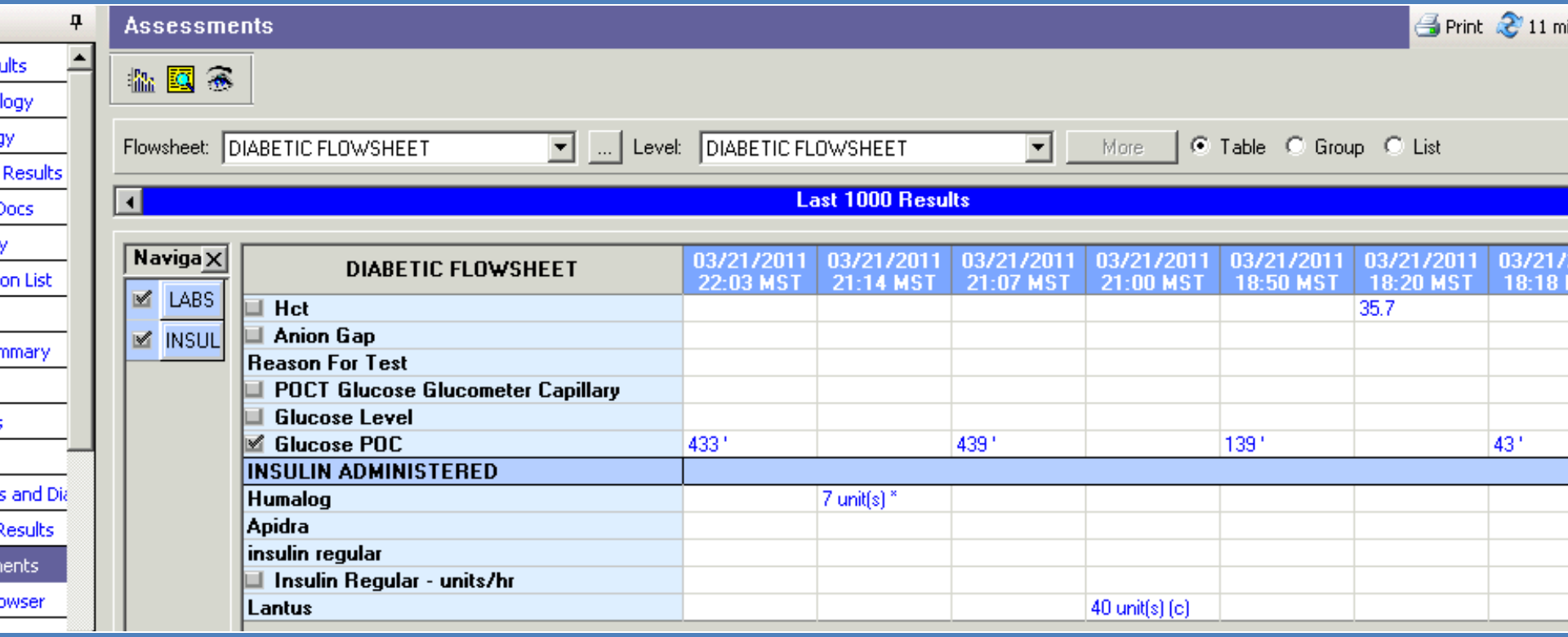
- If IV continous will be high all day, once a day po, high late afternoon/evening
- Keep thinking TDD
  - Cause more post prandial hyperglycemia
  - Change ratio to 30% basal/70% nutritional

Case 4- why low?

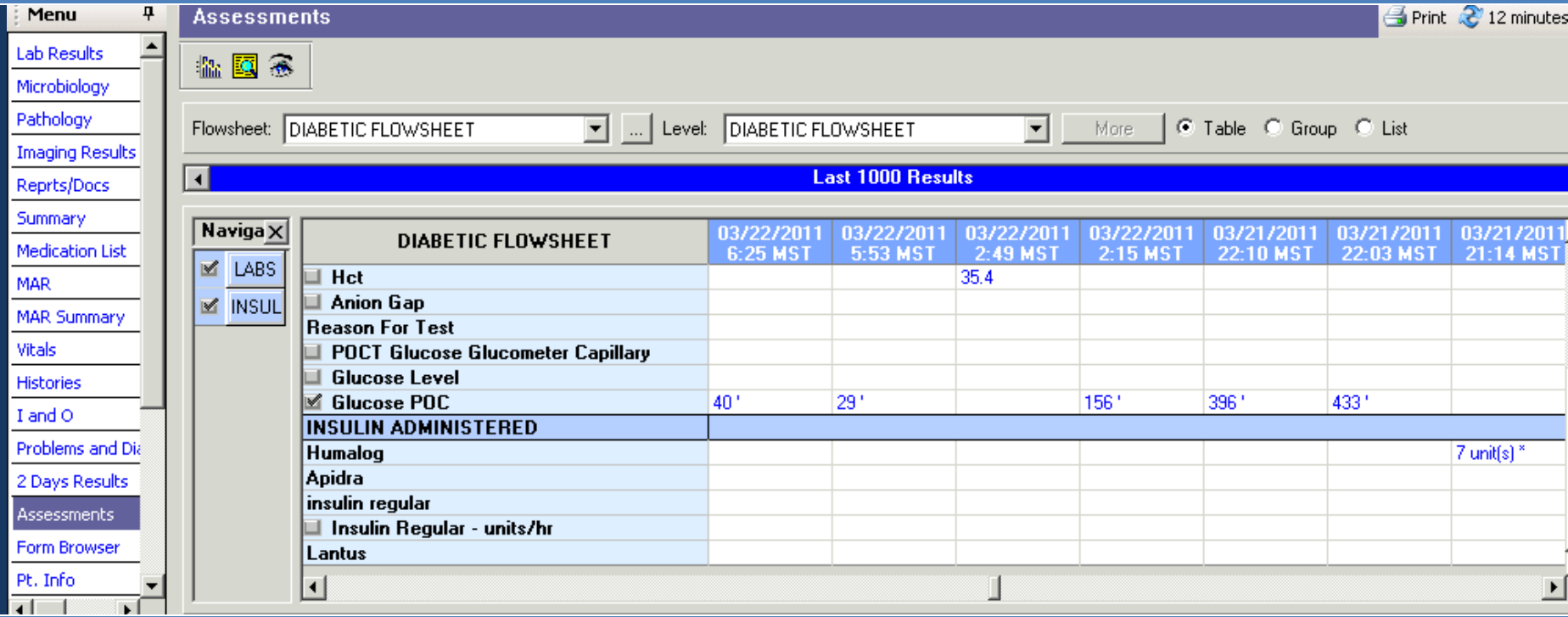


Answer

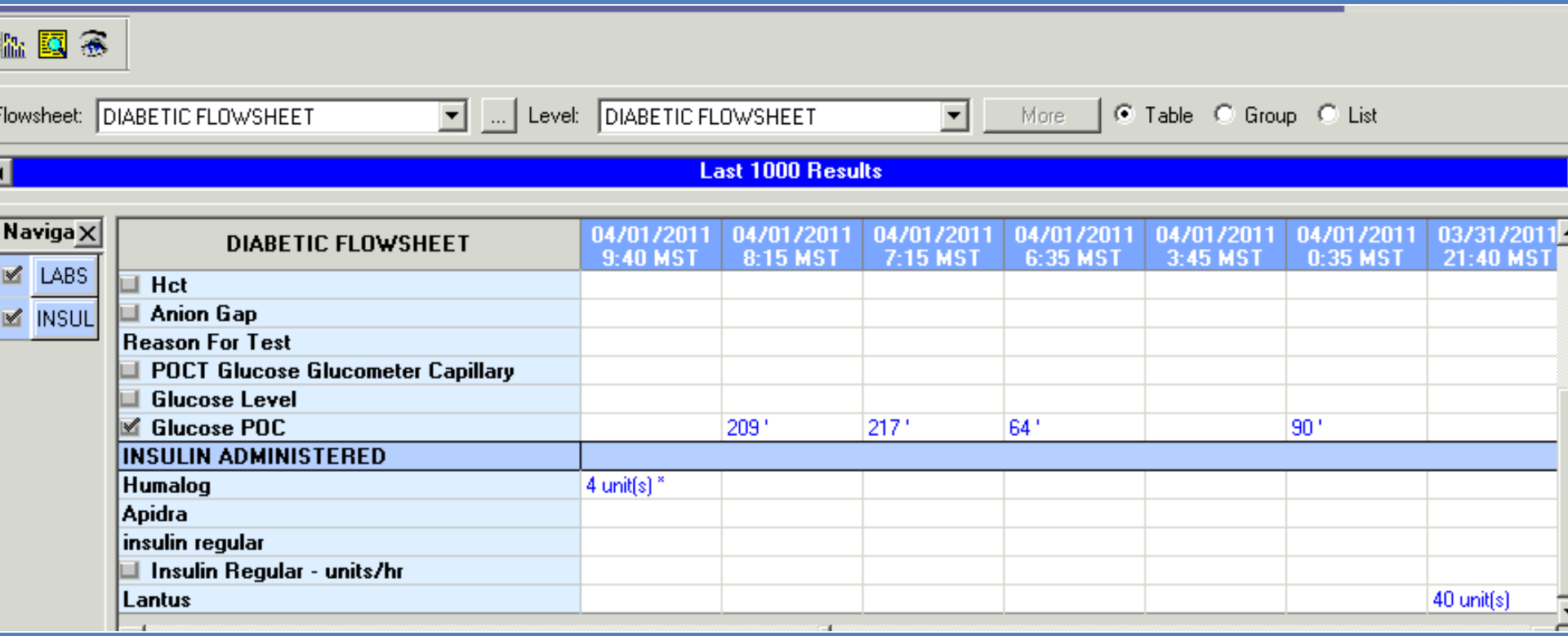
- Low because all insulin (TDD) was given as basal and she likely had unpredictable po


Assessments
Print
11 mi
Flowsheet: DIABETIC FLOWSHEET
Level: DIABETIC FLOWSHEET
More
Table
Group
List
Last 1000 Results
Naviga
LABS
INSUL
DIABETIC FLOWSHEET
03/21/2011 22:03 MST
03/21/2011 21:14 MST
03/21/2011 21:07 MST
03/21/2011 21:00 MST
03/21/2011 18:50 MST
03/21/2011 18:20 MST
Hct
35.7
Anion Gap
Reason For Test
POCT Glucose Glucometer Capillary
Glucose Level
Glucose POC
433 '
439 '
139 '
43 '
INSULIN ADMINISTERED
Humalog
7 unit(s) *
Apidra
insulin regular
Insulin Regular - units/hr
Lantus
40 unit(s) (c)

Do you see a pattern?



Repeat X 12 days



Flowsheet: DIABETIC FLOWSHEET ... Level: DIABETIC FLOWSHEET More Table Group List

Last 1000 Results

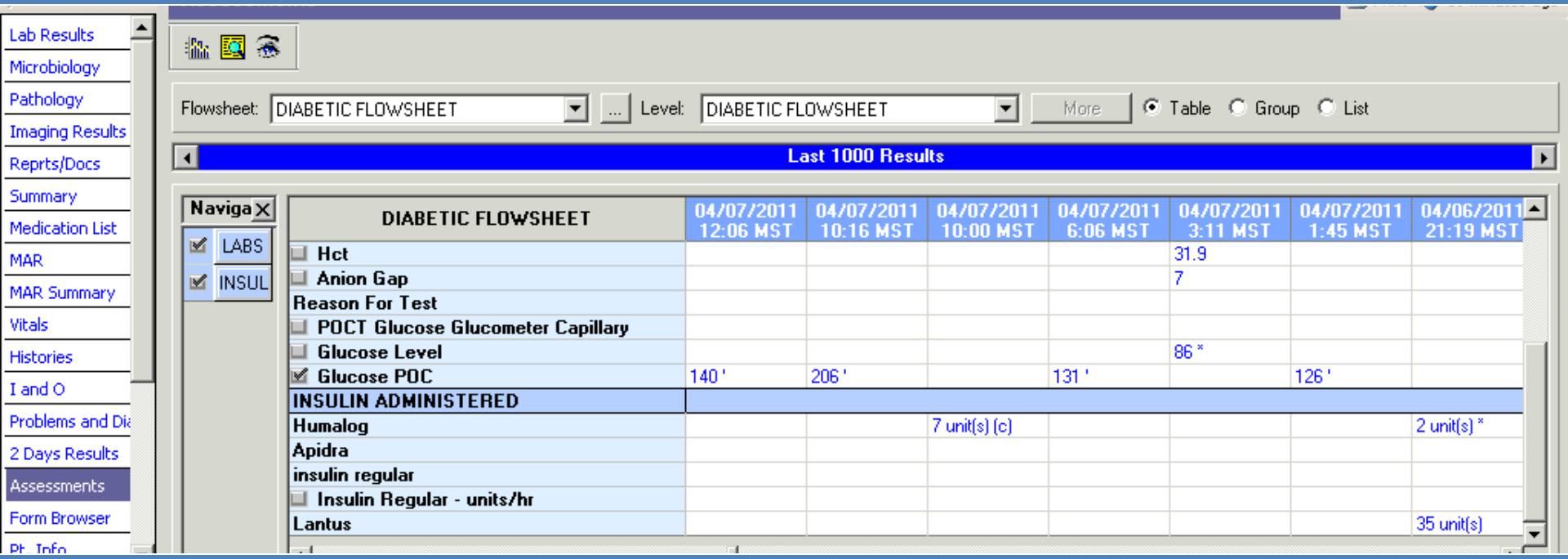
Naviga

LABS

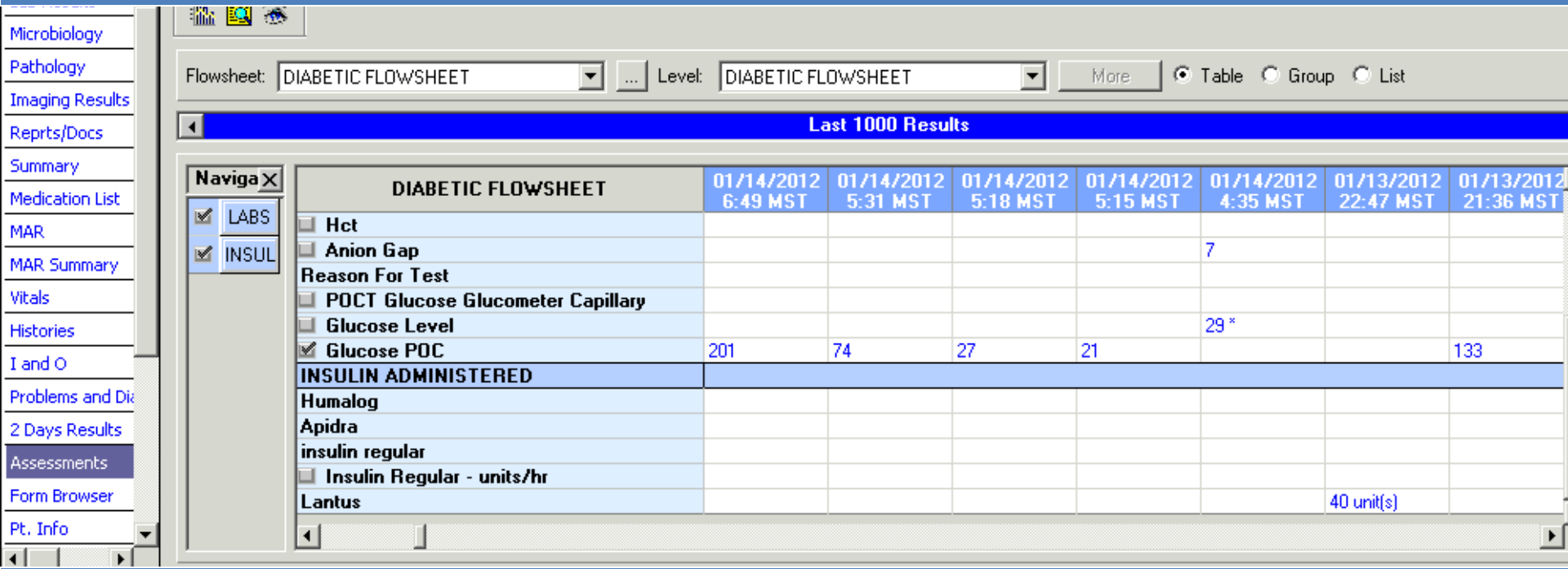
INSUL

DIABETIC FLOWSHEET	04/01/2011 9:40 MST	04/01/2011 8:15 MST	04/01/2011 7:15 MST	04/01/2011 6:35 MST	04/01/2011 3:45 MST	04/01/2011 0:35 MST	03/31/2011 21:40 MST
Hct							
Anion Gap							
Reason For Test							
POCT Glucose Glucometer Capillary							
Glucose Level							
Glucose POC		209 '	217 '	64 '		90 '	
INSULIN ADMINISTERED							
Humalog	4 unit(s) *						
Apidra							
insulin regular							
Insulin Regular - units/hr							
Lantus							40 unit(s)

Reduce Basal + nutritional



Same problem, different year…



Case 5

- 47 y.o. admitted with pyelonephritis and perinephric abcess. Wt 140 kg. Cr 1.5. doesn’t check BG at home, no hypoglycemia symptoms
- Home meds: metformin 500 bid .
- BG at transferring facility 323 and then 280 What do you want to order?

A. sliding scale because only on one oral agent

B. TDD 70, glargine 35, humalog 12 tidac + correction

C. Glargine 10 units + sliding scale

Answer

- B based on 0.5 units/kg X 140 kg= TDD of 70 units and then 50/50.
- If he has poor po then the order set includes to hold if eat < 50% of meal or nPO

Case 5

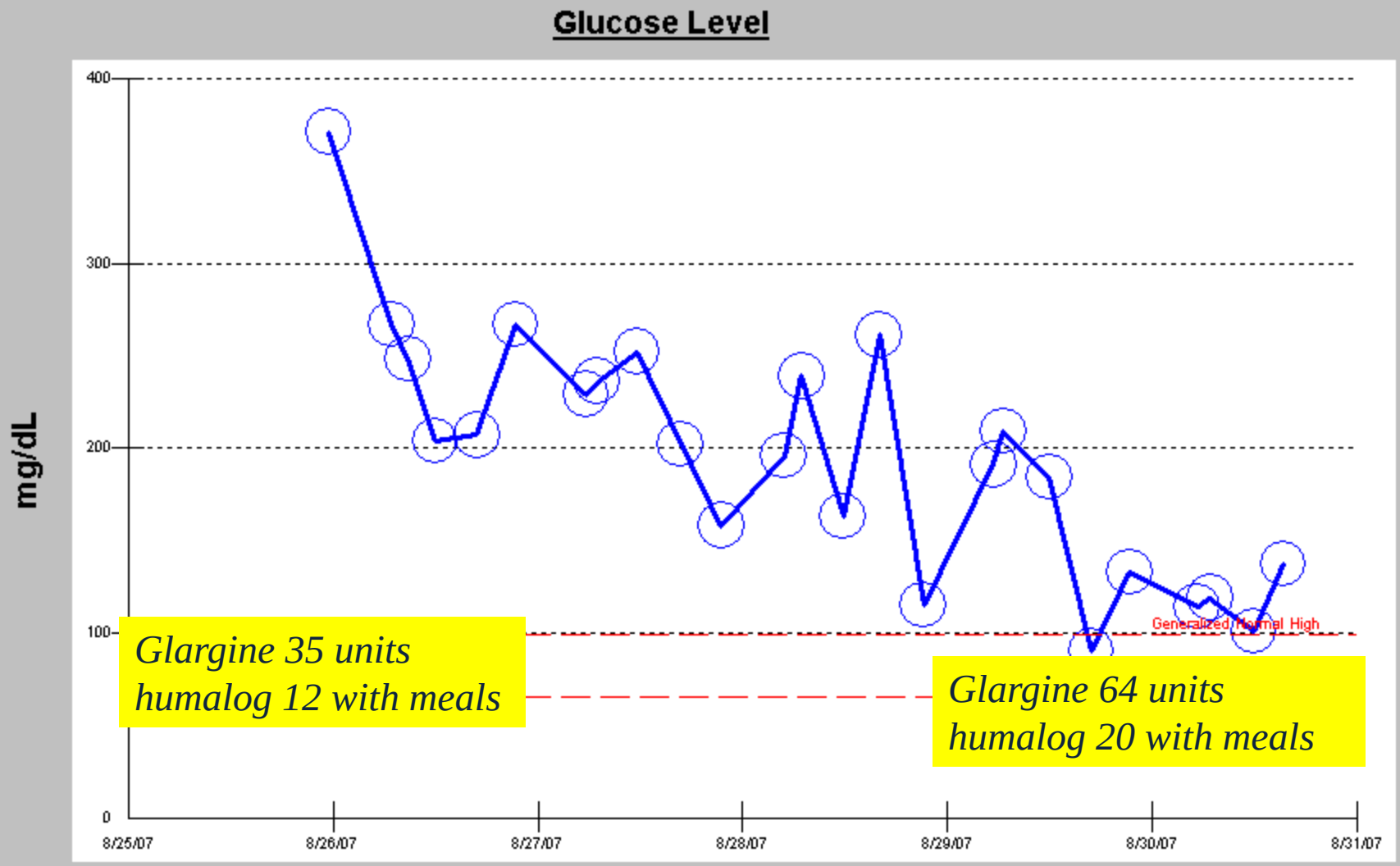
- 47 y.o. admitted with pyelonephritis and perinephric abcess. you start: TDD 70, glargine 35, humalog 12 tidac + correction
- All doses given and 20 extra units of correctional→ TDD 90 units in the last 24 h and BG 240-400
- What are your new insulin orders?

A. TDD 90 with 45 glargine, 15 humalog with meals
B. TDD 108 (90 + 20%)= 54 glargine +18 humalog with meals.
C. No change, it has only been 24 h

Answer

- A or B would be acceptable. BG are still very high, no lows
- Either increase TDD by 20% (option A)
- Add all that needed yesterday (new TDD) and then add another 20% (option B)

Case 5


Glucose Level
mg/dL
400
300
200
100
0
8/25/07
8/26/07
8/27/07
8/28/07
8/29/07
8/30/07
8/31/07
Generalized Normal High
Glargine 35 units
humalog 12 with meals
Glargine 64 units
humalog 20 with meals

RABBIT 2 Surgery Titration

Fasting BG	Adjustment
100-140 mg/dL	No change
140-180 mg/dl	Increase TDD by 10% daily
>180 mg/dl	Increase TDD by 20% daily
70-99 mg/dl	Decrease TDD by 10%
<70 mg/dl	Decrease by 20%

* Note: only increase the doses if NONE were <100mg/dl.

My Suggestions for Daily Adjustment

1. Any less than 100 mg/dL or > 180
2. Add up previous day's TDD
   - Include amount given as supplemental insulin
   - Adjust up or down by depending on degree of hypo- and hyperglycemia
   - Adjust for other factors (renal function, steroid dose, nutritional intake, severity of illness)
3. Divide new TDD into basal and nutritional components
   - Split 50/50 OR
   - Adjust basal and nutritional separately, depending on AM fasting vs. late day sugars
   - Watch out for too much basal

Case 6

- 59 y.o. 90 kg, BMI 39, s/p renal transplant admitted with emesis, diarrhea and sepsis from a urinary source. BG 230. Admitted to med-surg.
- Home med : 70/30 50 units qam and qpm. Well controlled, no lows. Last HbA1c 7
- What will your admit orders be

A. sliding scale for high resistance for 24 hours

B. Glargine 50 units + high resistance

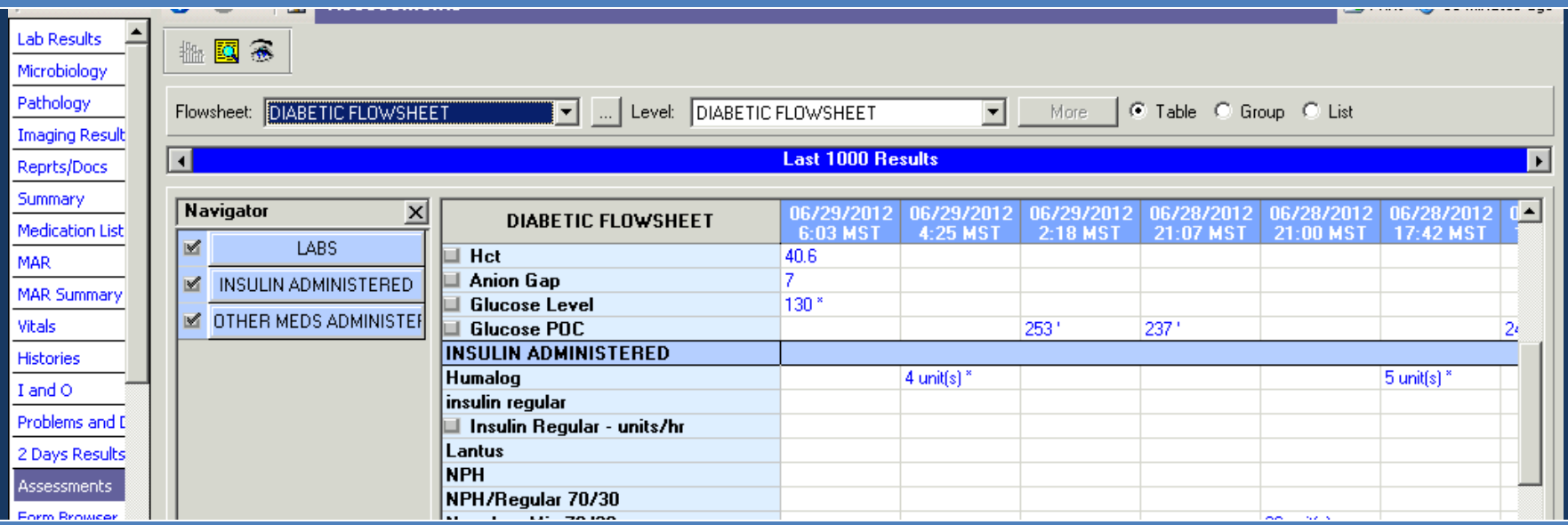
C. TDD 100 units→ 50 glargine 16 humalog AC

D. Continue 70/30 50 units bid

Answer

- C add together all of the home insulin to determine TDD (70/30 50 units bid = TDD of 100)
- 50% basal and 50% nutritional (will be held if doesn't eat)
- Note- since patient has good control at home and no new contraindication, can go back to 50 units bid of 70/30 at d/c.
- Should not use fixed split in hospital because of variable oral intake and lack of familiarity by nursing.

Case 7: How many units of rapid acting insulin did he get at bedtime?



Answer

- About 12 units. If he would have had a normal BG going in, then would be low unless eating a meal

References

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- Med. 2001;345:1359-67.
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