Improving Glycemic Control in Non-Critical Care Units
Learning Objectives

• Implement a subcutaneous basal bolus insulin protocol within a Non-Critical Care Unit.

• Apply better coordination and communication with bedside nursing related to 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**
  - 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**
  - Target 140 – 180 mg/dL
  - Certain groups <140 mg/dL
  - Certain groups with higher targets (terminally ill or comorbidities)

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

How do we achieve target glucose?

• Orals
  – Hold them all
Orals

Noninsulin Agents

Noninsulin agents are inappropriate in most hospitalized patients. Continued use of such agents may be appropriate in selected stable patients who are expected to consume meals at regular intervals. Caution must be exercised with use of metformin because of the potential development of a contraindication during the hospitalization, such as renal insufficiency, unstable hemodynamic status, or need for imaging studies with radiocontrast dye (8,113). Injectable noninsulin therapies such as exenatide and pramlintide have limitations similar to those with orally administered agents in the hospital setting.

Endocrine Practice 2009
## Glucose Management

**[12/22/11 16:00 - 12/28/11 11:59] in 8hr interval**

### Date: 12/17/11 - 12/22/11

#### Glucose (mg/dL)

<table>
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<th>00-08</th>
<th>08-16</th>
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<th>00-08</th>
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<td>262</td>
<td></td>
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</tr>
</tbody>
</table>

### A1C

- GlycoHgb (A1C): 7.6

### Insulin (units)

- Insulin (mIU/L)
  - 12:00: 200
  - 1:00: 150
  - 2:00: 100
  - 3:00: 50

### Antidiabetic

- acarbose Tab(o)(mg): 25, 25, 50
- glucose Tab(o)(mg): 16, 32, 16
- glit/Biguanide Tab(o)(mg): 10, 10
- Insulin/rsp Tab(o)(Units): 2, 1, 1
- metFORMIN Tab(o)(mg): 1,000, 1,000, 1,000
- sitagliptin Tab(o)(mg): 100, 100

### Diet

- Diet Status: PO
- Number of Items Taken: 0
- Number of Items on Tray: 4

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**HOSPITALISTS. TRANSFORMING HEALTHCARE. REVOLUTIONIZING PATIENT CARE.**
How do we achieve target glucose?

- **Orals**
  - Hold them all

- **Insulin**
  - Sliding Scale alone – no longer used, too many highs and lows
  - Basal / Bolus – preferred, most physiologic
  - Insulin drip – critical care, IMU/PCU setting
Which Patients Should Be treated with Physiologic Insulin Regimen?

Immediately at the time of admission
  • All patients with type 1 diabetes
  • Patients with type 2 diabetes if…
    – They are on insulin prior to admission
    – They are known to be poorly controlled
    – They are known to require high doses of oral agents that will be held in the hospital

During hospitalization
  • Any patient with blood glucose levels consistently above the target range
What Are Other Factors To Consider?

• Outpatient
  – Outpatient regimen
  – Compliance?
  – Control? Last A1C?
  – Diet
  – Activity level

• Inpatient
  – Dietary changes (↓)
  – Activity changes (↑)
  – Active infection/illness (↑)
  – Steroids (↑)
  – Pressors (↑)
  – Parenteral nutrition (↑)
  – Observed compliance (↓)
  – What medications are on board at time of admission?
Physiologic Insulin Secretion: Designing an Insulin Regimen

1. Basal
2. Nutritional
3. Correctional

![Graph showing basal insulin and glucose levels](image)
Our Tools - Insulin Pharmacokinetics

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Apidra</td>
<td>10-15 mins</td>
<td>60-90 mins</td>
<td>4-5 hours</td>
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<tr>
<td>Humalog</td>
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<tr>
<td>Novolog</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Regular</td>
<td>30-60 mins</td>
<td>2-4 hours</td>
<td>5-8 hours</td>
</tr>
<tr>
<td>NPH</td>
<td>1-3 hours</td>
<td>5-8 hours</td>
<td>12-18 hours</td>
</tr>
<tr>
<td>Levemir</td>
<td>90 mins</td>
<td>Relatively peakless</td>
<td>12-24 hours</td>
</tr>
<tr>
<td>Lantus</td>
<td>90 mins</td>
<td>Peakless</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

www.ourdiabetes.com (Adapted from NEJM, 352;2)
Basal/bolus regimen mimics normal insulin profile

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

• Long-acting, non-peak ing insulin is preferred as it provides continuous insulin action, even when the patient is fasting

• Purpose: suppress glucose and ketone production

• Required in ALL patients with type 1 diabetes

• Most patients with type 2 diabetes will require basal insulin in the hospital

• Can be estimated to be about 1/2 of the total daily dose of insulin (TDD)
Hyperglycemia in setting of basal insulin held for NPO
Nutritional Insulin

• Usually given as rapid-acting analogue (preferred in most cases) or regular insulin, for those patients who are eating meals

• Purpose: cover food/nutrition

• Should not be given to patients who are not receiving nutrition (e.g. NPO)

• Must be matched to the patient’s nutrition pattern
  – eating 3 meals vs cont TF or TPN

• Can be estimated to be about \( \frac{1}{2} \) of the total daily dose of insulin (TDD)
Patient eating or receiving bolus TF
Patient receiving continuous TF or TPN

Continuous nutrition coverage options:
- Analog q4hr
- Regular q6hr
- Intermediate q12hr
- Long acting q12-24hr
Patient NPO
Correctional Insulin

• Correctional insulin is extra insulin that is given to correct hyperglycemia
• Purpose: cover high blood sugar
• Usually rapid-acting or regular insulin (usually the same as the nutritional insulin)
• Can be given when NPO (even if rapid-acting)
• Often written in a “stepped” format that is used in addition to basal and nutritional insulin, customized to the patient using TDD
• If correctional insulin is required consistently, or in high doses, it suggests a need to modify the basal and/or nutritional insulin doses
The Basics: Current Guidelines

**Antihyperglycemic Therapy**
Any patient with a blood glucose >180
Check every patient at least once

**Insulin**
Recommended

**Intravenous Insulin**
Critically ill patients
Goal 140-180

**Oral Hypoglycemics**
Not appropriate

**Subcutaneous Insulin**
Non-critically ill patients

**Daily Dose**

**Scheduled**
Basal
Nutritional

**As needed**
Correctional
Designing Physiologic Insulin Regimen

• Basal insulin: Use non-peaking, longer acting insulins
  – Glargine or detemir are preferred
  – NPH also possible, but not preferred
Designing Physiologic Insulin Regimen

• Basal insulin: Use non-peaking, longer acting insulins
  – Glargine or detemir are preferred
  – NPH also possible, but not preferred

• Nutritional insulin: Depends on the type of nutrition
  – Rapid-acting insulin is preferred when patients are eating meals
  – Regular insulin also possible

• Correctional insulin: Use rapid-acting (or regular) insulin
  – Usually the same as the nutritional insulin
Case

- HPI: 54 y/o, obese gentleman with DM2 x8 yrs being admitted with diabetes related foot infection. Eating carbohydrate controlled meals.
  - Outpatient Meds: Glipizide 10 mg po qd, Metformin 1000 mg po bid and 20 units of NPH q HS
  - Weight 100 kg
  - Cr 0.91
  - Control: A1C 10%, BG in ED 240 mg/dL
Stepwise Approach to Physiologic Insulin Dosing

1. Estimate the amount of insulin the patient would need over one day, if getting adequate nutrition = Total Daily Dose (TDD)

2. Assess the patient’s nutritional situation

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

4. Add a correction scale based on the patient’s estimated insulin sensitivity

5. Assess blood glucoses at least daily, adjusting insulin doses as appropriate
STEP 1: Estimate the Amount of Insulin the Patient Would Need Over One Day, If Getting Adequate Nutrition = Total Daily Dose (TDD)

- Insulin drip-based estimate (for patients treated with an insulin infusion)

- For patients already treated with insulin, consider the patient’s preadmission subcutaneous regimen and glycemic control on that regimen

- Weight-based estimate:
  - TDD = 0.3-0.8 units per Kg
    - Lower end more conservative and should be used in
      - DM1, insulin sensitive or naïve, elderly, renal impairment, hypoglycemia risk factors
    - Higher end more aggressive and can be use in
      - Known insulin resistance, steroids
Our Patient

• Calculate TDD:
  – No drip
  – On orals and NPH as outpatient
  – Weight:
    • 100 kg (0.3 units/kg) = 30 units
    • 100 kg (0.4 units/kg) = 40 units
    • 100 kg (0.5 units/kg) = 50 units
    • 100 kg (0.6 units/kg) = 60 units
STEP 2: Assess the Patient’s Nutritional Situation

- 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
Which pattern of nutrition does your patient fit into?
Our Patient

- Eating carb controlled diet
STEP 3: Divide the TDD into approximately 50% basal insulin and 50% nutritional insulin

• Basal insulin can generally be estimated to be 1/2 of the TDD

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

50:50
STEP 4: Add a correction scale based on the patient’s estimated insulin sensitivity

• Correction scales vary in intensity

• Usually more than one is needed to fit varying levels of insulin sensitivity

• At least a low dose (sensitive) and high dose (aggressive) scale should be available, often more options are available to better tailor to patient’s needs
## Our Approaches

<table>
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<th></th>
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<th>VMMC</th>
<th>NYPH</th>
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<tbody>
<tr>
<td><strong>Order Set(s)</strong></td>
<td>Computer (EPIC)</td>
<td>Computer (Cerner)</td>
<td>Computer (Sunrise)</td>
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<td><strong>BG Target</strong></td>
<td>100-180 mg/dL</td>
<td>100-180 mg/dL</td>
<td>100-180 mg/dL</td>
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<td><strong>SubQ Protocol(s)</strong></td>
<td>Weight based 0.3 units/kg DM1, lean, renal impairment 0.4 units/kg standard 0.5-0.6 units/kg DM2, resistant, steroids</td>
<td>Weight based 0.3 units/kg</td>
<td>Weight based 5 levels: NPO, very low dose, low dose, medium dose, high dose 0.2 units/kg – 0.6 units/kg</td>
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<tr>
<td><strong>Total Daily Dose (TDD)</strong></td>
<td>Weight based 0.3 units/kg</td>
<td>Weight based 0.3 units/kg</td>
<td>Weight based 5 levels: NPO, very low dose, low dose, medium dose, high dose 0.2 units/kg – 0.6 units/kg</td>
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<tr>
<td><strong>Correction Scales</strong></td>
<td>Low, moderate, high and custom</td>
<td>Customizable-Cerner calculates insulin correction factor based on TDD</td>
<td>NPO, very low dose, low dose, medium dose, high dose</td>
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</table>

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**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
Our Patient

• Step 1: TDD
  – Weight: 100 kg (0.5 units/kg) = 50 units

• Step 2: Nutrition Pattern
  – Eating carb controlled meals

• Step 3: Insulin components and ratio
  – 50:50
  – Basal insulin 25 units once daily
  – Bolus- rapid acting insulin 8 units qac
  – Correction scale- rapid acting insulin qac and qhs
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


<table>
<thead>
<tr>
<th>Phase</th>
<th>Error</th>
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<tbody>
<tr>
<td>Prescribing</td>
<td>Incorrect dosage/irrational insulin orders</td>
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<td>Nomenclature-related errors</td>
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<tr>
<td>Transcribing</td>
<td>Incorrect transcription of verbal or telephone orders</td>
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<tr>
<td></td>
<td>Transcription of an incorrect dose</td>
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<tr>
<td>Dispensing and storage</td>
<td>Failure to double-check insulin products (i.e., preadministration)</td>
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<td>Look-alike containers</td>
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<td>Unsecure and/or non-segregated storage in patient care areas and/or pharmacy areas</td>
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<tr>
<td>Administering</td>
<td>Administration of incorrect doses</td>
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<tr>
<td></td>
<td>Incorrect use of insulin pens</td>
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<tr>
<td></td>
<td>Name confusion</td>
</tr>
<tr>
<td></td>
<td>Relationship of insulin administration to nutrition</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Failure to appropriately monitor for insulin effects and adjust dose accordingly</td>
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</tbody>
</table>
Prescribing: **Recommendations 1 - 3**

**Recommendation 1**
Develop protocol-driven and evidence-based order sets for specific uses of insulin:
- IV to Subcutaneous insulin transitions, DKA, etc
- Include decision-support to guide insulin use based on patient’s nutritional status and for appropriate monitoring

**Recommendation 2**
Eliminate the routine administration of correction / sliding scale insulin doses as the primary strategy to treat hyperglycemia

**Recommendation 3**
Eliminate the use of “free text” insulin orders in electronic and paper records.

Replace them with protocol-driven and evidence-based order sets that allow for the prescribing of complex insulin regimens.

Steps for Developing and Implementing Protocols and Order Sets

• Form a steering committee
• Assess current processes of care and identify potential barriers.
• Identify best practices and preferred regimens to manage diabetes and hyperglycemia in your hospital
• Integrate best practices and preferred institutional choices into an inpatient glycemic control protocol. Crystallize your protocol into a one page summary
• Integrate guidance from your protocol into standardized subcutaneous insulin order sets and other documentation and treatment tools
• Monitor the use of your order sets and protocol
• Intervene actively on non-adherents to your protocol and those with poor glycemic control
• Revise your protocol/order sets as needed
Integrate Best Practice into Protocols, Order Sets, Documentation

• Actionable glycemic target
• Consistent carbohydrate / dietary / consult
• A1c
• Patient education plan
• Hypoglycemia protocol
• Guidance for transitions (linked protocols)
• Coordinated monitoring / nutrition / insulin
• DC oral agents, insulin preferred
• Insulin regimens for different conditions
• Dosing guidance
INPATIENT HYPERGLYCEMIA MANAGEMENT OF THE NON-PREGNANT ADULT

Step 1: Discontinue non-insulin antihyperglycemic agents

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:
- 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:
- 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):
- Check glucose qac/hrs 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 (D5/2NS 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 D5/2NS at 75cc/hr

See reverse for special situations & more information about footnoted items

Target inpatient blood glucose levels: 100-180

Consider a diabetes/endocrine or medicine consult.
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 instead 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.
Prompt to d/c all orals

Glycemic target, prompt for education, Diets all CHO controlled
Medications — Required

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.

Order Sets

Fingerstick Glucose Orders for Hypoglycemia Protocol

- Glucose (POC)

Routine, PRN starting Today at 2211 Until Specified
Test blood glucose within 15 to 30 minutes of the initial glucose test showing blood glucose < 70 mg/dL with or without symptoms OR glucose < 80 mg/dL with symptoms (e.g., shaking, diaphoresis, confusion, irritability). If blood glucose is still below 80 mg/dL after treatment, RE-TREAT and check blood glucose again in 15 to 30 minutes. Continue to check blood glucose every 15 to 30 minutes until the glucose is greater than or equal to 80 mg/dL for TWO consecutive values.

Hypoglycemia Protocol

Link to UCSD Hypoglycemia Protocol

- Glucose chewable tablet 16 g
  - 16 g (4 tablet), Oral, PRN starting Today at 2211 Until Discontinued, Low Blood Sugar, Per Hypoglycemia Protocol
  Hypoglycemia is defined as a glucose less than 70 mg/dL or a glucose less than 80 mg/dL with the presence of symptoms. Give glucose lab or gel per patient preference to correct hypoglycemia if the patient is conscious and is tolerating oral intake.

- Glucose oral gel 1 Tube
  - 1 Tube, Oral, PRN starting Today at 2211 Until Discontinued, Low Blood Sugar, Per Hypoglycemia Protocol
  Hypoglycemia is defined as a glucose less than 70 mg/dL or a glucose less than 80 mg/dL with the presence of symptoms. Give glucose gel or lab per patient preference to correct hypoglycemia if the patient is conscious and is tolerating oral intake.

- Dextrose 50 % solution 12.5 g
  - 12.5 g, Intra/VENOUS, PRN starting Today at 2211 Until Discontinued, Low Blood Sugar, Per Hypoglycemia Protocol
  Hypoglycemia is defined as a glucose less than 70 mg/dL or a glucose less than 80 mg/dL with the presence of symptoms. Give glucose gel or lab per patient preference to correct hypoglycemia if the patient is conscious and is tolerating oral intake.

Admonition to avoid sliding scale.
Dosing guidance for transition from infusion.
Different SQ regimens for different intake.
Here is some guidance for dosing:

**Insulin Regimen - Patient Eating or Receiving Bolus Tube Feeds (Equivalent Lispro Dosing for Each Meal)**

Glargine should be **50%** of the total daily insulin dose; the remaining **50%** of the total daily insulin dose should be distributed among the three pre-meal lispro doses.

**For insulin glargine:** Enter a specific number of units **or** click one of the weight-based dosing buttons:
- Patients who are very lean, very sensitive to insulin, or who are on hemodialysis - **0.15 Units/Kg**
- Patients with normal body habitus - **0.2 Units/Kg**
- Patients who are overweight - **0.25 Units/Kg**
- Patients who are obese, on corticosteroids, or who are known to be insulin-resistant - **0.3 Units/Kg**

**For insulin lispro:** The dose of pre-meal lispro should be **one-third** of the insulin glargine dose.

**For correctional insulin lispro:** Use the SmartList in the administration instructions to select an appropriate correctional scale, based on the total daily dose of insulin. Every 24 hours, the amount of correctional insulin administered should be used as a guide to adjust the basal and nutritional insulin doses.

**Glucose (POC)**

Routine, **BEFORE MEALS & HS First occurrence Tomorrow at 0630 Until Specified**

**Insulin glargine (LANTUS) injection**

Subcutaneous, **EVERY MORNING, First Dose Tomorrow at 0900, Until Discontinued**
Basal glargine insulin should still be administered even if the patient is temporarily NPO for a procedure, or if the patient has temporary interruption of nutrition.

**Insulin lispro (HUMALOG) injection**

Subcutaneous, **3 TIMES DAILY WITH MEALS, First Dose Tomorrow at 0800, Until Discontinued**
Give with first bite of food (or up to 30 minutes after first bite of food if patient is nauseated or has poor appetite). Give 0 units if patient ate less than 50% of the meal, give half of the scheduled dose if patient ate 50% of the meal, and give the full dose if patient ate more than 50% of the meal.

**Insulin lispro (HUMALOG) injection 1-10 Units**

1-10 Units, Subcutaneous, **4 TIMES DAILY WITH MEALS & NIGHTLY, First Dose Today at 2230, Until Discontinued**
{Lispro Insulin Correctional Scale:13821}
### Formulary basal insulin

**Lab Test Results**

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<tr>
<th>Component</th>
<th>Time Elapsed</th>
<th>Value</th>
<th>Range</th>
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<tbody>
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<td>214 (H)</td>
<td>70 - 115 mg/dL</td>
<td>Final result</td>
<td>Hemoglobin A1c values of 5.7-6.4 percent indicate an increased risk for developing diabetes mellitus. Hemoglobin A1c values greater than or equal to 6.5 percent are diagnostic of diabetes mellitus. Diagnosis should be confirmed by repeating the HbA1c test. HbA1c higher than 10 percent of total Hb may yield falsely low results. Conditions that shorten red cell survival, such as the presence of unstable hemoglobins like Hb SC, Hb CO, and Hb SC, or other causes of hemolytic anemia may yield falsely low results. Iron deficiency anemia may yield falsely high results.</td>
</tr>
<tr>
<td>Glyco Hgb (A1C)</td>
<td>4 days (07/19/15 0650)</td>
<td>5.8</td>
<td>4.8 - 5.9 %</td>
<td>Final result</td>
<td></td>
</tr>
</tbody>
</table>

**Reference Links:**

1. Clinical Pharmacology

**Dose:**

- 10 Units
- 20 Units
- 0.15 Units/kg
- 0.2 Units/kg
- 0.25 Units/kg
- 0.3 Units/kg

**Route:**

- Subcutaneous

**Frequency:**

- EVERY MORNING
- HS
- AM Daily before lunch

**For:**

- G Doses
- Hours
- Days

**Starting:** 7/24/2015

**First Dose:** Tomorrow

**First Dose Time:** 0600

**Scheduled Times:**

- 7/24/15 0000
- 7/25/15 0900
- 7/26/15 0900

**Order has no end date or number of doses, so more times will be scheduled at a later date.**

**Admin. Int.:** Basal clargine insulin should still be administered even if the patient is temporarily NPO for a procedure, or if the patient has temporar...

**Click to add text**

(300 char max.)

**Additional Order Details**
**Basal glargine insulin** should still be administered even if the patient is temporarily NPO for a procedure, or if the patient has temporary interruption of nutrition.

## Formulary rapid acting insulin

<table>
<thead>
<tr>
<th>Reference</th>
<th>Links:</th>
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</thead>
<tbody>
<tr>
<td><strong>Dose:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Route:</strong></td>
<td>Subcutaneous</td>
</tr>
<tr>
<td><strong>Frequency:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>For:</strong></td>
<td>2 Units</td>
</tr>
<tr>
<td><strong>Starting:</strong></td>
<td>7/24/2015</td>
</tr>
<tr>
<td><strong>First Dose:</strong></td>
<td>Include Now</td>
</tr>
<tr>
<td><strong>First Dose:</strong></td>
<td>Tomorrow 0800</td>
</tr>
<tr>
<td><strong>Scheduled Times:</strong></td>
<td>Hide Schedule</td>
</tr>
<tr>
<td></td>
<td>7/24/15</td>
</tr>
<tr>
<td></td>
<td>7/25/15</td>
</tr>
</tbody>
</table>

**Order has no end date or number of doses, so more times will be scheduled at a later date.**

**Admin. Inst.:** Give with first bite of food (or up to 30 minutes after first bite of food if patient is nauseated or has poor appetite). Give 0 units if patient ate less than 500 calories.

**Comments (500 char max.):** Click to add text.
Here are our 4 different scales with guidance on which one to pick based on the patient’s total daily dose of insulin.

Hemoglobin A1c values of 6.7-6.4 percent indicate an increased risk for developing diabetes mellitus. Hemoglobin A1c values greater than or equal to 6.5 percent are diagnostic of diabetes mellitus. Diagnosis should be confirmed by repeating the Hb A1c test. Hb A1c higher than 10 percent of total Hb may yield falsely low results. Conditions that shorten red cell survival, such as the presence of unstable hemoglobins like Hb SS, Hb CC, and Hb SC, or other causes of hemolytic anemia may yield falsely low results. Iron deficiency anemia may yield falsely high results.

{Lispro Insulin Correctional Scale: 13821}

{Correctional Scale (Low Intensity / TDD Less Than 40 Units): TXT, 12418}
{Correctional Scale (Moderate Intensity / TDD 40 to 60 Units): TXT, 12416}
{Correctional Scale (High Intensity / TDD Greater Than 60 Units): TXT, 12417}
{Provider-Specified Correctional Scale: TXT, 12427}
Correction Insulin
These are the different scales written out

<table>
<thead>
<tr>
<th>Glucose Range</th>
<th>QAC</th>
<th>QHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70 mg/dL</td>
<td>See</td>
<td></td>
</tr>
<tr>
<td>70 - 150 mg/dL</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>151 - 175 mg/dL</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>176 - 200 mg/dL</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>201 - 250 mg/dL</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>251 - 300 mg/dL</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>301 - 350 mg/dL</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>351 - 400 mg/dL</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>&gt; 400 mg/dL</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

**Low Dose Correction**

- 1:50 >150 qac and > 200 qhs

<table>
<thead>
<tr>
<th>Glucose Range</th>
<th>QAC</th>
<th>QHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70 mg/dL</td>
<td>See</td>
<td></td>
</tr>
<tr>
<td>70 - 150 mg/dL</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>151 - 175 mg/dL</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>176 - 200 mg/dL</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>201 - 250 mg/dL</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>251 - 275 mg/dL</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 275 mg/dL</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**Moderate Dose Correction**

- 1:25 >150 qac and > 200 qhs

<table>
<thead>
<tr>
<th>Glucose Range</th>
<th>QAC</th>
<th>QHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70 mg/dL</td>
<td>See</td>
<td></td>
</tr>
<tr>
<td>70 - 150 mg/dL</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>151 - 175 mg/dL</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>176 - 200 mg/dL</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>201 - 225 mg/dL</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>226 - 250 mg/dL</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>251 - 275 mg/dL</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 275 mg/dL</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**High Dose Correction**

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

<table>
<thead>
<tr>
<th>Glucose Range</th>
<th>QAC</th>
<th>QHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70 mg/dL</td>
<td>See</td>
<td></td>
</tr>
<tr>
<td>70 - 150 mg/dL</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>151 - 175 mg/dL</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>176 - 200 mg/dL</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>201 - 225 mg/dL</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>226 - 250 mg/dL</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>251 - 300 mg/dL</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 300 mg/dL</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>
## Cerner SubQ Insulin Order Set

Organized into Basal-bolus therapy

<table>
<thead>
<tr>
<th>MEDICATION(S)</th>
<th>Note(S)</th>
<th>Order(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daily Insulin</strong>: Target therapy for goal of BG 100-180.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Basal Insulin</strong>: All the time insulin, covers sugar that the body makes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indication</strong>: Diabetics already on insulin and/or insulin naive diabetic patients with BG&gt;180.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For continuation of home regimen, select order below</strong>:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insulin glargine (LANTUS)</strong></td>
<td>unit(s), inj soln, SUB-Q, Every Bedtime, Routine, Note: Hold if BG&lt;100. Notify MD for dose adjustment. DO NOT HOLD for NPO.</td>
<td></td>
</tr>
<tr>
<td><strong>Use weight based dosing in an insulin naive patient, select order below</strong>:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight based glargine-type 2 diabetics on oral hypoglycemics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nutritional</strong>: Food insulin, covers sugar taken in. Standing order before meals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indication</strong>: Diabetics already on insulin and/or insulin naive diabetic patients with a single BG&gt;230 or two consecutive BG&gt;180 despite basal insulin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For continuation of a home regimen, select the order below</strong>:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insulin lispro (HUMALOG)</strong></td>
<td>unit(s), inj soln, SUB-Q, TID Before Meals, Routine, Note: Hold if BG&lt;100. Notify MD for dose adjustment. HOLD if NPO.</td>
<td></td>
</tr>
<tr>
<td><strong>For weight based dosing in an insulin naive patient, select the order below</strong>:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight based lispro-type 2 diabetics on oral hypoglycemics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Correctional</strong>: Sliding scale, covers leftover sugar production.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Review dose daily and titrate regimen accordingly:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Patient is eating:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insulin lispro (HUMALOG - sliding scale)</strong></td>
<td>2-10 unit(s), inj soln, SUB-Q, TID Before Meals, PRN, Routine, Note: NOTIFY MD OF GLUCOSE&gt;400.</td>
<td></td>
</tr>
<tr>
<td><strong>Patient is NPO:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insulin regular (HUMULIN R - sliding scale)</strong></td>
<td>2-10 unit(s), inj soln, SUB-Q, Q6 HR, PRN, Routine, Note: NOTIFY MD OF GLUCOSE&gt;400.</td>
<td></td>
</tr>
</tbody>
</table>
NYPH Basal/Bolus Order Sets

- **Insulin Aspart Fasting NPO Order Set**
  Use for short term NPO; If Type 1 diabetes, must order basal insulin

- **Insulin Aspart Glargine Order Set: Very Low Dose**
  Use for Poor PO Intake less than 50% of tray

- **Insulin Aspart Glargine Order Set: Low Dose**
  Use for Type 1 Diabetes; Lean Body Type; Renal Insufficiency; Elderly; Pancreatectomy

- **Insulin Aspart Glargine Order Set: Med Dose**
  Use for average body size.

- **Insulin Aspart Glargine Order Set: High Dose**
  Use for Obese, Steroids
Secret to Success: Pre-Checked Orders Are Almost Always Placed!
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, Adjusting Insulin Doses as Appropriate

- Blood glucose targets can only be achieved via continuous management of the insulin program

- There is no “autopilot” insulin regimen for a hospitalized patient!
Daily Adjustments

• Having all necessary data in one place will be KEY

• Most EHR’s have a glucose management page/ M page where this information can be consolidated

• Minimize the number of places a provider must go to gather the information necessary to make an informed clinical decision
# UCSD Glucose Management Page

## Glucose Management (05/23/12 08:00 - 05/29/12 15:59) for 8-h interval

<table>
<thead>
<tr>
<th>Date</th>
<th>05/23</th>
<th>05/24</th>
<th>05/25</th>
<th>05/26</th>
<th>05/27</th>
<th>05/28</th>
<th>05/29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>15:00</td>
<td>16:00</td>
<td>16:00</td>
<td>16:00</td>
<td>16:00</td>
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<tr>
<td>Glucose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POC Glucose (mg/dL)</td>
<td>177</td>
<td>142</td>
<td>142</td>
<td>142</td>
<td>142</td>
<td>142</td>
<td>142</td>
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<tr>
<td>Glucose (mg/dL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1C and Serum Cr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glyc Hgb (A1C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.37</td>
<td>0.37</td>
<td>0.40</td>
<td>0.40</td>
<td></td>
<td></td>
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</table>

## Insulin (units)

<table>
<thead>
<tr>
<th>Insulin (U/hr)</th>
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<th></th>
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<th></th>
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</table>

## Antidiabetic

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<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin glargine Soln(Units)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin regular Soln(Units)</td>
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## Steroids

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Prednisone Tab(s/mg)</td>
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<td>20</td>
<td>20</td>
<td>20</td>
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</tbody>
</table>

## Diet

<table>
<thead>
<tr>
<th>Diet</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Diet Status</td>
<td>NPO</td>
<td>NPO</td>
<td>NPO</td>
<td>NPO</td>
<td>NPO</td>
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<tr>
<td>Number of Items Taken</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of Items on Tray</td>
<td>5</td>
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<td>5</td>
<td>5</td>
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<td>5</td>
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</table>

## IV

<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate TPN (mL/hr)</td>
<td>00 mL/hr</td>
<td>00 mL/hr</td>
<td>00 mL/hr</td>
<td>00 mL/hr</td>
<td>00 mL/hr</td>
<td>00 mL/hr</td>
<td>00 mL/hr</td>
</tr>
<tr>
<td>Volume TPN (mL)</td>
<td>321.33 mL</td>
<td>830.57 mL</td>
<td>217 mL</td>
<td>772 mL</td>
<td>428 mL</td>
<td>773.34 mL</td>
<td>201.33 mL</td>
</tr>
<tr>
<td>Volume Lactate (mL)</td>
<td>100.42 mL</td>
<td>175 mL</td>
<td>175 mL</td>
<td>105 mL</td>
<td>638.67 mL</td>
<td>1121.3 mL</td>
<td>788.67 mL</td>
</tr>
</tbody>
</table>

## Tube Feedings

<table>
<thead>
<tr>
<th>Tube Feedings</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TF Bolus - intake (mL)</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
</tr>
<tr>
<td>TF Total Rate/Vol - intake (mL)</td>
<td>360 mL</td>
<td>360 mL</td>
<td>240 mL</td>
<td>430 mL</td>
<td>120 mL</td>
<td>450 mL</td>
<td>120 mL</td>
</tr>
</tbody>
</table>

---

**HOSPITALISTS. TRANSFORMING HEALTHCARE. REVOLUTIONIZING PATIENT CARE.**
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.
### Summary

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>BG Values</th>
<th>Insulin (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/15/16</td>
<td>12:00 - 1:00 PM</td>
<td>10:30 PM</td>
<td>3:00 PM</td>
</tr>
<tr>
<td>02/16/16</td>
<td>8:00 AM</td>
<td>&gt;600 (08:00)</td>
<td>217 (11:07)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>208 (12:04)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>227 (13:11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>195 (14:17)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulin (units)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulin (units)</td>
</tr>
<tr>
<td>02/17/16</td>
<td>4:00 AM</td>
<td>304 (06:00)</td>
<td>267 (16:03)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>245 (19:13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulin (units)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulin (units)</td>
</tr>
<tr>
<td>02/18/16</td>
<td>3:00 AM</td>
<td>334 (07:00)</td>
<td>209 (21:39)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>245 (19:13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulin (units)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insulin (units)</td>
</tr>
</tbody>
</table>

### Lowest BG
- 235
- 193
- 227
- 200

### Highest BG
- 600
- 384
- 276
- 600

### High BG
- 180
- 180
- 180
- 180
# NYPH Insulin Titration Algorithm

## Step 1

### WHICH INSULIN NEEDS ADJUSTMENT:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>If AM fasting BG is too high or low:</td>
<td>Adjust Basal Insulin</td>
</tr>
<tr>
<td>If pre-lunch, pre-dinner or bedtime is too high or low:</td>
<td>Adjust Bolus Insulin</td>
</tr>
</tbody>
</table>

### HOW TO ADJUST:

<table>
<thead>
<tr>
<th>BG range</th>
<th>Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 50</td>
<td>Deduct 50%</td>
</tr>
<tr>
<td>Less than 70</td>
<td>Deduct 20%</td>
</tr>
<tr>
<td>70-100</td>
<td>Deduct 10%</td>
</tr>
<tr>
<td>180-250</td>
<td>Add 10%</td>
</tr>
<tr>
<td>&gt;250</td>
<td>Add 20%</td>
</tr>
</tbody>
</table>
NYPH Insulin Titration Algorithm

**Step 2**

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

<table>
<thead>
<tr>
<th>Prandial Rapid Acting Insulin</th>
<th>High Dose Aspart Doses</th>
<th>High Dose +10% For BGs 180-250 mg/dl</th>
<th>High +20% For BGs &gt; 250 mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-100</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>101-150</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>151-200</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>201-250</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>251-300</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>301-350</td>
<td>14</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>351-400</td>
<td>16</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>&gt; 400</td>
<td>18</td>
<td>20</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bed Time Rapid Acting Insulin</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>70-199</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>200-250</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>251-300</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>301-350</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>351-400</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>&gt; 400</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>
1. What form of insulin would you add first?
2. How do you determine the dose?
3. How long would you wait to make your next round of adjustments?
Dosing Insulin: Insulinosis

By how much would you reduce this patient’s total daily dose?

- 70-99; reduce by 10-20%
- 50-69; reduce by 20-30%
- <50; reduce by 50%
Dosing Insulin: Glycemic V-Tach
Glycemic V-Tach: differential diagnosis?

Too much of one type of insulin (basal only or bolus only)---physiologic needs typically 50:50 split

This case: Lots of Lantus (LOL)

1. How would you adjust?
2. How do you determine the dose?
3. How long would you wait to make your next round of adjustments?
Basal/bolus regimen mimics normal insulin profile

- Short-acting insulin bolus
- Long-acting insulin basal coverage

Plasma insulin μU/ml

- Normal insulin profile

4 AM  8 AM Noon  4 PM  8 PM Midnight  4 AM  8 AM

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

<table>
<thead>
<tr>
<th>Problems</th>
<th>Pearls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep ratio ~50:50 basal:bolus</td>
<td>Add nutritional insulin when daytime BG &gt;180 despite appropriate weight based basal insulin</td>
</tr>
<tr>
<td>Too large a percentage increase</td>
<td>Avoid increases in excess of 20-30% unless initial dose is significantly less than weight based</td>
</tr>
<tr>
<td>No response or recommendation regarding hypoglycemia</td>
<td>If a patient is hypoglycemic, a downward adjustment of at least one form of insulin is usually necessary</td>
</tr>
</tbody>
</table>
Inpatient Diets for Patients with Diabetes

- Consistent Carbohydrate (CC) diet is the standard for hospitalized patients with diabetes
- “ADA” diet no longer current practice, may unnecessarily restrict calories
- CC diet provides flexibility in calorie content and food choices
- Snacks not necessary with appropriate insulin dosing and administration
- Snacks can be provided based on patient need and preference
Menus

• Should be labeled with carbohydrate content of food
• Helps patients select appropriate foods
• Can be used as a teaching tool
Coordination of Tray, Glucose Monitoring and Insulin Administration

• Common Problems
  – Meal tray delivery times are inconsistent from the kitchen
  – BG monitoring done far before mealtime without realizing impact
  – Poor communication between person drawing BG and nurse administering insulin
  – Trays delivered to rooms without coordination of either BG or insulin
  – BGs being checked after patient has started meal
  – Room service times not coordinated between meals
  – Nurse concerned about hypoglycemia and unwilling to give insulin until completion of meal which is often delayed >one hour after meal completion
  – Room service delivering meals directly to patients without notification or coordination with nursing or techs
Recommended Interventions

• Minimize the time between BG monitoring, insulin administration and meals, consider goal of <30-60 minutes

• Implement practice of Nutrition Services notifying unit of tray arrival within 30 min as a sign that BG checks should begin

• Alert nurses to tray arrival so cascade of events can occur in a timely manner

• Reduce the number of staff involved in BG monitoring, tray delivery and insulin administration
## Our Approaches

<table>
<thead>
<tr>
<th></th>
<th>UCSD</th>
<th>VMMC</th>
<th>NYPH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carb controlled diet</strong></td>
<td>All carb limited trays limited to 60g per tray, including room service</td>
<td>All carbs labelled on the menu, no restrictions, room service</td>
<td>45 g/tray, 60 g/tray- default 75 g/tray</td>
</tr>
<tr>
<td><strong>Alert Trays Arriving</strong></td>
<td>Phone call from kitchen 30 min prior to tray arrival on floor</td>
<td>Kitchen staff notifies RN by Vocera</td>
<td>Tray assistant notifies RN upon tray arrival on unit</td>
</tr>
<tr>
<td><strong>BG Check</strong></td>
<td>Done by RN 30 min prior to scheduled meal-time with call from kitchen as reminder</td>
<td>Patient presses call light when they order and then patient care technician comes to check BG</td>
<td>Done by RN within 60 minutes of arrival of tray on unit</td>
</tr>
<tr>
<td><strong>Trays delivered by</strong></td>
<td>Food Service staff leaves all carb limited trays in cart to be delivered by RN (with insulin). Room service has cut-offs when patient allowed to order/receive carb limited tray</td>
<td>Delivered by patient care technician or RN</td>
<td>Food Service staff delivers carb controlled trays first directly to patient</td>
</tr>
<tr>
<td><strong>Nutritional Insulin administration</strong></td>
<td>Administered with first bite of food or up to 30 min after if patient has nausea or poor appetite</td>
<td>With first bite of food</td>
<td>+/- 15 min of first bite of food</td>
</tr>
</tbody>
</table>
Key Points

• Moderate blood glucose target of 100-180 mg/dL for most patients

• Physiologic insulin regimen
  – Basal, Nutritional, Correction, 50:50

• Build Clinical Decision Support into Protocols, Order sets and Guidelines, hardwire as much as possible

• Flow sheets can help pull together required data and make trends more apparent

• Consistent Carbohydrate diet with appropriately labeled menus

• Coordination of tray delivery, BG monitoring and insulin administration
Thank you