Calculate Starting Doses

Total Daily Dose (TDD) for Insulin Pump Start

<table>
<thead>
<tr>
<th>Sample Patient: Type 1 Male</th>
<th>Weight: 70 kg (154 lb)</th>
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</thead>
<tbody>
<tr>
<td>Pre-Pump Insulin Regimen</td>
<td>Rapid-acting: 11 units pre-meal x 3 + 33 units/day</td>
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<tr>
<td></td>
<td>Long-acting: 20 units (Bedtime) + 20 units/day</td>
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<tr>
<td>Pre-Pump Total Daily Dose</td>
<td>53 units/day</td>
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METHOD 1

Based on Pre-Pump TDD

Reduce pre-pump TDD by 25%*

Example: 53 units/day x 0.75 = 40 units/day

(*Reduce less if pre-pump TDD is >70% rapid-acting insulin.)

METHOD 2

Based on Patient Weight

Example: 70 kg x 0.5 = 35 units/day or 154 lbs x 0.23 = 35 units/day

Clinical Guidelines

Use both methods and AVERAGE the two values to determine the starting insulin pump TDD

Example: (40 units/day + 35 units/day) / 2 = 37.5 units/day Insulin Pump Total Daily Dose

- For hypoglycemia or hypoglycemia unawareness, use the lower value
- For consistent hyperglycemia, an elevated A1C, or in pregnancy, use the higher value
- For erratic glucose control, or if starting insulin pump therapy at diagnosis or from oral medications, use the weight-based method

Basal Rate

Provides a continuous infusion of insulin to cover hepatic glucose production.

Mimics pancreatic basal secretion and maintains glucose stability in the fasting state (between meals and during sleep).

Programmed to meet patient's individual diurnal variations.

Basal Rate

STEP #1: Total Daily Basal Requirement

Divide Insulin Pump TDD in half

Example: 37.5 units/day ÷ 2 = 18.75 units/day (total daily basal insulin)

STEP #2: Starting Hourly Basal Rate

Divide Total Insulin Pump Basal Requirement by 24 hours

Example: 18.75 units/day ÷ 24 hours = 0.78 units/hour

Starting Basal Rate = 0.8 units per hour

Begin insulin pump therapy with one basal rate delivering evenly over 24 hours. Adjust or add additional basal rates based on glucose trends over two to three days.
Calculate Starting Doses

Carbohydrate Ratio/Meal Bolus

METHOD 1: 450 RULE

450 ÷ by the Pump TDD = Carbohydrate Ratio

Example: 450 ÷ 37.5 = 12 grams
1 unit covers ~ 12 grams of carbohydrate

or

ALTERNATE METHODS

• Weight: kg. x 6 ÷ Pump TDD = Carb Ratio or
  lbs. x 2.8 ÷ Pump TDD = Carb Ratio

Example: 70 kg x 6 ÷ 37.5 units/day = 11 grams or
154 lbs x 2.8 ÷ 37.5 = 11 grams
1 unit covers ~ 11 grams of carbohydrate

• Fixed Bolus: ½ Pump TDD ÷ 3 (equal meals)

Example: 37.5 x 0.5 ÷ 3 = 6.3 units per meal

(Use for patients who are not yet carbohydrate counting, or who have lower cognitive ability. Convert fixed units per meal to fixed grams of carbohydrate per meal and provide dosing instructions for small, medium and large meals.)

Carbohydrate Ratio
The number of carbohydrate grams covered by one unit of insulin. May change for different meals or time of the day.

Insulin Sensitivity Factor (ISF)/Correction Bolus

SENSITIVITY FACTOR: 1700 RULE

1700 ÷ Pump TDD = ISF

Example: 1700 ÷ 37.5 = 45.3 mg/dL
One unit decreases BG ~ 45 mg/dL

CORRECTION DOSE FORMULA

(Current BG – Target BG) ÷ ISF = Correction Dose

Example: Current BG = 200 mg/dL
Target BG = 100 mg/dL

(200 – 100) ÷ 45 = 2.2 units (Correction Dose)

Insulin Sensitivity Factor
The number of mg/dL one unit of insulin lowers glucose.

Correction Dose
The amount of insulin added to or subtracted from a bolus to correct a BG that is above or below target.

Target BG
The BG value that is targeted when determining the need for a correction dose.
The target may change for pre-meal, post-meal or bedtime.

Examples

Formula: (Current BG – Target BG) ÷ ISF = Correction Dose

Blood Glucose Target = 100 mg/dL
Insulin Sensitivity Factor = 45 mg/dL

• If BG is above target, a positive correction dose is calculated
  BG = 160 mg/dL: (160 – 100) ÷ 45 = 1.3 units

• If BG is below target, a negative correction is calculated and subtracted from the meal bolus
  BG = 60 mg/dL: (60 – 100) ÷ 45 = - 0.9 units
Basal Rate Adjustments

Focus on Overnight Basal Rates First

Evaluate overnight control by comparing BG and/or CGM values across time segments.

- The basal rate is properly set if BG remains within desired range throughout the night
- Adjust/add basal rate based on rise or fall pattern of BG in each time segment
  - Example: bedtime to 12 a.m.: 12 a.m. to 3 a.m. and 3 a.m. to 7 a.m.
  - The start time of the basal rate adjustment should be set two to three hours prior to
    rise or fall in BG
  - If BG increases more than 30mg/dL: *increase* basal rate by 10-20 percent
  - If BG decreases more than 30mg/dL (or falls below target): treat the low BG and *decrease*
    basal rate by 10-20 percent
  - Verify changes by reevaluating overnight BGs over the next two to three nights

Two Methods of Adjusting Daytime Basal Rates

Method One (Fasting Technique)

- Choose a calm day when BG is in normal (safe) range
- Have patient skip a meal (do not try to skip more than one meal/day)
- Have patient check BG every hour and observe glucose
- If BG *increases or decreases* more than 30 mg/dL during the fasting period: Adjust basal rate
  in 10–20 percent increments
  - Verify change by repeating the fasting test
- If BG drops below 70 mg/dL (or below target): Have patient treat the low and *decrease* the
  basal rate by 10–20 percent
  - Verify change by repeating the fasting test the next day

Method Two (Post-meal to Pre-meal Technique)

The following principles apply when evaluating basal rates in the non-fasting state: 1) Two-hour
post-meal BGs should be 30–60 mg/dL higher than pre-meal BGs and 2) The two-hour post-meal
BGs should steadily decline to fall back within the next pre-meal target range.

- Instruct patient NOT to eat between meals
- Instruct patient NOT to correct post-meal high BG (if post-meal high is corrected, do not
  include this post- to pre-meal time period in your evaluation)
- Evaluate the basal rate by comparing the two-hour post-meal BG to the next pre-meal BG
  - If BG *decreases* more than 60 mg/dL, or falls below BG target: *decrease* basal rate by
    10–20 percent
  - If BG *decreases* less than 30 mg/dL, or stays the same, or rises: *increase* the basal rate by
    10–20 percent

Bedtime BG
Patients should always have a BG >100 mg/dL before going to sleep.

Fasting Technique
Confirm daytime basals by delaying and/or skipping meals (one meal at a time).

Non-Fasting Technique
Can be used to check daytime basals when patients cannot or will not fast/skip meals (i.e.,
children, pregnancy).
Bolus Adjustments

Insulin-to-Carbohydrate Ratios

The Insulin-to-Carbohydrate Ratio should be adjusted to correct two-hour, post-meal glucose levels that are above or below target. Adjustments are made by comparing the pre-meal BG to the two-hour post-meal BG.

The insulin-to-carbohydrate ratio is correct if the two-hour post-meal BG is 30mg/dL to 60 mg/dL higher than the pre-meal BG.

- If the two-hour post-meal BG is higher than 60 mg/dL above the pre-meal BG two to three days in a row, decrease the insulin-to-carbohydrate ratio by 10–20 percent or one to two grams/unit.
- If the two-hour post-meal BG is less than 30 mg/dL above the pre-meal BG, increase the insulin-to-carbohydrate ratio by 10–20 percent or one to two grams/unit.

<table>
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<tr>
<th>Post-Meal BG Target Recommendations</th>
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<td>ADA: ≤160mg/dL</td>
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Factors to Assess Prior to Adjusting Carbohydrate Ratio

- Was bolus missed or administered late?
- Is patient carbohydrate counting correctly?
- Is patient adhering to Bolus Wizard® calculator recommendations?

Insulin Sensitivity Factor

The sensitivity factor is best evaluated by comparing the two-hour post-correction BG with the pre-correction BG.

Insulin Sensitivity Factor/Correction Bolus Test

- Have patient perform test
  - When BG is above target range
  - When patient has not eaten or given insulin over the last three hours
- Have patient administer correction bolus using the Bolus Wizard® calculator recommendation
  - Patient should monitor BG every hour for three to four hours post-correction
  - Patient should not eat during this time
- The Insulin Sensitivity Factor is correct if BG is within 30 mg/dL of the target range two hours after correction and at target range at four hours

In situations where it is not reasonable for the patient to go for prolonged periods without food, a modified version of this test can be used for evaluation.
Dosing Guidelines

Clinical Guidelines

**Basal Rate**
(Pump TDD x 0.5)/24 hr

- Start with one basal rate, adjust according to glucose trends over two to three days
- Adjust to maintain stability in fasting state (between meals and during sleep)
- Add additional basalss according to diurnal variations (dawn phenomena)

**Carbohydrate Ratio (CR)**
450/TDD

- Adjust based on lowfat meals with known carbohydrate content
- Acceptable 2-hour post-prandial rise is approximately 30–60 mg/dL above pre-prandial BG
- Adjust carbohydrate ratio in 10–20% increments based on post-prandial BG

**Alternate Methods**
- Carbohydrate Ratio: (6 x wt. in kg/TDD) or (2.8 x wt. in lbs/TDD)
- Fixed Meal Bolus = (TDD x 0.5)/3 equal meals (when not carbohydrate counting)

**Sensitivity Factor (ISF)/Correction**
1700/Pump TDD

- Sensitivity Factor is correct if BG is within 30 mg/dL of target range 2 hours after correction
- Make adjustments in 10–20% increments if 2-hour post correction BGs are consistently above or below target

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Clinical Considerations for Insulin Pump TDD
- Average values from Methods 1 and 2
- Hypoglycemic patients — start at lower value
- Hyperglycemic, elevated A1C or pregnant — start at higher value

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Method 1
Pre-Pump Total Daily Dose (TDD)
Pre-pump TDD x 0.75

Method 2
Patient weight
Wt: kg x 0.5 or lb x 0.23

Insulin Pump TDD