Diabetes Education SERVICES

15 years

Diabetes Boot Camp – Class 3

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www.DiabetesEd.net

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Important Stuff

- Welcome to our First Boot Camp ever
- We will meet for 3 consecutive Thursdays – from 11:30am to 1pm
- I will stay after the program to answer any questions "off – line"
- The course will be recorded and available for viewing within 4 hours of completion of the session
- Login to the Online University to hear the recorded version, take the quiz and get your CEs
- Please email us with any questions or concerns at Lainey@diabetesed.net

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Boot Camp 3 ~ Insulin and Pattern Manage-ment

Session 3 - Insulin Replacment Therapy and Pattern Management

"AACE Comprehensive Diabetes Management Algorithm 2013. A slide set summary of the ACE/AACE Statement by an American Association of Clinical Endocrinologists/American College of Endocrinology Consensus Panel on Type 2 Diabetes Mellitus. Encourage all those planning to take CDE exam to review this info carefully.

ADA Algorithm for Type 2 Diabetes - 2009 - This 2 page chart provides a simple and clear approach to initiating type 2 patients on insulin therapy.

AADE White Paper on Continuous Subcutaneous Insulin Therapy - This paper outlines the topics that should be covered by diabetes educators when teaching patients and families or significant others about insulin pump therapy

AADE Strategies for InsulinTherapy 2011.PDF – An excellent review of the latest research on proper insulin administration techniqes, patient barriers and insulin therapy.

Diabetes Meds on a Budget - 2014 - this article by Beverly Thomassian, provides practical and affordable strategies to manage hyperglycemia when funds are limited.

Use of U-500 Insulin in the Treatment of Severe Insulin Resistance (2008) – This article presents an updated algorithm for the administration and dosing of U-500 insulin based on clinical experience.

U-500 Insulin - When more with Less Yields Sucess – with the growing weight of our population, there is an increasing need for larger insulin doses. This article on U-500 insulin offers helpful information on pharmacotherapy, safety and dosing.

Inhaled Insulin - Afrezza - Package Insert

Inhaled Insulin - Afrezza - Patient Medication Guide

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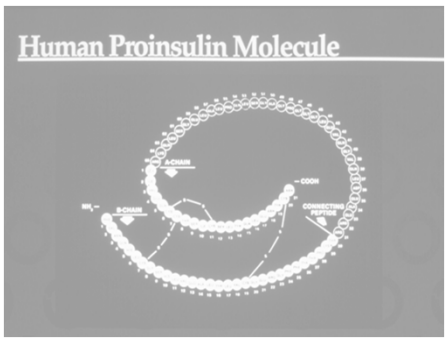
Objectives – Insulin and Pattern Management

Objectives:

- Discuss the actions of different insulins
- Describe pattern management as an insulin adjustment tool.



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Poll Question 1

- John has type 2 and needs to start insulin. He tells you, “There is no way I am going to take shots”. What is the best response?

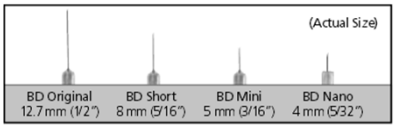
a. Don’t worry, insulin won’t cause weight gain.
b. Insulin prevents complications
c. The new insulin needles don’t hurt at all
d. Ask him to tell you why

Psychological Insulin Resistance (PIR)

- 50% of providers in study threatened pts “with the needle”.
- Less than 50% of providers realized insulins’ positive effect on type 2 dm
- Most pts don’t believe that insulin would “better help them manage their diabetes”.
- Solutions: Find the root of PIR and address it, use more insulin pens

Diabetes Attitudes, Wishes, Needs Study - Rubin

Needle Size often a Barrier
Size *Does* Matter



BD Nano 4mm and BD Mini 5mm only available in pen needles

- Use more short needles – 4 mm
- Effective for pts with BMI of 24- 49
- Keeps it subq
- If pt thin, inject at angle
- To avoid leakage, count to 10 before withdrawing needle
- ½ the patients who could benefit from insulin are not using it due to needle phobias
- Consider inhaled insulin

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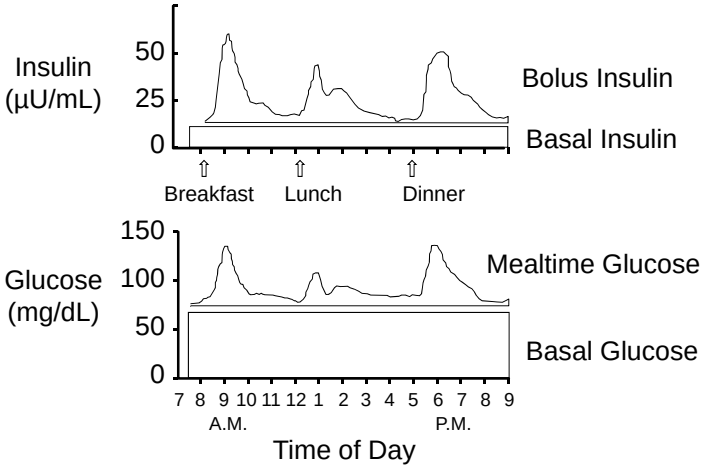
Physiologic Insulin Secretion: 24-Hour Profile



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Insulin Action Teams

- Bolus: lowers after meal glucose levels
  - Rapid Acting
    - Aspart, Lispro, Glulisine
  - Short Acting
    - Regular
  - Afrezza - Inhaled
- Basal: controls glucose between meals, hs
  - Intermediate
    - NPH
  - Long Acting
    - Detemir (Levemir)
    - Glargine (Lantus)

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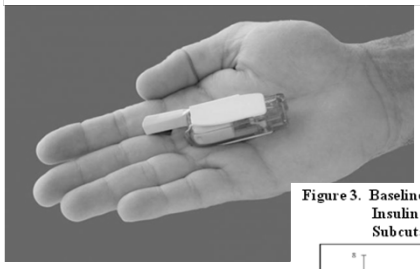
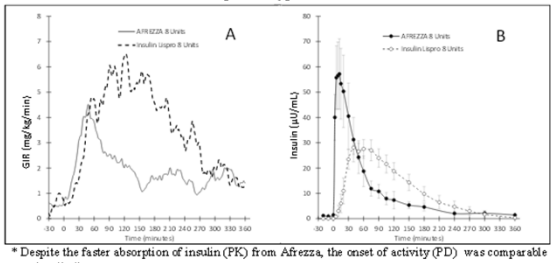
Afrezza – Inhaled Insulin – Approved 2014 – Type 1 or 2



afrezza

Only studied in adults over 18
Not indicated for pregnancy, while breastfeeding

Figure 3. Baseline-Corrected Glucose Infusion Rate (A) and Baseline-Corrected Serum Insulin Concentrations (B) after Administration of AFREZZA or Subcutaneous Insulin Lispro in Type 1 Diabetes Patients*



* Despite the faster absorption of insulin (PK) from Afrezza, the onset of activity (PD) was comparable to insulin lispro.

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Bolus Insulins
(½ of total daily dose ÷ meals)

Name	Onset	Peak Action
Lispro (Humalog)	15-30 min	1-1.5 hrs
Aspart (NovoLog)		
Glulisine (Apidra)		
Afrezza (Inhaled)		
Regular	30 mins	2-4 hrs

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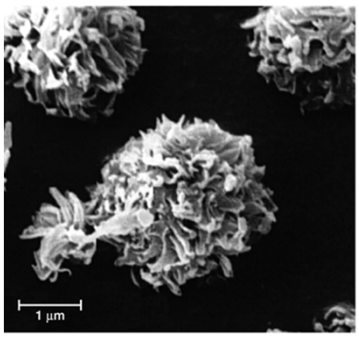
Steps, Cost, Terms

- 1st step – FDA approved. Sanofi Aventis to produce, market and distribute
- Pricing –similar pricing as pens ~ $300 a month
- Afrezza is regular human insulin in powder form using Technosphere technology.
- Referred to as TI in papers – "Technosphere Insulin"



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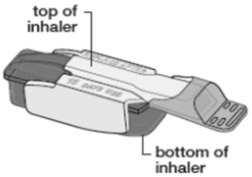
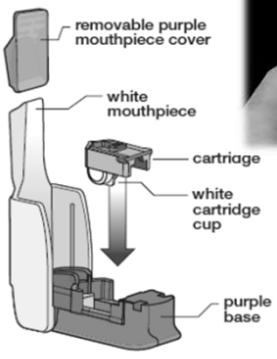
Afrezza Dosing and Considerations

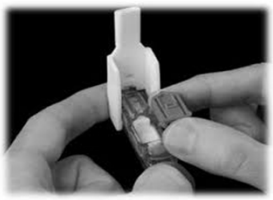
- Bolus regular insulin – inhaled before meals
- Dosing: 4 and 8 unit cartridges
  - Convert with 1:1 ratio to existing insulin dose
- Lung function test before start (FEV1)
  - Not for pts w/ chronic lung issues
    - Asthma, COPD, history of lung cancer, smokers
    - Can cause acute bronchospasm – Black box warning
- Side effects:
  - Hypoglycemia, sore throat, cough
  - Less hypoglycemia than injected insulin

Afrezza Inhaler

Know your AFREZZA® inhaler:

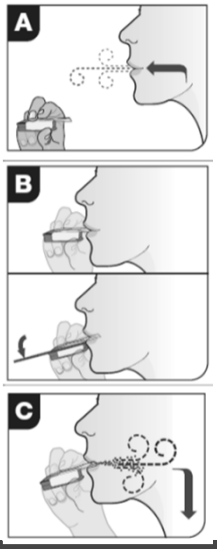






Replace inhaler every 15 days – Do not wash

Afrezza – Proper Inhale Technique



- Exhale
- Position inhaler in mouth (take off cover)
- Tilt inhaler down toward chin, keep head level
- Inhale deeply and hold breath for as long as comfortable
- Remove cartridge
- Replace cover

Afrezza – Combos to get right dose

If you cannot find your injected dose in the chart below, you must talk to a healthcare provider before using AFREZZA®.

To switch from injected mealtime insulin to AFREZZA®...

Find your injected insulin dose in the chart.

Injected Mealtime Insulin Dose	AFREZZA® Dose	# of **4 unit** (blue) cartridges needed	# of **8 unit** (green) cartridges needed
up to **4** units	**4** units		
5-8 units	**8** units		
9-12 units	**12** units	+	
13-16 units	**16** units		
17-20 units	**20** units	+	
21-24 units	**24** units		

Find the correct dose of AFREZZA®.

Example:

If you need to take **12 units** of AFREZZA® you can use...

1 blue (4 unit) cartridge + 1 green (8 unit) cartridge

Sample situations - Pt on….

- 5 units regular break, dinner, 10 units detemir
- 10 units aspart at meals, 30 Lantus
- Carb counts – 1:15 .. Had 75 gms
  - Type 1
  - Type 2
  - BG before meal 67
  - BG before meal 170

Bolus Insulin Summary

- Regular, Novolog, Humalog, Apidra, Afrezza
- Starts working fast (15-30 mins)
- Gets out fast (3-6 hours)
- Post meal BG reflects effectiveness
- Should comprise about ½ total daily dose
- Covers food or hyperglycemia.
- 1 unit
  - Covers ≈ 10 -15 gms of carb
  - Lowers BG ≈ 30 – 50 points

Poll Question 2

- Mary takes 4 units lispro (Humalog) before breakfast. Which BG result reflects that the dose was the right dose?

1. Before breakfast BG of 97
2. 1 hour post breakfast BG of 153
3. Before lunch BG of 69
4. 2 hour post breakfast BG of 183

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Bolus Insulin Timing

- How is the effectiveness of bolus insulin determined?
  - 2 hour post meal (if you can get it)
  - Before next meal blood glucose
- Glucose goals (ADA) – may be modified by provider/pt
  - 1-2 hours post meal <180
  - Before next meal – 70 - 130

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Bolus – Insulin Sliding Scale

Starts at 150, 2 units for every 50 mg/dl >150

	Break	Lunch	Dinner	HS
Day 1	94 no insulin	212 4 uR	148 no insulin	254 6 uR
Day 2	243 4uR	254 6 uR	201 4uR	199 no insulin
Day 3	189 2uR	243 4uR	162 2uR	244 4uR
Day 4	66 No insulin	287 6uR	144 none	272 6uR

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Basal Insulins

(½ of total daily dose)

Intermediate Acting	Peak Action	Duration
▸ NPH	4-12 hrs	12-24

Long Acting	Peak Action	Duration
▸ Detemir (Levemir)	peakless	20 hrs
▸ Glargine (Lantus)	No peak	24 hrs

Fasting BG reflects efficacy of basal

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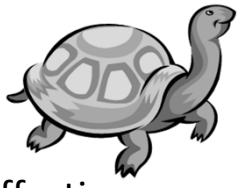
Basal Insulin Summary

- NPH, Levemir, Lantus
- Covers in between meals, through night
- Starts working slow (4 hours)
- Stays in long (12-24 hours)
  - NPH/ Lente 12 hrs
  - Levemir, Lantus 20-24 hrs
- Fasting blood glucose reflects effectiveness



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Type 2, 60kg Basal Only
A1c 8.9% at month 3

	Break	Lunch	Dinner	HS
Mo 1	178			298 10uLan
Mo 2	166			233 20uLan
Mo 3	143			206 30uLan

Poll Question 3

- Calvin takes 5 units reg at dinner and 18 units of NPH at HS. His am BG ranges from 63 to 72. What is best action?

a. Decrease dinner regular to 4 units
b. Encourage him to eat bedtime snack
c. Decrease NPH insulin at HS
d. Have him check a 2am BG

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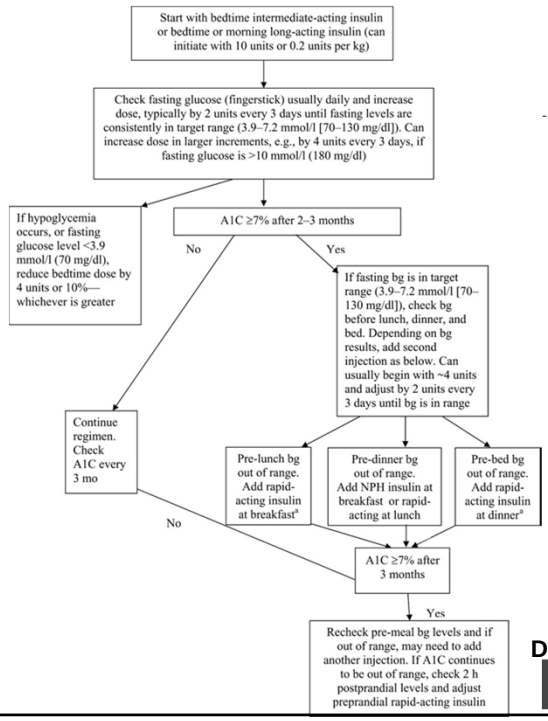

Diabetes Care 32:193-203, 2009

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Combination SQ Insulin

Insulin Type	Onset	Duration
Humalog Mix 75/25: 75% NPL, 25% lispro 50/50: 50% NPL, 50% lispro	5-15 min	10-16 hrs
NovoLog Mix 70/30: 70% NPA, 30% aspart	5-15 min	10-16 hrs
NPH + Reg Combo 70/30: 70%N /30%R 50/50: 50%N /50%R	30 – 60 min	10-16 hrs

Considerations:

- Pre-mixed, difficult to fine tune therapy

Basal / Bolus Premixed Action Info

	Brkfst	Lunch	Dinner	HS
AM Basal (NPH, NPL,NPA)			X	
AM Bolus (Reg, Lispro, Aspart)		X		
PM Basal	X			
PM Bolus				X

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20u 70/30 Pre breakfast/dinner
14/6 14/6

	Break	Lunch	Dinner	HS
Day 1	73	131	92	87
Day 2	162	92	137	109
Day 3	71	129	112	95
Day 4	68	139	132	102

Case Study

- 70 yr old, weighs 100kg
- History of CABG, tobacco
- A1c – 11.3%, BG 400-500 for past weeks
- Insulin – 100+ units Lantus at hs (solostar)
- Oral Meds: Metformin, Invokana
- What is a better insulin dosing strategy?
- Pt can't afford insulin pen – what other option
- Diabetes Meds on a Budget - 2014 - provides practical and affordable strategies to manage hyperglycemia

Cost Per Vial in Northern CA

Per vial cost	Walmart	Walgreens	Costco
Regular Insulin	$25*	$92	$99
NPH	$25*	$92	$99
70/30	$25*	$92	$101
Humalog	$200	$220	$178
Novolog	$197	$217	$178
Apidra	$180	$246	$178
Levemir	$300	$300	$300
Lantus	$226	$221	$206

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Quick Calculation – Hint 1 vial holds 1000 units of u-100 insulin

- Pt takes:
- 30 units of Humalog at breakfast and dinner.
- 20 units of Humalog at lunch and in between breakfast and lunch if BG over 200.
- A1c 8.7%
- How many vial(s) of insulin would he use a month?

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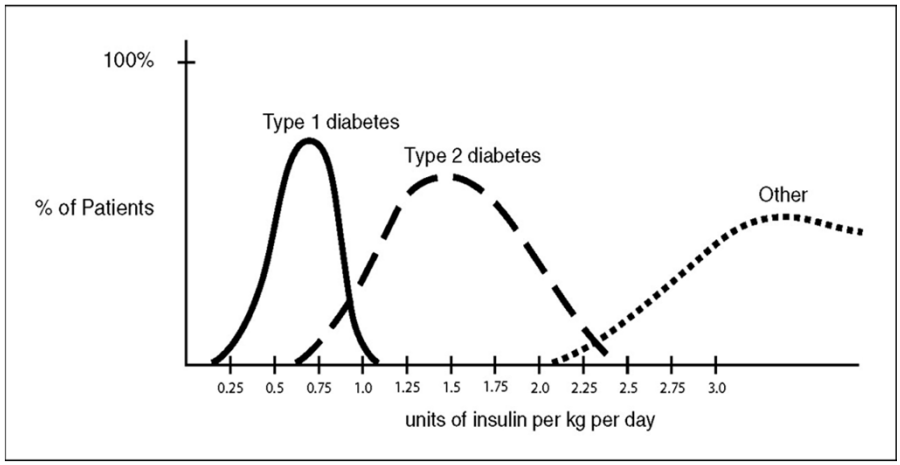
Poll Question 4

- Sarah takes 30 units lispro BID, 20 units in-between BID as needs. How many vials a month?
  1. 1-2
  2. 2-3
  3. 3
  4. 2

Insulin Dosing Type 1 & 2



U-500 Insulin: When More With Less Yields Success: *Diabetes Spectrum March 20, 2009 vol. 22 no. 2 116-122*

More than 200 units a day?

Medscape

Source: Am J Health-Syst Pharm © 2010 American Society of Health-System Pharmacists

Consider u-500

- Consider U-500 (5 x's more potent)
  - 1 unit on U-100 syringe = 5 units insulin
  - Dosing – take total daily needs and split into two doses
    - 60% am / 40% pm
  - 20 mL per vial - 500 units per mL = 10,000 units per vial
  - Costs ~ $400 per vial
  - No basal insulin needed, because U-500 has bolus and basal action
  - Needs careful monitoring/ education

U-500 Insulin: When More With Less Yields Success: *Diabetes Spectrum March 20, 2009 vol. 22 no. 2 116-122*

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U-500 Dose in u-100 syringe IN TB Syringe

If this is **your dose** of Humulin R U-500	Fill a U-100 **insulin syringe** up to this marking	Fill a **tuberculin syringe** up to this marking
25	5	0.05
50	10	0.1
75	15	0.15
100	20	0.2
125	25	0.25
150	30	0.3
175	35	0.35
200	40	0.4
225	45	0.45
250	50	0.5
275	55	0.55
300	60	0.6
325	65	0.65
350	70	0.7
375	75	0.75
400	80	0.8
425	85	0.85
450	90	0.9
475	95	0.95
500	100	1.0

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Dosing Conversion for U-500 using U-100 Syringe

U-500 in U-100 Syringe	**Actual Dose**
1 unit	5 units
3 units	15 units
6 units	___ units
8 units	40 units
_____	60 units
_____	80 units
20 units	___ units

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Pattern Management

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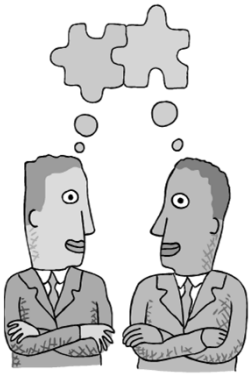
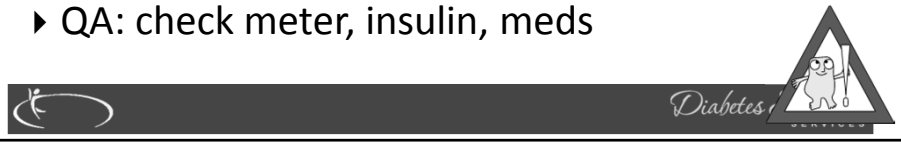
Pattern Management

- ID personal glucose goals
- Assess ability to self adjust based on BG
- Frequency of BGM
- Willingness to keep detailed log
- Social and Provider support



Pattern Management

- Safety 1st!! - Evaluate 3 day patterns
- **Hypo** eval 1st and fix:
  - If possible, decrease medication dose
  - Timing of meals, exercise, medications
- **Hyperglycemia:** evaluate 2nd
  - Identify patterns:
  - fix fasting first, r/o Somogyi (check 3am BG)
- QA: check meter, insulin, meds



New Type 2 - Lantus 10 units Hs Patterns? Questions

	Break	Lunch	Dinner	HS
Day 1	164			181
Day 2		124	106	195
Day 3	149		102	242
Day 4	151	81		211

Type 2 – glyburide 10mg AM,
Detemir 12 units at hs

	Break	Lunch	Dinner	HS
Day 1	164	94	66	162
Day 2	169		59	195
Day 3		84	81	242
Day 4	159		43	211

Basal Bolus – What Adjustments?
Pt weighs 80kg

	Break	Lunch	Dinner	HS
Day 1	69 7H	79 5H	245 8H	190 22u Det
Day 2	81 7H	87 5H	170 8H	133 22u Det
Day 3	73 7H	94 5H	194 8H	110 22u Det
Day 4	62 7H	83 5H	211 8H	127 22u Det

Intensive Diabetes Therapy
Insulin Dosing Strategy

50/50 Rule

- 0.5-1.0 units/kg day
  (.5 units/kg most common)
- Basal = 50% of total
  - Glargine Q day
  - NPH or Detemir BID
- Bolus = 50% of total
  - usually divided into 3 meals

Example

- Wt 50kg x 0.5 = 25 units of insulin/day
- Basal dose: 13 units
  - Glargine 13 units Q day
  - NPH/Detemir 6u BID
- Bolus dose: 12 units
  - 4 units NovoLog, Apidra, Reg, Humalog each meal

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Intensive Diabetes Therapy
Insulin Dosing Strategy

50/50 Rule

- 0.3-1.0 units/kg day
  (.5 units/kg most common)
- Basal = 50% of total
  - Glargine Q day
  - NPH or Detemir BID
- Bolus = 50% of total
  - usually divided into 3 meals

Example – You Try

- Wt 80 kg x 0.5 = ___ units of insulin/day
- Basal dose: _____ units
  - Glargine ____ units QD
  - NPH/Detemir ____ BID
- Bolus dose: _____ units
  ____units NovoLog, Apidra Humalog each meal

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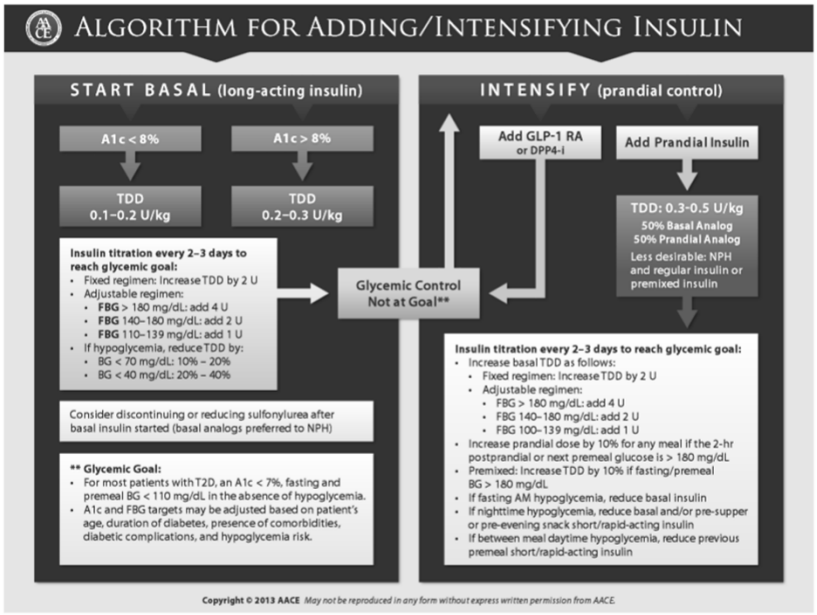
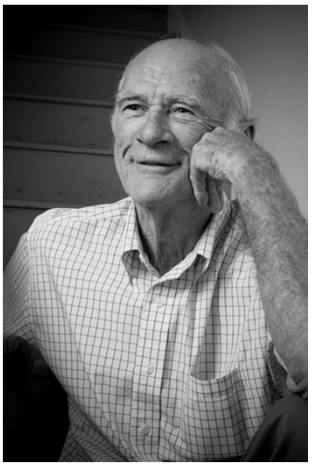
Basal Bolus – Using 50/50 Rule – Pt weighs 80kg

	Break	Lunch	Dinner	HS
Day 1	84 6H	89 7H	145 7H	190 20 u Det
Day 2	81 6H	97 7H	107 7H	133 20u Det
Day 3	79 6H	104 7H	124 7H	110 20u Det
Day 4	69 6H	103 7H	208 7H	193 20u Det

AACE Algorithm



Based on Mr R's clinical picture – In hospital How Much Insulin Needed?



- Creatinine 1.6
- 76 years old
- Not very hungry
- BMI 21
- Weighs 80kg
- Glucotrol 5mg at home
- A1c 7.2%

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Calculate Daily Insulin Needs

- Based on unique characteristics of pt, where would you start?
  - Body wt in Kg x _____ = total daily dose
  - May need more or less based on clinical presentation

Less 0.3 u/kg — 0.5u/kg — More 1.0 u/kg

Thin, elderly, ↑ creat — Heavy, infection, steroids

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Calculate Insulin Needs
Basal/ insulin carb/ correct

- Body wt in Kg x 0.3
- 80kg x 0.3 = 24 units daily

- Basal = 12 units
- Bolus = 12 units / 3 meals = 4 units each meal
- What if he is nauseated?

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Bolus Basics

- Carbohydrate/ Prandial Coverage
  - Match the insulin to the carbohydrates
  - 1 unit for 15 gms - Common starting point
- Correction Bolus - targets hyperglycemia
  - 1 unit for every 30-50 points over target
- Adjust ratios depending on sensitivity and response

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Carbohydrate Ratio How does that work?

Rapid/Fast Acting Insulin

- Dinner **(60 gms cho)**
  - Lemon Chicken
  - 1 cup rice pilaf (45 gms cho)
  - Asparagus
  - Dinner Roll (15 gms cho)

Blood Glucose 165mg/dl

Serving Size	Gms CHO	Insulin
1	15 gms cho	1 unit
2	30 gms cho	2 units
3	45 gms cho	3 units
4	60 gms cho	4 units

Adjusting Bolus and Correction Doses Carbohydrate-to-Insulin Ratio

Based on three questions before meals:

1. How much carbohydrate am I going to eat?
2. What is my insulin dose for this amount of carbohydrate?
3. Should I lower the dose because I plan to be very active or have recently been active or my blood sugar is low?

Correction Bolus

Rapid/Fast Acting Insulin (1 unit:50 mg/dl>150)

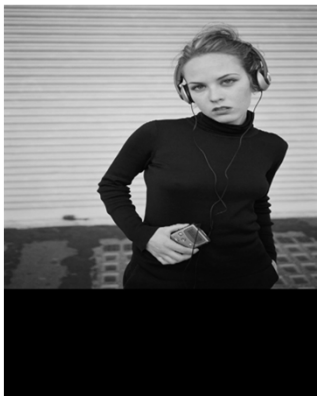
Less than 70	Subtract 1 unit
70-150 mg/dl	0 units
151-200 mg/dl	1 unit
201-250 mg/dl	2 units
251-300 mg/dl	3 units
301-350 mg/dl	4 units
351-400 mg/dl	5 units

Poll Question 5

- 1 unit novolog for 10 gms of carb. Meal 1 cup rice, bbq steak, 1 c. skim milk, sm banana, SF ice tea. BG 68.

a. 8 units
b. 7.2 units
c. 6.2 units
d. 6.0 units

Type 1 and a Teen



- Cindy is trying to carb count and adjust her insulin, but is still having trouble. She weighs 60kg.
- What is her daily dose of insulin?
- What is her basal dose?

1. Pre meal target BG is 120
2. Post meal goal < 180.
3. Carb ratio: 1 unit for every 15 gms
4. Hyperglycemic correction factor is one unit for every 55 above goal (she uses Humalog and 1700 rule)

1700 Rule
1700 / TDD = insulin sensitivity
1700 / 30 = 56
1 unit drops BG 56 points

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Correction Bolus for Cindy – Insulin Sensitivity

Analog Insulin (1 unit:55 mg/dl>120)

Less than 70 mg/dl	Subtract 1 unit
70-119 mg/dl	0 units
120-175 mg/dl	1 unit
176-230 mg/dl	2 units
231-285 mg/dl	3 units
286-340 mg/dl	4 units
341-395 mg/dl	5 units

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Poll Question 6

- Bob's correction scale is 1 unit for every 30 above his target of 120. His BG is 270. How much correction insulin?

1. 4 units
2. 5 units
3. Needs to count carbs first
4. Depends on his activity level

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Adjusting Cindy's Bolus Insulin With Ratios

BG before lunch 285, she plans to eat 45 gms of carbohydrate.

285-120 = 165 over target, 165/55 = 3

45gms / 15 = 3

- 3 units bolus insulin to correct to target
- 3 units bolus insulin to cover carbs in meal

Total adjusted dose: 6 units humalog insulin

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Adjusting Cindy's Bolus Insulin With Ratios - You Try

BG before lunch 230, plans to eat 60 gms of carbohydrate.

____-120 = ____ over target, ____/55 = ____units

_____gms / ____ = ____ units ins for carbs

- _____ units insulin to correct for hyperglycemia
- _____ units insulin to cover carbs in meal

Total adjusted dose: ___ units humalog insulin

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Adjusting Cindy's Bolus Insulin With Ratios - Answers

Fingerstick before lunch 220, plans to eat 60 gms of carbohydrate.

220 -120 = 110 over target, 110/55 = 2

60 gms / 15 = 4 units for carbs

- 2 units insulin to correct hyperglycemia
- 4 units insulin to cover carbs in meal

Total adjusted dose: 6 units humalog insulin

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How much Insulin Needed?

- Morning - BG 173
  - Breakfast – slice cold pizza, ½ c. applesauce
- Lunch BG 69
  - Menu- ham sandwich, pear, diet 7-up, mini snickers bar.
- 2 hours after lunch, BG 148 - ran track
- Before dinner - BG 98
  - Cheeseburger, small fries, chocolate chip cookie
- At bedtime, BG 173

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Cindy, 60kg, Carb (1u/15gms) Target 120 pre meal, Hyper 1 for 55

	Break	Lunch	Dinner	HS
Day 1	99	154	128	69
Pre meal BG	2uH	6uH	5uH	15 GI
Carb	30gms	75gms	60gms	15gm
Day 2	143 /184	122 /156	220 / 89	228
Pre/ post meal BG	3uH	4uH	5uH	15 GI
Carb	45gms	60gms	45gms	0gm

Poll Question 7

- Which of the following is NOT a clinical indication for insulin pump use?
  a. Gastroparesis
  b. High glucose variability
  c. History of substance abuse
  d. Hypoglycemia unawareness

Insulin Teaching Keys

- Bolus insulin with meals
- Basal 1-2xs daily
- Abdomen preferred injection site
- Stay 1" away from previous site
- Don't re-use ultra fine syringes
- Keep unopened insulin in refrigerator
- Toss opened insulin vial after 28 days
- Proper disposal
- Review patients ability to withdraw and inject.
- Side effects include hypoglycemia/wt gain
- Insulin pens –
  - Prime needle to assure accurate insulin dose given
  - Hold needle in for 5 seconds after injection
  - Roll 70/30 pens

Poll Question 8

- Which of the following is an accurate insulin teaching statement?

a. Insulin should never be injected through clothes
b. Test BG, Inject insulin, Eat
c. Insulin must always be refrigerated
d. If reusing needles, wipe off first with alcohol pad

Sharps Disposal: Product and Info

- Look in the Government section white pages for a household hazardous waste listing for your city or county.
- Call 1-800-CLEANUP (1-800-253-2687)
- Search for collection centers on the California Integrated Waste Management Board (CIWMB) Web site: http://www.ciwmb.ca.gov/HHW/HealthCare/Collection/

Thank You

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- Web
  www.diabetesed.net