Basal-Bolus Insulin Therapy (BBIT)

AHS Diabetes Obesity & Nutrition Strategic Clinical Network (DON SCN)
Provincial Diabetes Inpatient Management Initiative
April 2016

Click for PDF: http://www.ucalgary.ca/cdm/files/cdm/pdf_bbitapr6_2016.pdf

How common is Diabetes in Hospital?

- Over 3 million Canadians have Diabetes
  - For an overview of how Type I and Type II diabetes differ http://www.mayoclinic.com/health/blood-sugar/MM00641, or the Canadian Diabetes Association www.diabetes.ca

- 1 in 5 of all adult patients in Alberta hospitals has diabetes

Length of Stay

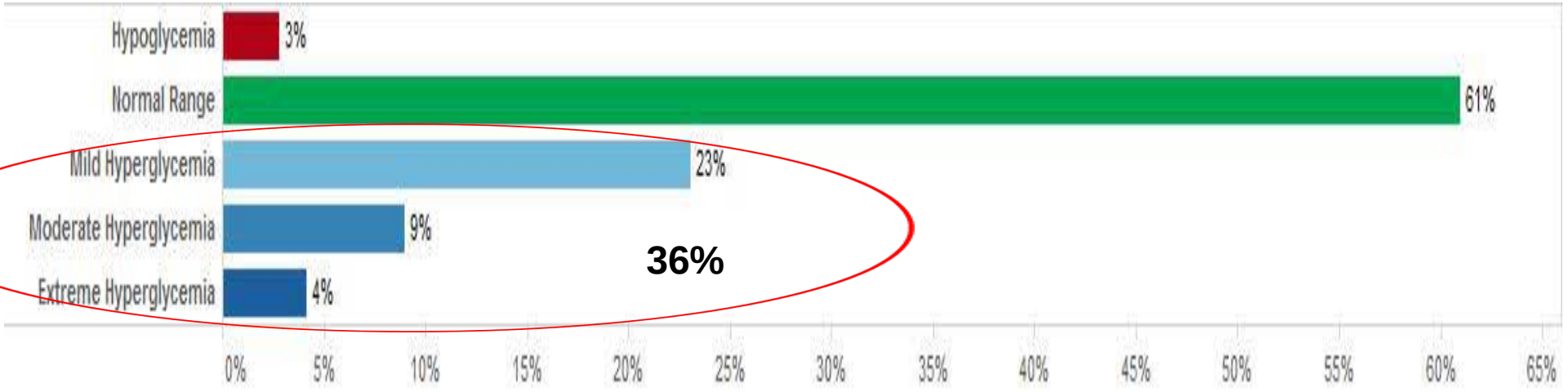
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
X	X	X				
Patients without diabetes						
X	X	X	X	X		
Patients with diabetes						

Prevalence of Hyperglycemia in Alberta

P.O.C. Blood Glucose Testing Data

- Four Acute Calgary Sites
- Among Adult, DM Patients who had an LOS >24 hrs.
- Accounted for 371,433 Point of Care (Glucometer) Tests in 2014

Percent of Blood Glucose Results by Category



Blood Glucose Results by Category and Diabetes Type (%)

What is the problem?

- High Blood Glucose (BG) in hospital causes:
  - More infections, poor wound healing
  - Worse outcomes after surgeries and procedures
  - Longer Length of Stay
  - Increased chance of Death

Holden, CDA Clinical Practice Guidelines, 2013

Risk factors for high and low BG in hospitalized patients with diabetes

- Changes in diet
- Changes in clinical status or medications
- Failure of clinicians to make adjustments to glycemic therapy based on daily BG patterns
- Poor coordination of BG testing and administration of insulin with meals
- Poor communication during times of patient transfer
- Errors in order writing and transcription
- Prolonged use of sliding scale insulin

Moghissi, Diabetes Care, 2009

Treatment in hospital

- In hospital, treatment options are more limited as some medications are affected by kidney or liver dysfunction, by an inflamed pancreas (pancreatitis), or by drug interactions

- Treatment in hospital is challenging because of changing health status, intake and activity

- The default insulin treatment in hospital currently tends to be sliding scale insulin (often without basal insulin).

Sliding Scale Insulin (SSI) Dosing

NOT INDIVIDUALIZED!!

IGNORES:

- Type of diabetes
- Patient weight
- Doses/types of home medications
- Acuity of illness
- Pt's intake/activity

BG 9.1-22 (Give 4-12U)
BG 7.1-22 (Give 4-14U)
BG 4.2-22 (Give 4-16U)

SSI an Outdated practice?

Sliding Scale Insulin (SSI) alone is a:

- Popular default regime
- Simple and convenient

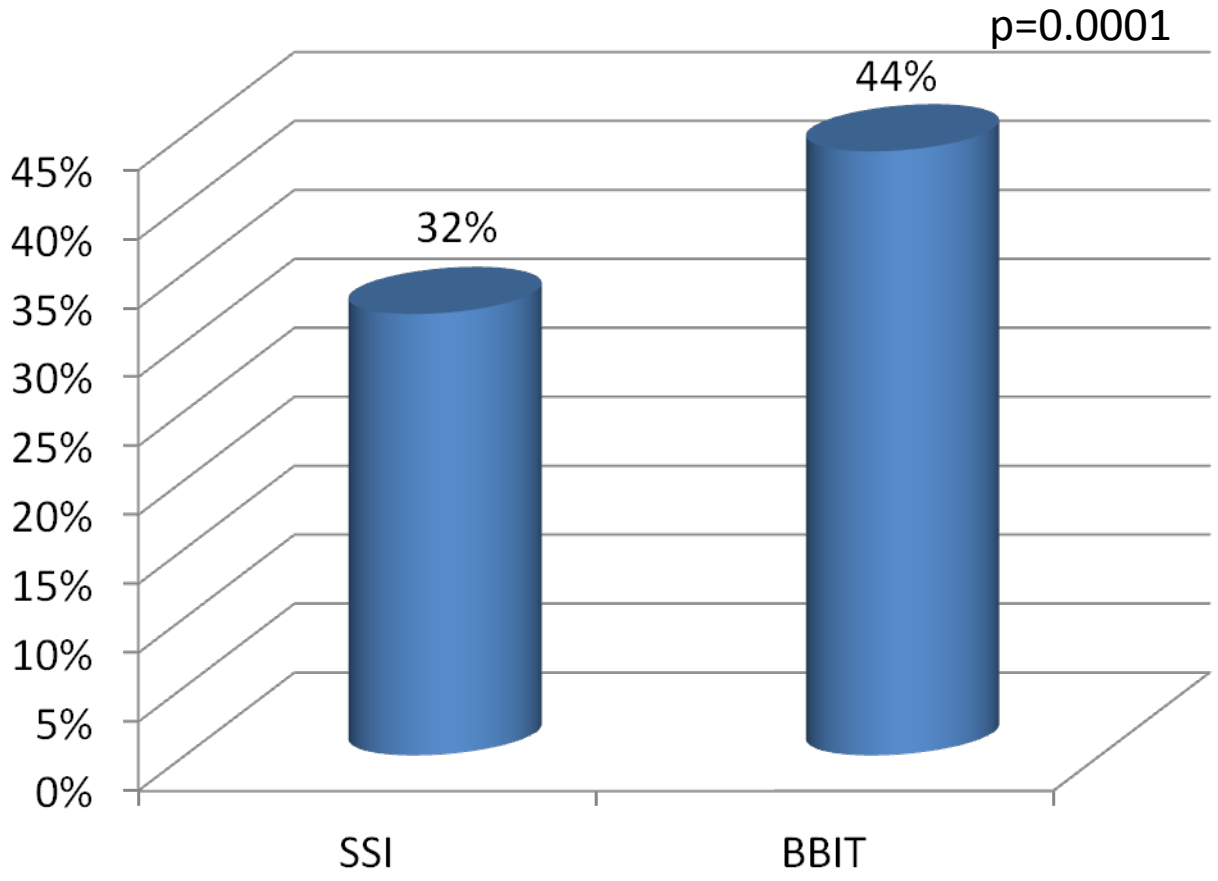
BUT

- It is a reactive vs. proactive way to treat blood sugars
- Never been shown to improve clinical outcome
- Outdated – YES!

What are we aiming for??

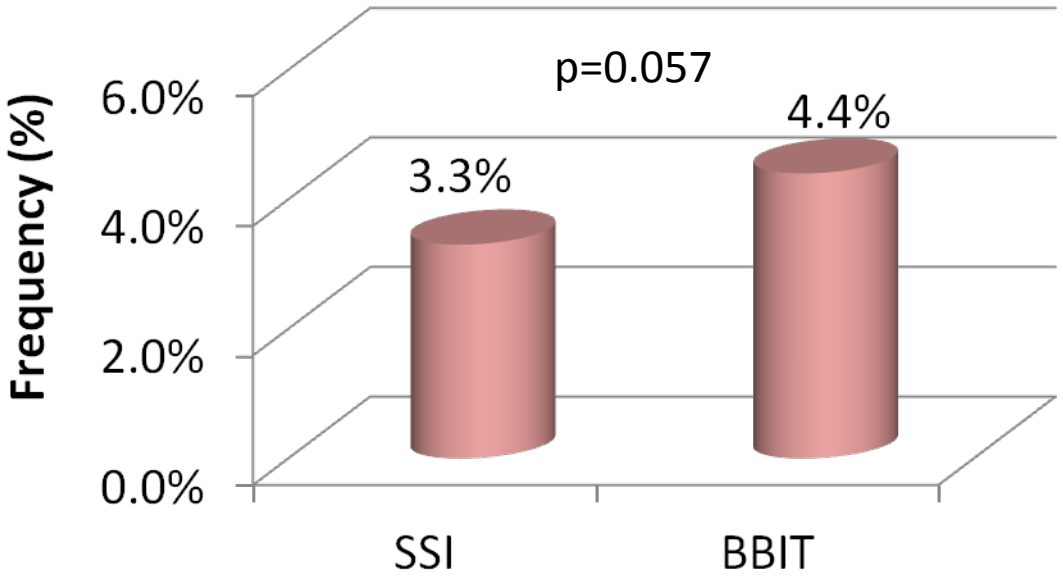
Chemstrips of 5-10!!

Percent of Days Spent “In-Target”



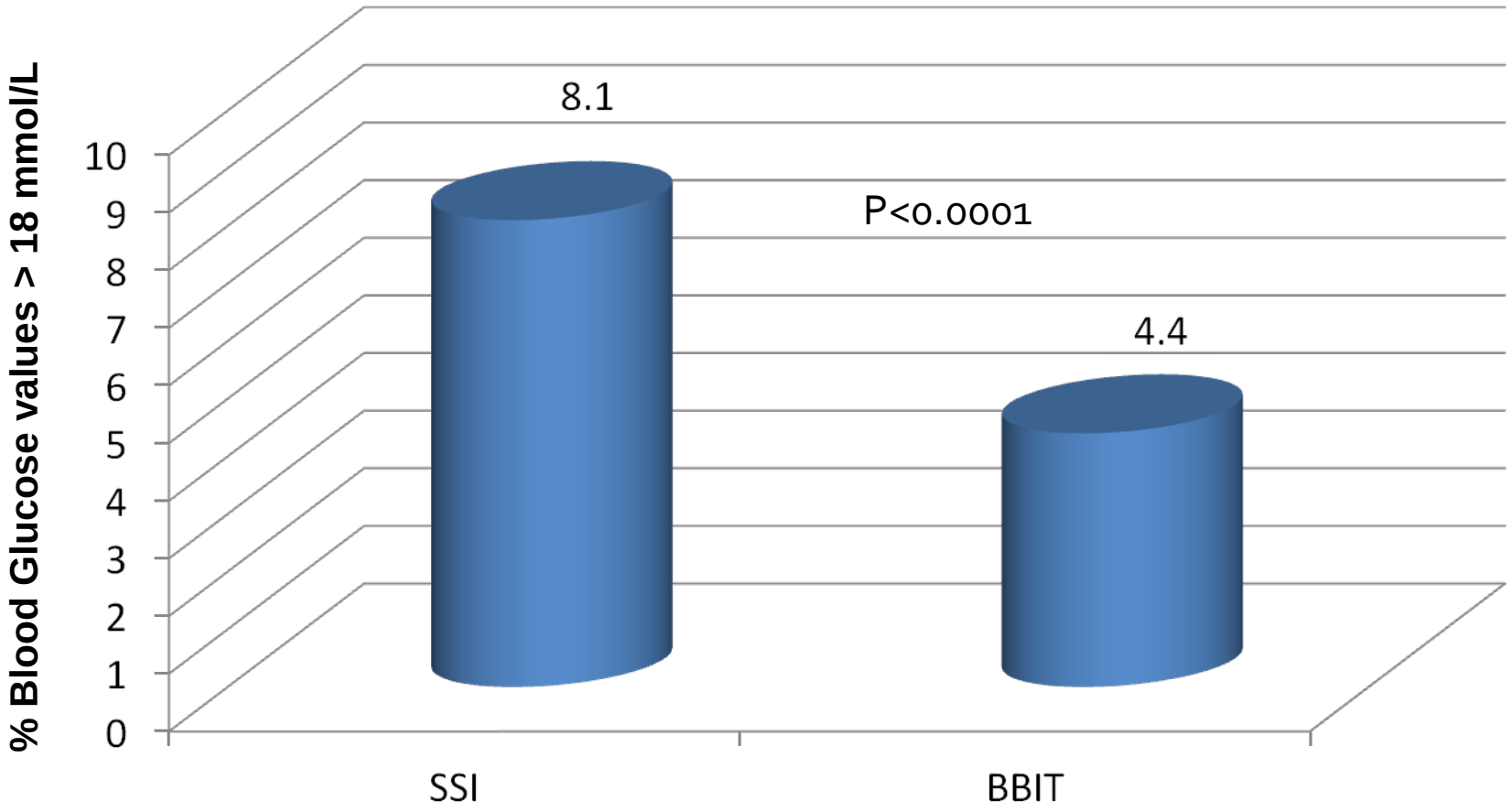
Internal Medicine units – 2010

Frequency of Hypoglycemia (BG<4)



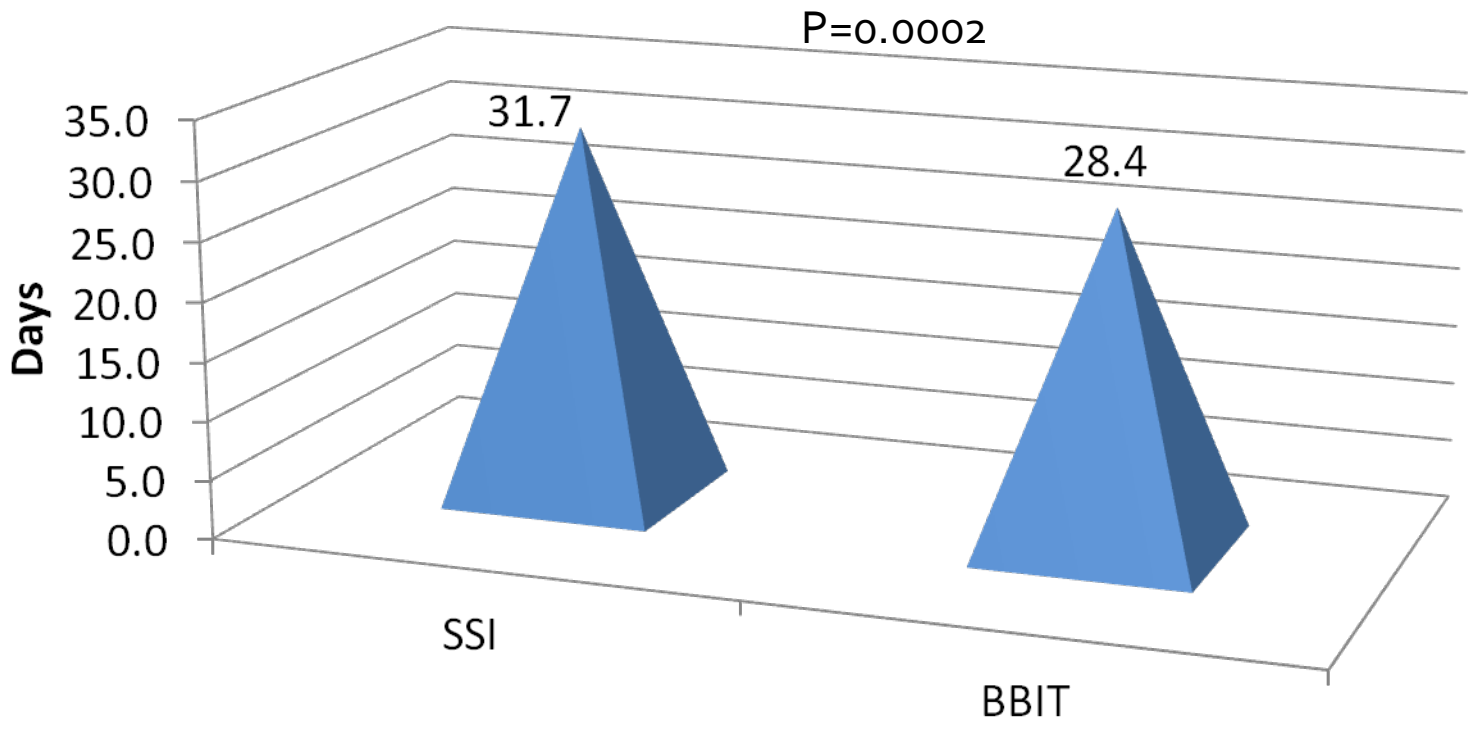
Internal Medicine units – 2010

Frequency of Severe Hyperglycemia (CBG >18 mmol/L)



Internal Medicine units – 2010

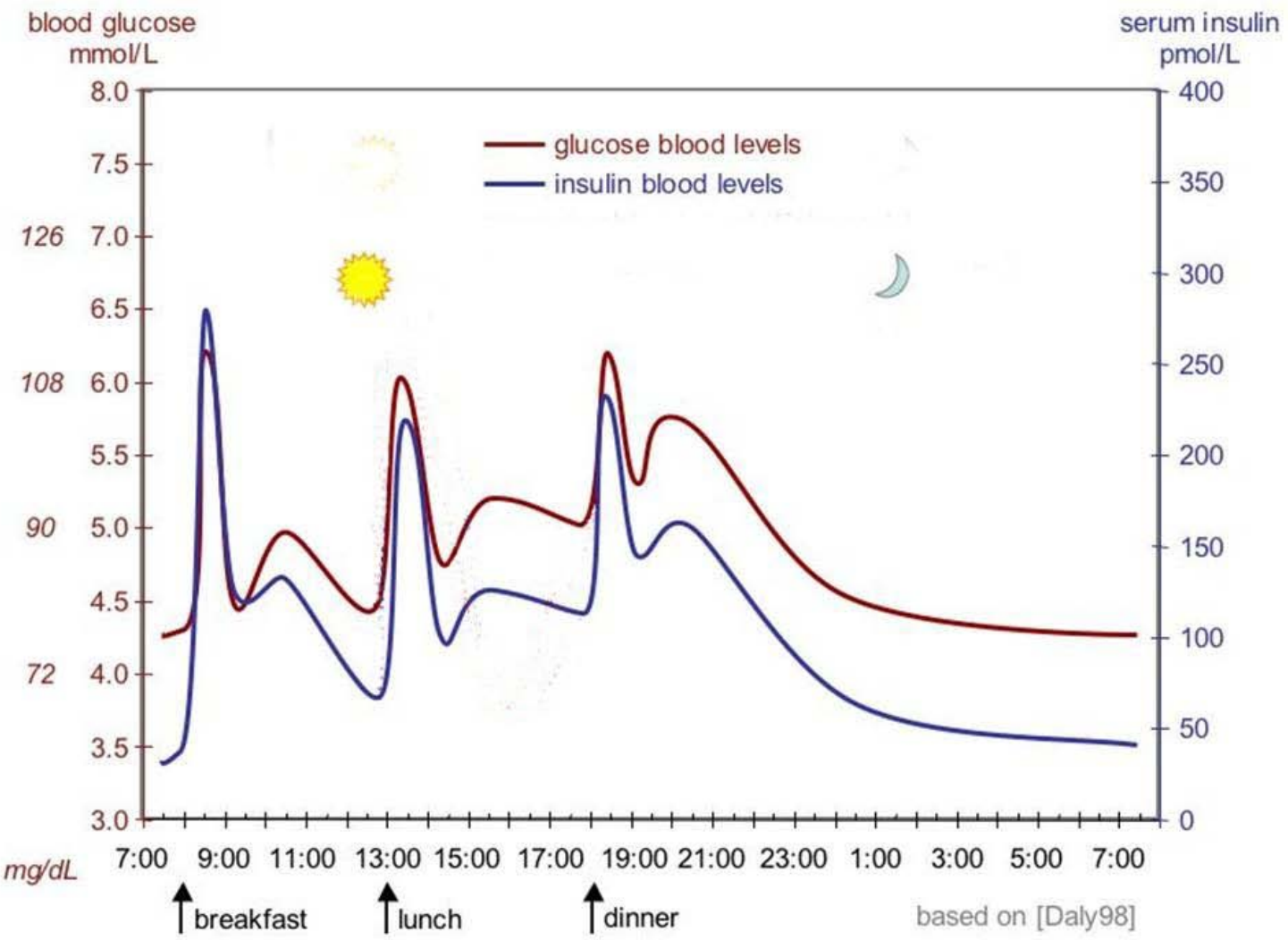
Diabetic Length of Stay on MTU



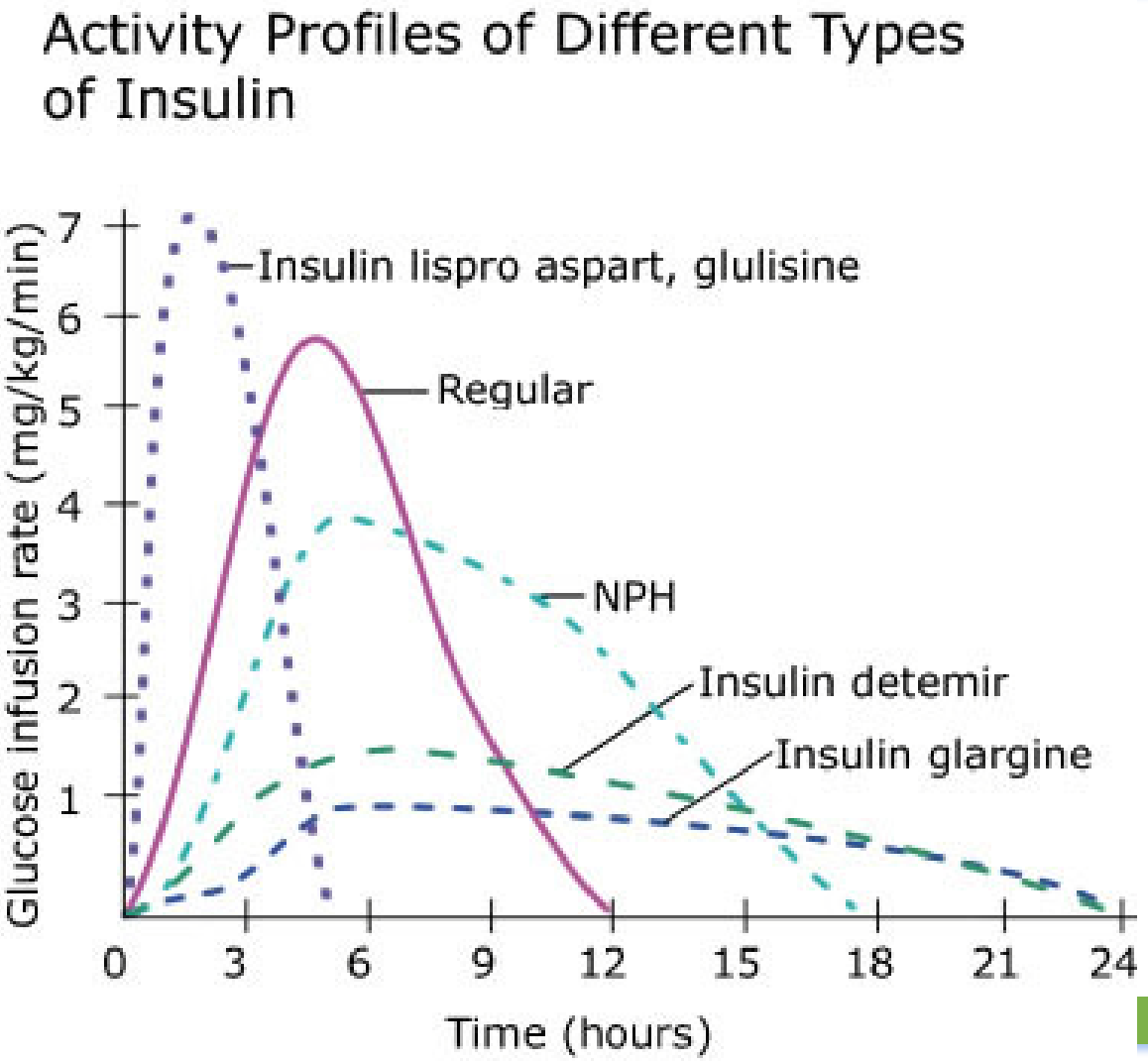
Internal Medicine units – 2010

SO WHAT ARE WE GOING TO DO ABOUT IT??

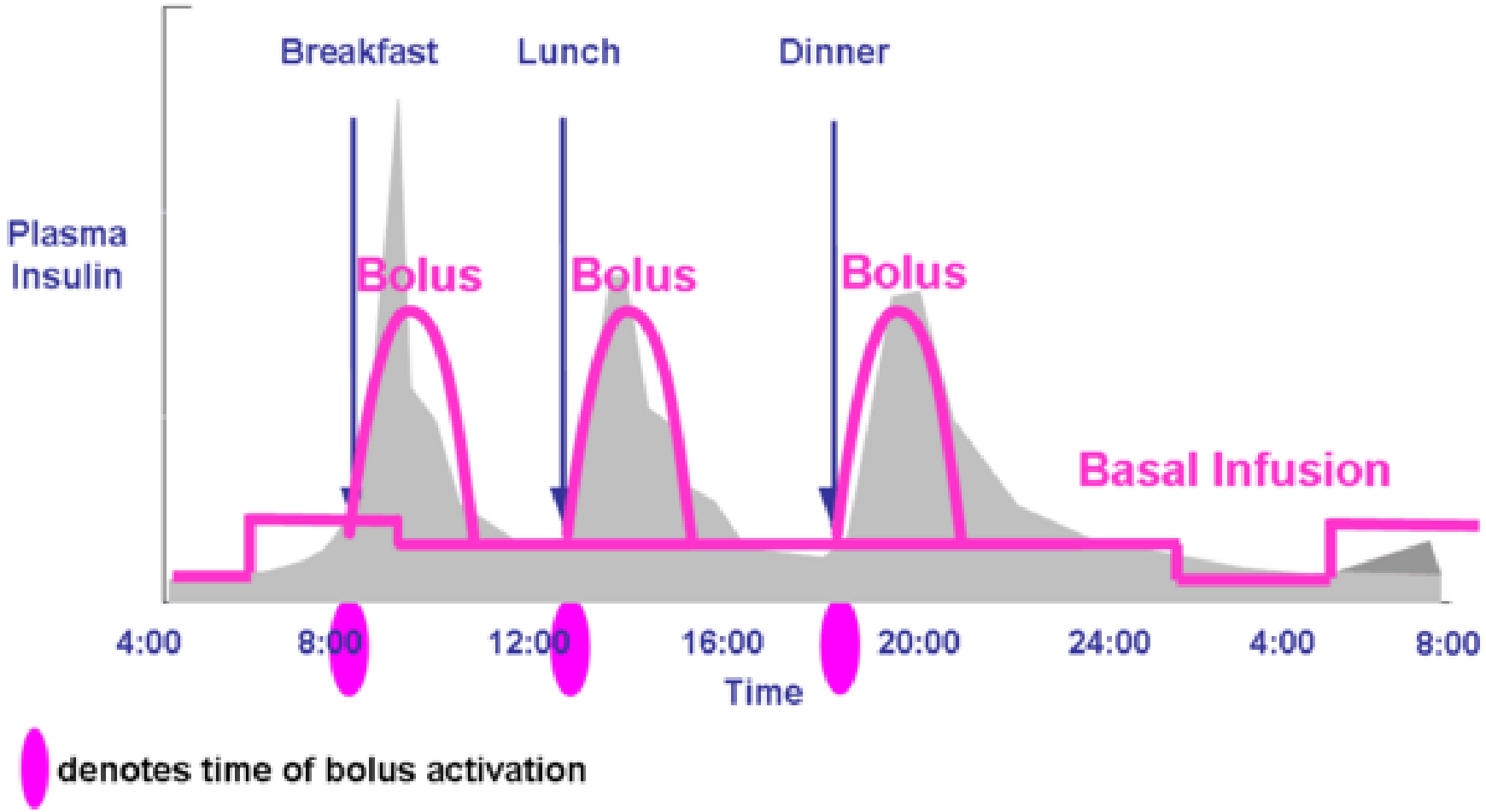
What our body does naturally



Insulin profiles & chemstrips



Our goal…

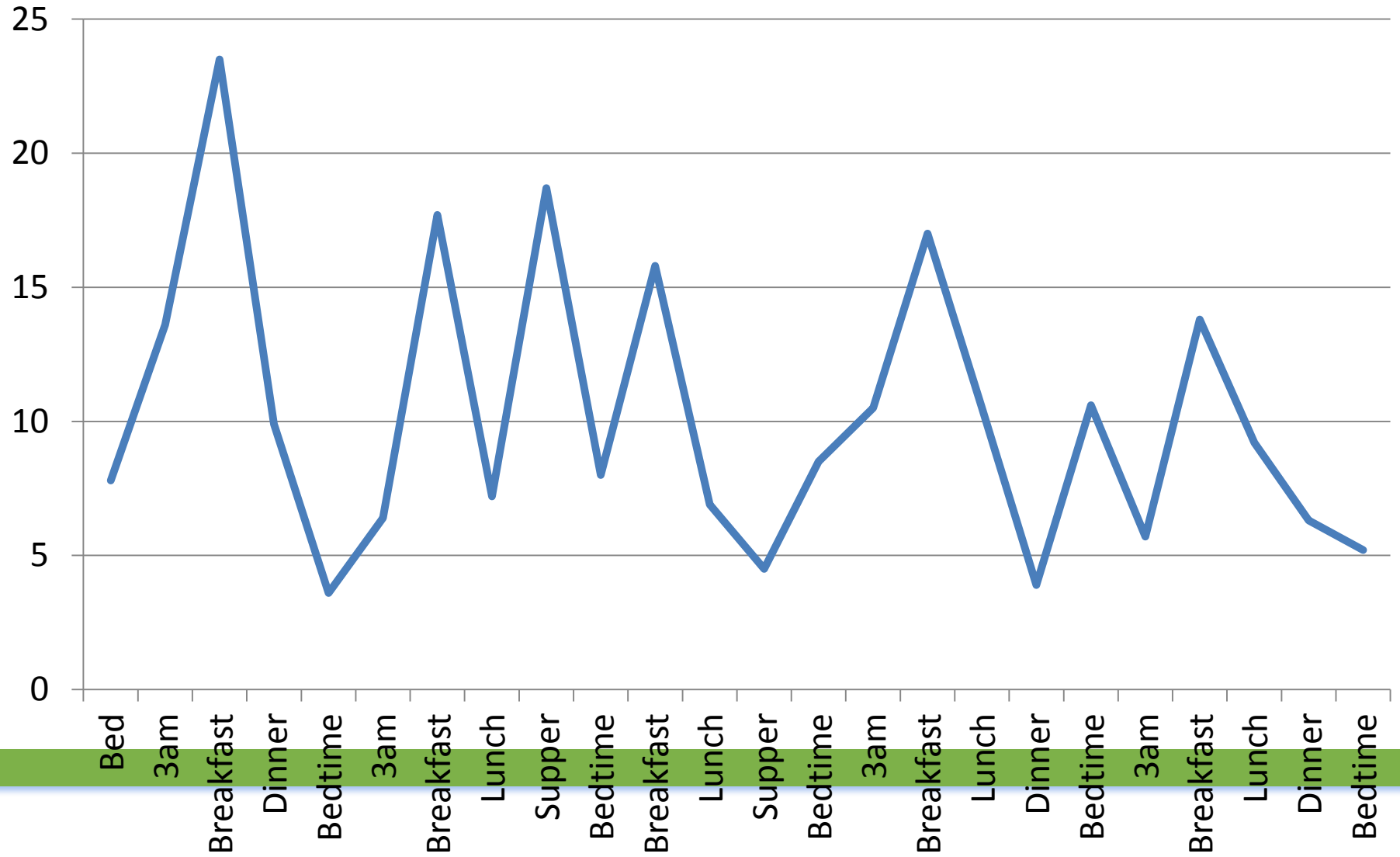

Breakfast
Lunch
Dinner
Plasma Insulin
Bolus
Bolus
Bolus
Basal Infusion
4:00
8:00
12:00
16:00
20:00
24:00
4:00
8:00
Time
denotes time of bolus activation

Sliding Scales: NOW

- Mrs. Diane Abetes
- Past Med: Type 2 Diabetes x 24 yrs, HTN, cholesterol, admitted with NSTEMI
- Meds: metformin and gluconorm at home, thiazide, metoprolol, ramipril, atorvastatin
- In hospital, oral diabetes meds held, started Sliding Scale:
- R insulin, sc, tid ac meals

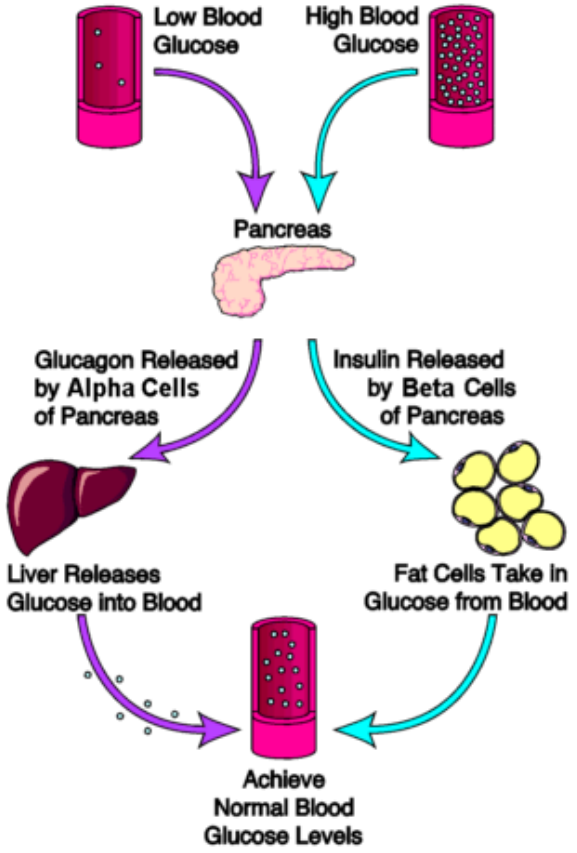
- <4 – hypoglycemia protocol
- 4.1-7.0 – give 0 units
- 7.1-9.0 – give 0 units
- 9.1-12 – give 2 units
- 12.1-14 – give 4 units
- 14.1-17 – give 6 units
- 17.1-19 – give 8 units
- 19.1-22 – give 10 units
- >22 – give 12 Units

Actual BG on Sliding Scale, Actual MTU patient, 5 days



Basal Bolus Insulin Therapy (BBIT)

Basal Bolus Insulin Therapy focuses on a more physiologic way of treating diabetes based on what diabetic patients are taught as outpatients



Basal Bolus Insulin Therapy (BBIT)

Basal: Intermediate or Long Acting Insulin covers the blood sugar the liver makes naturally, 24 hours a day, between meals and overnight….

Bolus: Rapid or Short Acting Insulin covers the carbohydrate that, if left untreated, will raise the blood sugar after the meal/snack

Insulin Correction: Rapid or Short acting Insulin CORRECTION scale, given IN ADDITION TO Basal and Bolus insulin to correct the patient's BG back into target range if it is high

TITRATE: Every patient is different! The BG needs to be checked regularly, and doses adjusted q1-3 days!

- If ac breakfast BG too high – increase basal
- If consistently using a correction at a certain time of day, increase the PRECEDING bolus dose…

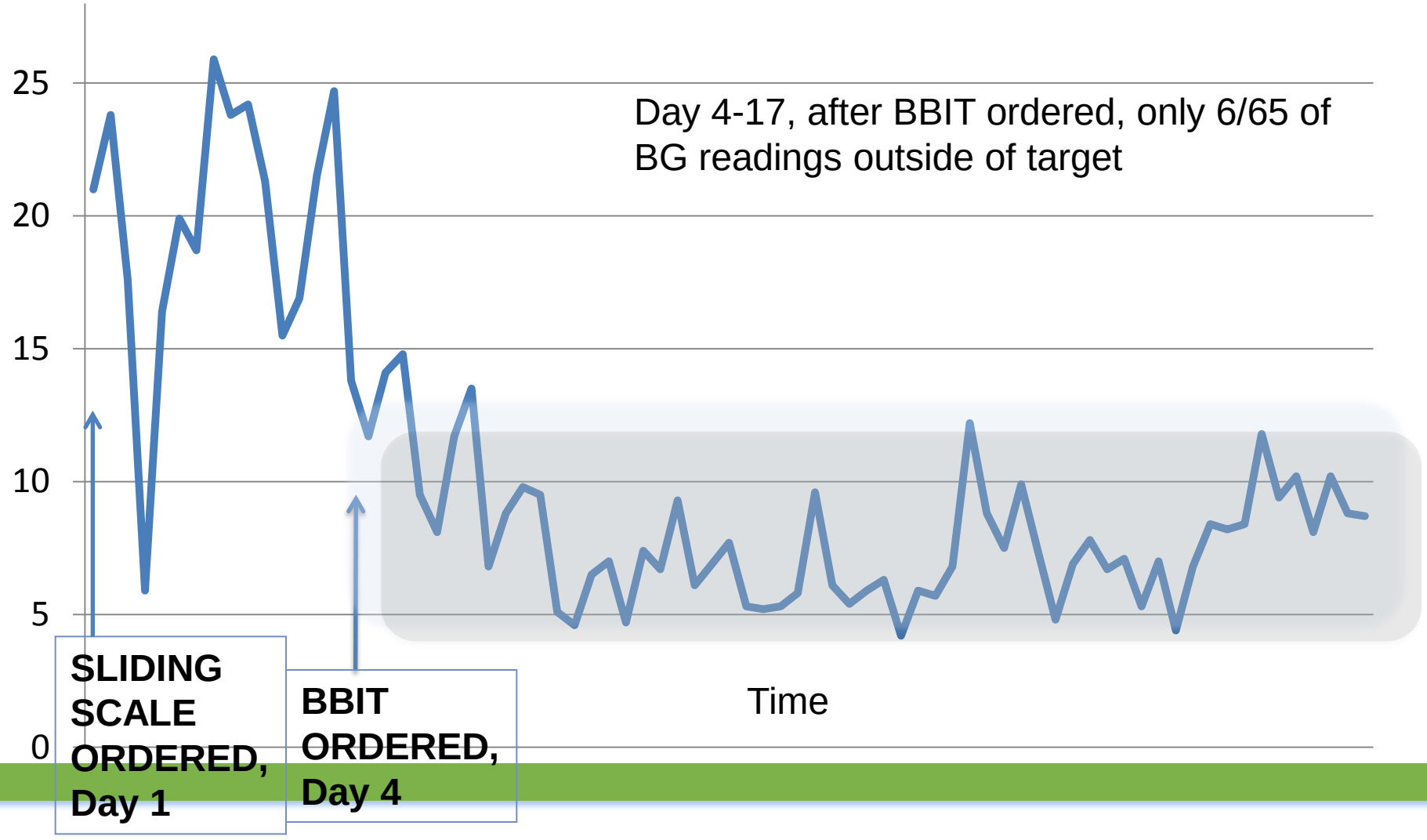
When to use BBIT?

- Use BBIT whenever you are ordering subcutaneous insulin or when you would ORDINARILY have ordered a sliding scale
  - i.e. patient's diet/activity is unreliable, NPO, not sure of patient's home doses, patient has very poor control at home, etc...

- Remember: BG target in hospital is **5-10** mmol/L!!!

So does it work?

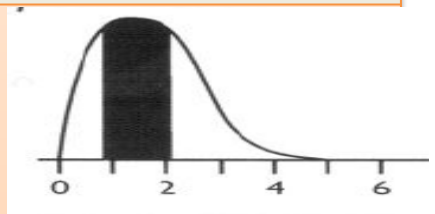
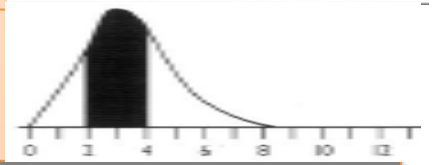
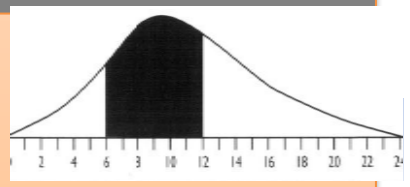
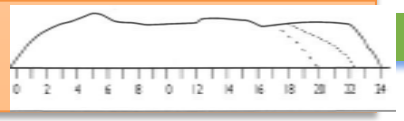
Actual MTU Patient, 17 days of admission



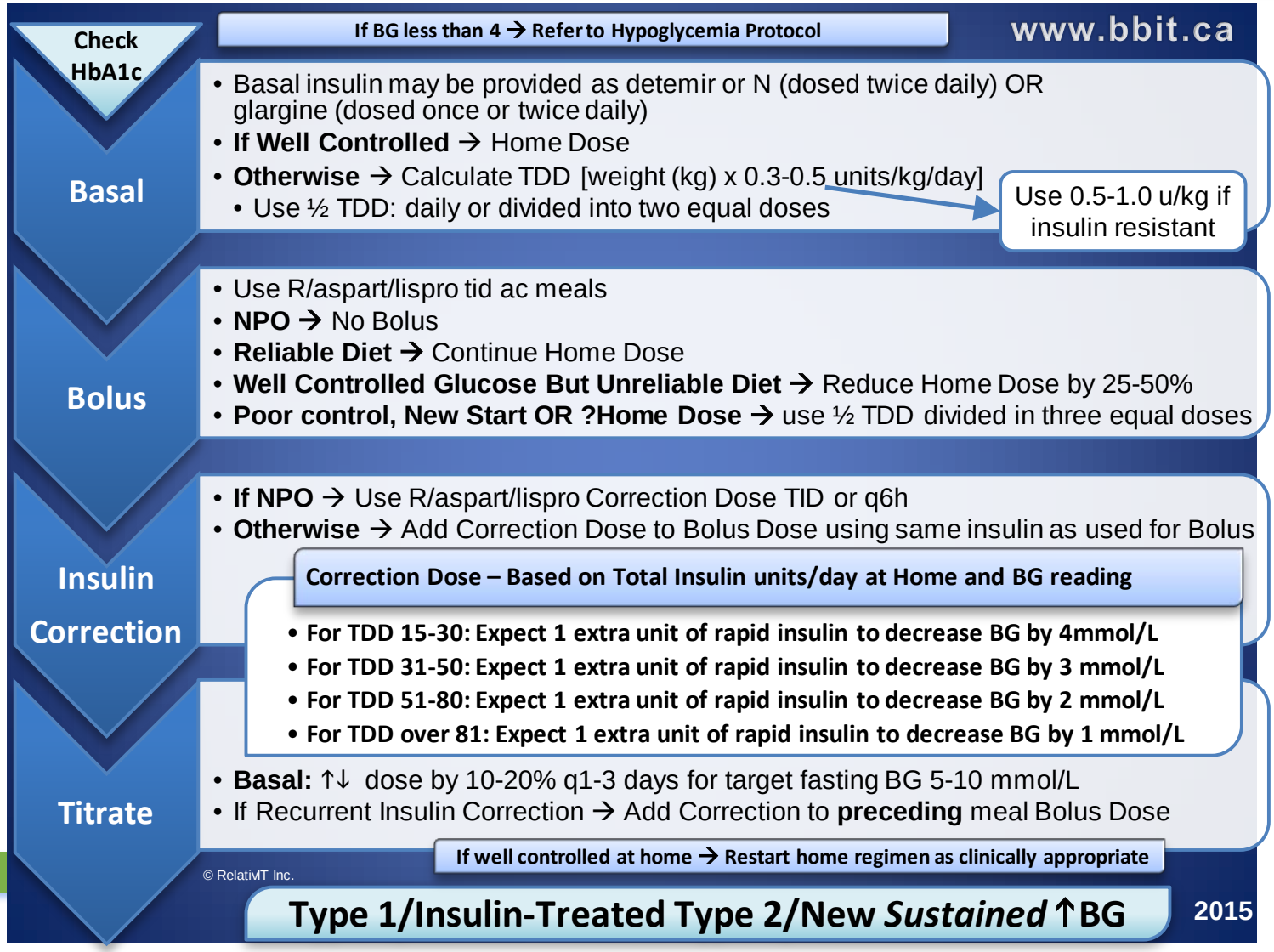
It works!!
Now how do we do it?

For information on how to order and use BBIT, visit www.bbit.ca

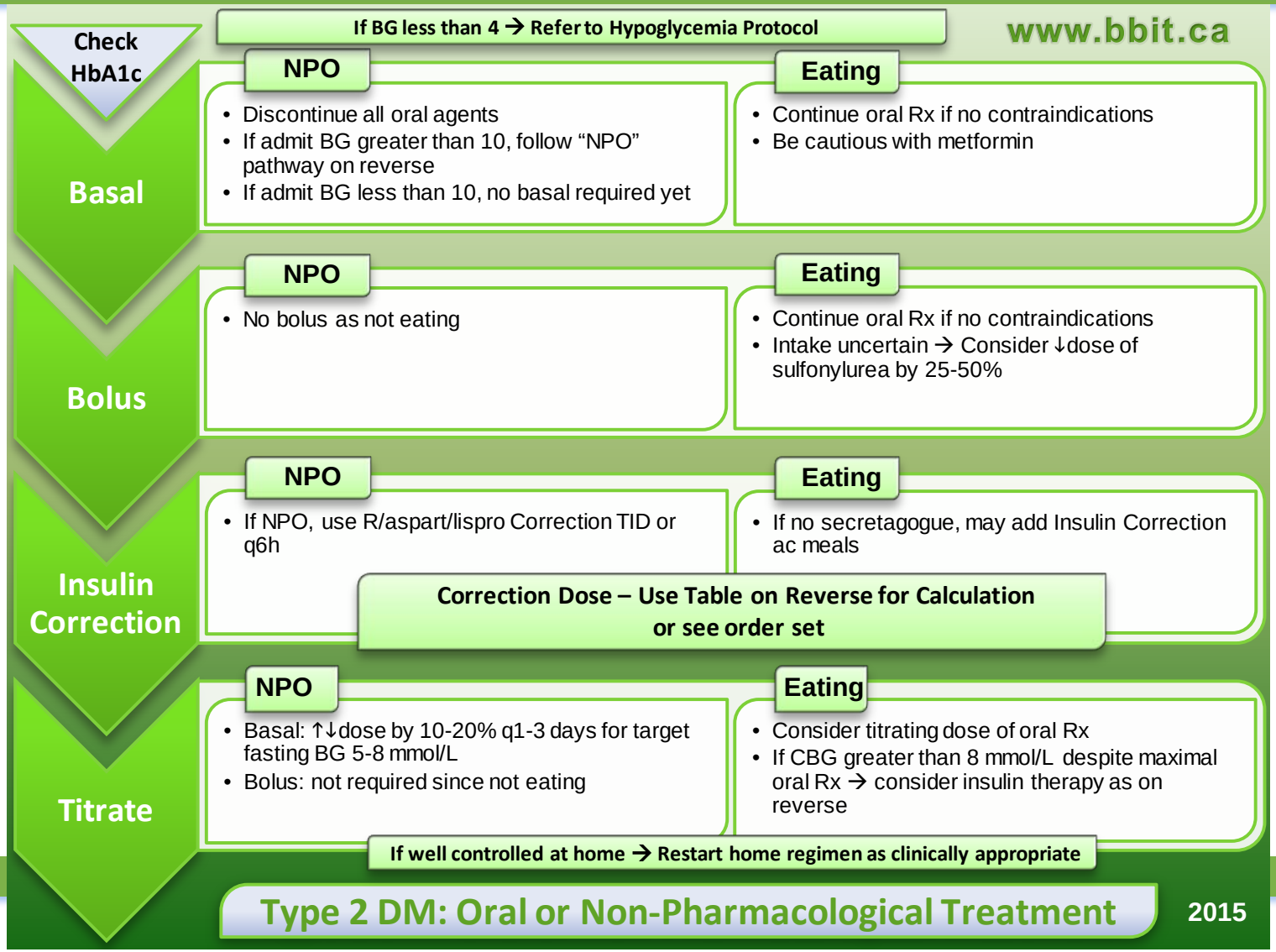
Types of Insulin for Use in BBIT

Insulin Type (trade name)	Onset	Peak	Duration	Action Profile
Bolus (meal) Insulins				
Rapid-acting insulin analogues (clear): • Insulin aspart (NovoRapid®) • Insulin lispro (Humalog®)	 10-15 min 10-15 min	 1-1.5 h 1 - 2 h	 3-5 h 3.5-4.75 h	
Short-acting insulin (clear): • Insulin regular (Humulin®-R)	30 min	2 - 3 h	6.5 h	
Basal Insulins				
Intermediate-acting insulin (cloudy): • Insulin NPH (Humulin®-N)	1 - 3 h	5 - 8 h	Up to 18 h	
Long-acting basal insulin analogues (clear) • Insulin detemir (Levemir®)	90 min	Not applicable	16-24 hours	
• Insulin glargine (Lantus®)	90 min	Not applicable	24 hours	

The Algorithms
(pocket cards available–no need to memorize!)



Pocket card side 2



EVEN EASIER STILL: www.bbit.ca

Patient Safety

1. Most important aspect is communication!!
2. Patients with Type 1 diabetes ALWAYS need some insulin to prevent diabetic ketoacidosis
3. If patient NPO, they should NOT get their meal BOLUS (rapid or short acting) insulin. Patient will still receive their scheduled basal insulin and correction insulin if needed.
4. Designed to under-shoot for first few days to prevent hypoglycemia→ requires aggressive titration
5. Chemstrips MUST be done qid (ac meals, qhs)
6. BBIT tool to aid, not replace, clinical judgment

Fear of hypoglycemia…

- The truth is, one of the major risks of prolonged sliding scale insulin is hypoglycemia (even though we justify it as “being on the safe side”)
- After trialing BBIT within the hospital setting, there was no increase in the incidence of hypoglycemia
  - THIS IS SAFE TO USE!!
  - It prevents wide swings in blood glucose, and keeps patients in a good range…
  - However, if hypoglycemia develops, patients should be treated as per the hypoglycemia protocol

Holding Insulin

- Our goal is to MAINTAIN a target blood glucose, which will mean administering insulin even when a patient is meeting the CDA target of 5-10 mmol/L, particularly if the patient is about to eat a meal.

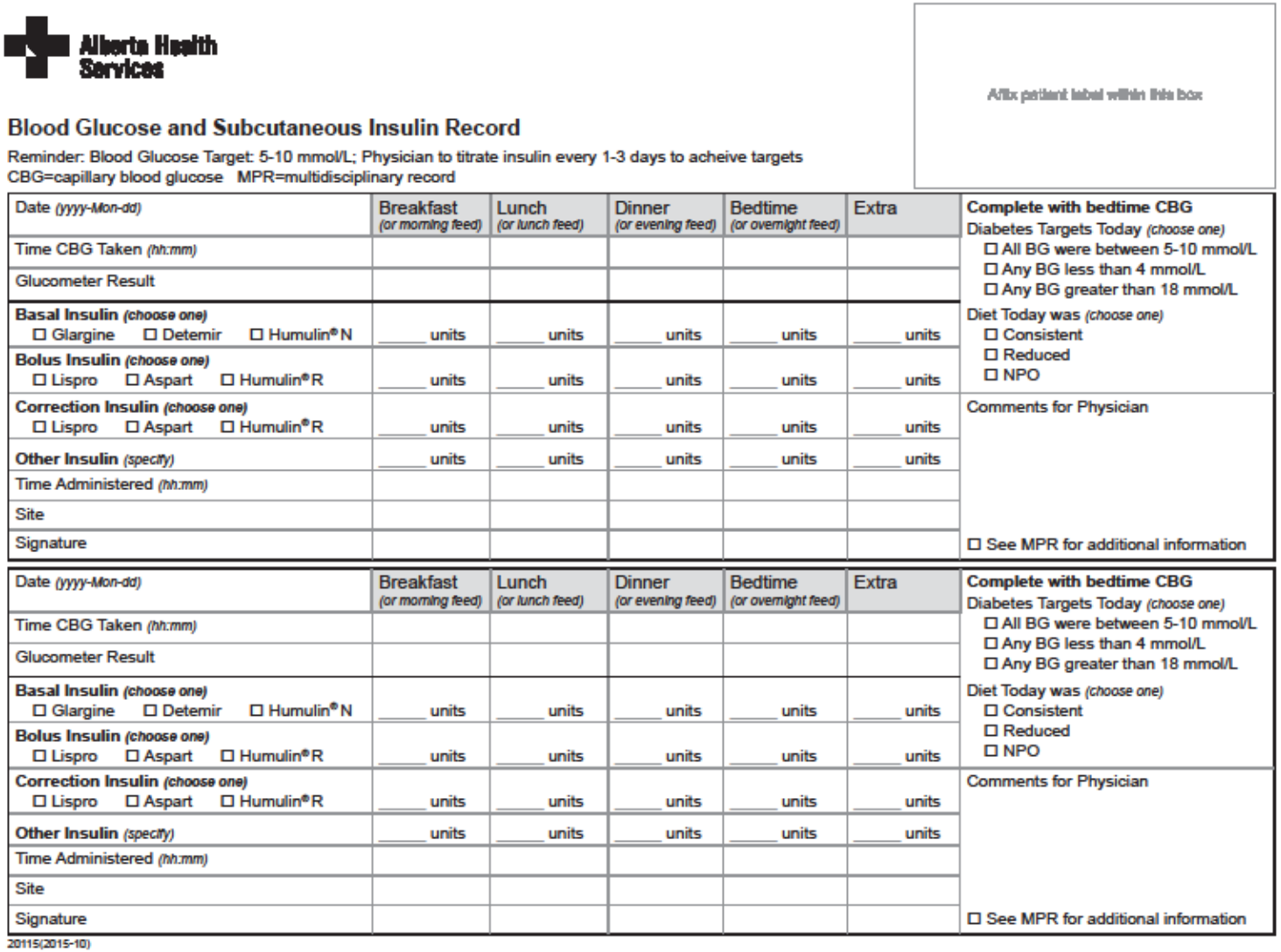
- Holding insulin ALWAYS requires an ORDER from the most responsible MD (or other prescriber).

- Remember: patients with Type 1 diabetes always need some form of basal insulin!!!

What might be different from current practice?

- Patients' last 24-48 hours of BG measurements need to be reviewed daily!!
- Patients will have individualized orders
- Insulin doses should be adjusted every 1-3 days, aiming for a target BG 5-10 mmol/L
- Patients will have 3 forms of insulin ordered:
  - basal (long acting)
  - bolus (short acting)
  - correction insulin scale (short acting)

Linking BG to medication management



Alberta Health Services

Affix patient label within this box

Blood Glucose and Subcutaneous Insulin Record

Reminder: Blood Glucose Target: 5-10 mmol/L; Physician to titrate insulin every 1-3 days to acheive targets
CBG=capillary blood glucose MPR=multidisciplinary record

Date *(yyyy-Mon-dd)*	Breakfast *(or morning feed)*	Lunch *(or lunch feed)*	Dinner *(or evening feed)*	Bedtime *(or overnight feed)*	Extra
Time CBG Taken *(hh:mm)*					
Glucometer Result					
Basal Insulin *(choose one)* ☐ Glargine ☐ Detemir ☐ Humulin® N	_____ units	_____ units	_____ units	_____ units	_____ units
Bolus Insulin *(choose one)* ☐ Lispro ☐ Aspart ☐ Humulin® R	_____ units	_____ units	_____ units	_____ units	_____ units
Correction Insulin *(choose one)* ☐ Lispro ☐ Aspart ☐ Humulin® R	_____ units	_____ units	_____ units	_____ units	_____ units
Other Insulin *(specify)*	_____ units	_____ units	_____ units	_____ units	_____ units
Time Administered *(hh:mm)*					
Site					
Signature					

Complete with bedtime CBG

Diabetes Targets Today *(choose one)*
- ☐ All BG were between 5-10 mmol/L
- ☐ Any BG less than 4 mmol/L
- ☐ Any BG greater than 18 mmol/L

Diet Today was *(choose one)*
- ☐ Consistent
- ☐ Reduced
- ☐ NPO

Comments for Physician

☐ See MPR for additional information

Date *(yyyy-Mon-dd)*	Breakfast *(or morning feed)*	Lunch *(or lunch feed)*	Dinner *(or evening feed)*	Bedtime *(or overnight feed)*	Extra
Time CBG Taken *(hh:mm)*					
Glucometer Result					
Basal Insulin *(choose one)* ☐ Glargine ☐ Detemir ☐ Humulin® N	_____ units	_____ units	_____ units	_____ units	_____ units
Bolus Insulin *(choose one)* ☐ Lispro ☐ Aspart ☐ Humulin® R	_____ units	_____ units	_____ units	_____ units	_____ units
Correction Insulin *(choose one)* ☐ Lispro ☐ Aspart ☐ Humulin® R	_____ units	_____ units	_____ units	_____ units	_____ units
Other Insulin *(specify)*	_____ units	_____ units	_____ units	_____ units	_____ units
Time Administered *(hh:mm)*					
Site					
Signature					

Complete with bedtime CBG

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- ☐ All BG were between 5-10 mmol/L
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Comments for Physician

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Benefits

- **For patients**: Safer diabetes management, fewer highs and lows, shorter stay, better outcomes, a better understanding of how they should be treating their diabetes at home
- **For the hospital**: fewer complications from highs and lows, shorter stays, less $$$
- **For interdisciplinary team**: better understanding of diabetes management, collaborative practice with the team including the patient, and better patient care without extra time investment

Key Messages for Diabetes Inpatient Management

www.bbit.ca

The Next Step

For examples of how to order basal bolus insulin and how to interpret those orders view:

www.bbit.ca

Questions??

www.bbit.ca

DiabetesObesityNutrition.SCN@ahs.ca

Provincial Diabetes Management Leadership Group

- Dr. Julie McKeen
- Dr. Karmon Helmle
- Rhonda Roedler
- Sasha Wiens
- Ed Rogers
- Glenda Moore
- Kelly Mrklas
- Chandell Popik

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