Insulin Initiation and titration in the Primary Care-KISS

Rotorua GP CME Meeting June 2011

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Workshop goal

To make participants comfortable in the timely initiation and titration of insulin

Linda

T2D
6
years

Linda

- **51-year-old laboratory technician (works day shifts)**
- **Presents for annual review of her T2D following a reminder letter triggered by the diabetes recall system**
- **Has completed the routine tests requested on the pathology slip that was included with the reminder letter in time for this visit**

☆ **Diagnosed with T2D 6 years ago**

- **Married with two sons in secondary school**

History (1)

- **You have managed Linda's diabetes on and off since diagnosis**
  - **Her oral hypoglycaemic agents (OHAs) have been slowly increased to get better control**

- **Linda checks blood glucose most days — mainly first thing in the morning; occasionally before dinner**
  - **Comments that her 'morning test' (i.e. fasting blood glucose [FBG]) is usually well over 8 mmol/L)**

History (2)

- **Eyes tested 2 months ago by optician — no problems found**
- **Non-smoker who drinks alcohol at weekends**
  - **A few Friday night drinks with work colleagues; occasional wine on Saturday evenings**
- **Led a sedentary life prior to diabetes diagnosis but has become more active with your help:**
  - **Regular yoga class once a week**
  - **Organises walks with friends once a week**

Examination

Height: **1.60 m**

Weight: **84 kg**

BMI: **33 kg/m^2**

Waist: **99 cm**

BP: **135/90 mmHg**

Feet : **Sensation adequate,**

pulses easily felt

Urinanalysis: **No abnormalities noted**

Pathology results

HbA_{1c}	**11.2%**
TC	**4.3 mmol/L**
TG	**2.1 mmol/L**
HDL	**1.1 mmol/L**
LDL	**2.7 mmol/L**
eGFR	**>60 mL/min**
ACR	**40 mg/mmol**
Microalbuminuria	**40 µg/24 h**

Medications

Metformin	**1000 mg bd**
Gliclazide	**160mg bd**
Aspirin	**100 mg daily**
Atorvastatin	**40 mg daily**
Cilazapril	**5mg daily**

Reviewing A1C target

You previously set an A1c target of ≤7% with Linda, but her A1c has been slowly creeping up.

Would you revise Linda's A1c target at this point?

1. **Yes, I would give her an interim target of 8%**
2. **No, an A1c of ≤7% is still appropriate**
3. **No, leave for now and review later**
4. **Not sure**

Setting an A1C target

- **1% fall in A1C reduces microvascular complications by 37%,[1] but risk of:[2]**
  - **Hypoglycaemia ⇧**
  - **Weight gain (approx 2kg) ⇧**

1. Stratton IM et al. *BMJ* 2000; 321: 405–12; 2. Phillips PJ. *Medicine Today* 2007; 8(4): 43-52.

Setting an A1C target

- **Recommended A1c target ≤7% but should be tailored to patient. Consider:[2]**
  1. ***The individual's A1C value*** **— the higher the A1C, the more difficult it may be to achieve target of ≤7%**
  2. ***Patient's age*** **— may have to consider less tight glycaemic control if patient is old, frail, or has a failing memory**
  3. ***Patient's lifestyle*** **— hard to avoid weight gain if patient has conditions that make increasing physical activity or controlling diet difficult to do; conversely, if patient exercises a lot or lives alone, has higher risk of hypoglycaemia**

1. Stratton IM et al. *BMJ* 2000; 321: 405–12; 2. Phillips PJ. *Medicine Today* 2007; 8(4): 43-52.

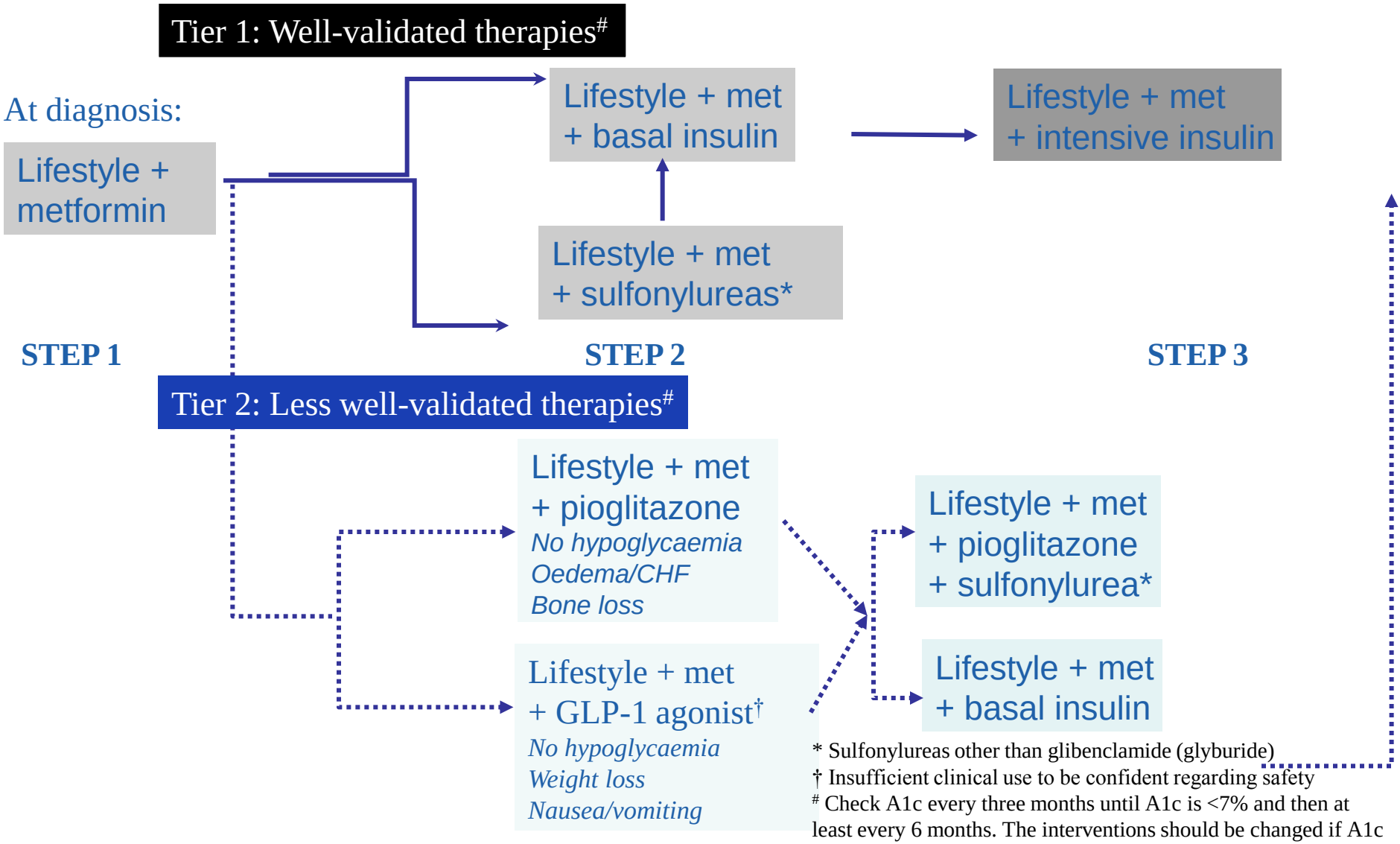
Improving glycaemic control

You decide that an A1C target of ≤7% is still appropriate for Linda and discuss with her the best option for improving her glycaemic control.

What treatment change would you recommend to Linda at this point?

1. **Add acarbose to existing regimen**
2. **Add glitazone to existing regimen**
3. **(Add exenatide or sitagliptin to existing regimen)**
4. **Start insulin**

2009 ADA/EASD treatment algorithm



* Sulfonylureas other than glibenclamide (glyburide)

† Insufficient clinical use to be confident regarding safety

Check A1c every three months until A1c is <7% and then at least every 6 months. The interventions should be changed if A1c is ≥7%.

Nathan D *et al*. *Diabetes Care* 2009; 32: 193–203.

Actions of available drugs

	↑ insulin	↓ peripheral insulin resistance	↓ liver insulin resistance	↓carbohydrate absorption
Sulphonylureas	**X**			
Glitizones		**X**		
Metformin			**X**	
Acarbose				**X**
Insulin	**X**			

HbA1c decrease by agent

Agent	HbA1c reduction, %
Diet	**1.0 – 2.0**
Exercise	**1.0 – 2.0**
Weight loss	**Even more**
Metformin	**1.0 – 1.5**
Acarbose	**0.5 – 1.0**
Sulphylurea	**1.0 – 1.5**
Pioglitazone	**1.0 – 1.5**
Insulin	**Even more**

Kenealy et al 2008

"Jim was diagnosed with diabetes, and his doctor says he needs to keep active, so I hide his TV remote three times a week."

© 2009 Diabetes Health

Initiating insulin therapy

You think you need to start Linda on insulin because of her very elevated A1c, however you decide to check a few other things first.

What else do you need to check before starting insulin therapy?

1. **That the patient is compliant with all lifestyle measures and medication and whether any modifications could improve glycaemia**
2. **Any possible secondary causes of hyperglycaemia**
3. **Both 1 and 2**
4. **Nothing else**

When to introduce insulin therapy

A1C persistently above target

↓

Lifestyle
Patient compliant with agreed modifications?
Any further modifications that can be considered?

Oral hypoglycaemic medication
Is patient taking as prescribed?
Can these be maximised further?

Secondary causes for hyperglycaemia?
Medications (e.g. contraceptive pill, thiazides,beta-blockers, oral corticosteroids) Medical conditions (e.g. hyperthyroidisim, urinary or dental infections, occult malignancy)

↓

A1C still above target — Initiate insulin

Philips P. *Medicine Today* 2007; 8: 23-34.

Diabetes/insulin education

Education on injecting insulin, BGL monitoring, hypos, activity/diet and life with insulin is essential to prepare patients for insulin therapy. Do you do it all yourself or engage other healthcare professionals to assist you?
You discuss your plan with Linda and organise this through a Team Care Arrangement.

In your current practice, how would you educate Linda?

1. **Do it all yourself**
2. **Refer to a Specialist/DNS**
3. **Engage your practice nurse**
4. **Engage your practice nurse and a DNS**
5. **Other**

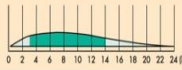
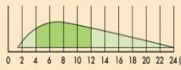
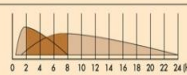
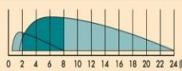
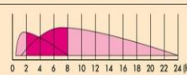
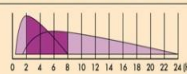
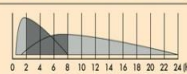
Selecting an insulin

You decide to start Linda on insulin and discuss the different insulin profiles with her.

Which insulin would you recommend for Linda and why?

1. Rapid-acting insulin to the meal with the highest preprandial BGL
2. Intermediate-acting insulin in the morning or night
3. Insulin premixed for ease of use
4. Basal insulin to reduce both postprandial and fasting BGLs

NOVO NORDISK - BALANCING INSULIN AND DELIVERY.

Brand	Presentation	Schematic Time-Action Profile*	Insulin Profile*
NovoRapid® *Rapid-acting insulin aspart (rys)*	3mL **Penfill®** 10mL Vial		Onset: 10-20 minutes Peak: 1-3 hours Duration: 3-5 hours
Levemir® *Long-acting insulin detemir (rys)*	**FlexPen®**		Peak: 3-14 hours Duration: Up to 24 hours
Actrapid® *Short-acting human insulin (rys)*	3mL **Penfill®** 10mL Vial		Onset: 30 minutes Peak: 1-3 hours Duration: 8 hours
Protaphane® *Intermediate-acting human insulin (rys)*	3mL **Penfill®** 10mL Vial		Onset: 1.5 hours Peak: 4-12 hours Duration: 24 hours
PenMix® 30 & Mixtard® 30 (10mL) *30% Short-acting & 70% Intermediate-acting human insulin (rys)*	3mL **Penfill®** 10mL Vial		Onset: 30 minutes Peak: 2-8 hours Duration: 24 hours
PenMix® 10 *10% Short-acting & 90% Intermediate-acting human insulin (rys)*	3mL **Penfill®**		Onset: 30 minutes Peak: 2-8 hours Duration: 24 hours
PenMix® 20 *20% Short-acting & 80% Intermediate-acting human insulin (rys)*	3mL **Penfill®**		Onset: 30 minutes Peak: 2-8 hours Duration: 24 hours
PenMix® 40 *40% Short-acting & 60% Intermediate-acting human insulin (rys)*	3mL **Penfill®**		Onset: 30 minutes Peak: 2-8 hours Duration: 24 hours
PenMix® 50 & Mixtard® 50 (10mL) *50% Short-acting & 50% Intermediate-acting human insulin (rys)*	3mL **Penfill®** 10mL Vial		Onset: 30 minutes Peak: 2-8 hours Duration: 24 hours

Please review Data Sheet before prescribing. Full Data Sheet is available from the Novo Nordisk Customer Care Centre 0800 733 737. *In clinical practice, the duration of insulin action may be shorter or longer than the durations specified. Variations between and within patients may occur depending upon injection site and technique, insulin dosage, as well as diet and exercise. ® Registered trademark of Novo Nordisk A/S. Novo Nordisk Pharmaceuticals Ltd, PO Box 51268 Pakuranga, Auckland. www.novonordisk.co.nz

Novo Nordisk Customer Care Centre
0800 733 737
www.novonordisk.co.nz

novo nordisk®

Lilly Insulin Range[1]

FULL RANGE NOW FUNDED*

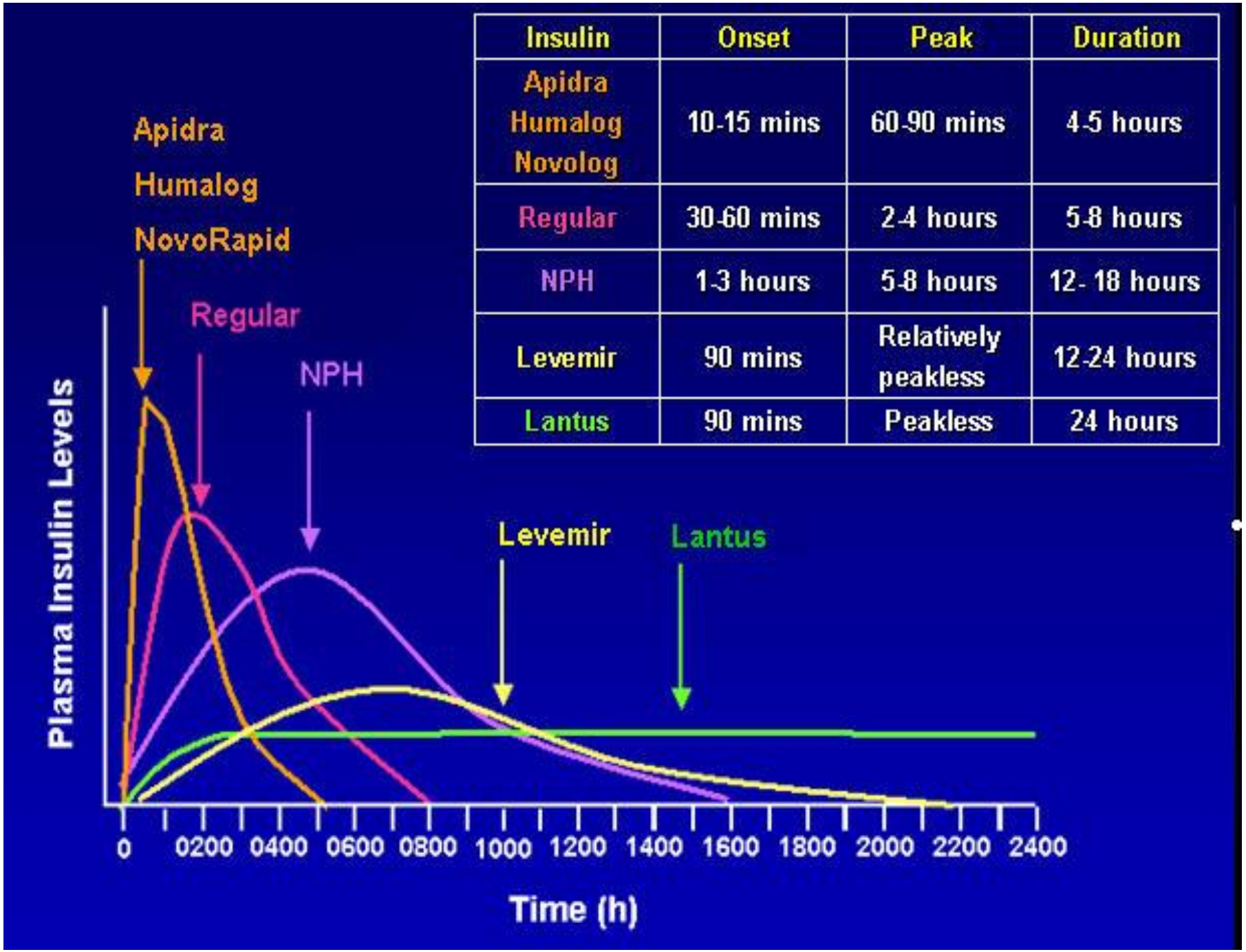
Brand Name[2,3]	Type of Insulin (generic name) / Product Description	Presentation	Schematic Action Profile*
Humalog®	insulin lispro Rbe RAPID-ACTING	10mL vials and 3mL cartridges	Onset: 0–15 mins Peak: 1 hour Duration: 3.5–4.5 hours
Humulin® R	insulin neutral (Soluble) SHORT-ACTING	10mL vials and 3mL cartridges	Onset: 30 mins Peak: 2–4 hours Duration: 6–8 hours
Humulin® NPH	isophane (NPH) INTERMEDIATE ACTING	10mL vials and 3mL cartridges	Onset: 1 hour Peak: 4–10 hours Duration: 16–18 hours
Humalog® Mix25®	25% insulin lispro, 75% insulin lispro protamine suspension Rbe PREMIXED INSULIN LISPRO	3mL cartridges	Onset: 0–15 mins Peak: 1 hour Duration: 16–18 hours
Humalog® Mix50®	50% insulin lispro, 50% insulin lispro protamine suspension Rbe PREMIXED INSULIN LISPRO	3mL cartridges	Onset: 0–15 mins Peak: 2 hour Duration: 16–18 hours
Humulin® 30/70	30% insulin neutral, 70% isophane (NPH) PREMIXED INSULIN	10mL vials and 3mL cartridges	Onset: More rapid than NPH alone Peak: 2–12 hours Duration: 16–18 hours

HUMAPEN LUXURA CAN ONLY BE USED WITH LILLY 3mL INSULIN CARTRIDGES. BEFORE PRESCRIBING PLEASE REVIEW THE PRODUCT DATA SHEET.

HumaPen® LUXURA

Lilly

Insulin	Onset	Peak	Duration
Apidra Humalog Novolog	10-15 mins	60-90 mins	4-5 hours
Regular	30-60 mins	2-4 hours	5-8 hours
NPH	1-3 hours	5-8 hours	12- 18 hours
Levemir	90 mins	Relatively peakless	12-24 hours
Lantus	90 mins	Peakless	24 hours



Selecting an insulin
RACGP & ADA/EASD guidelines state…

- ☆ Start with **single daily dose** (10 units) of **bedtime intermediate-acting insulin** or **morning or bedtime long-acting insulin**[1,2]

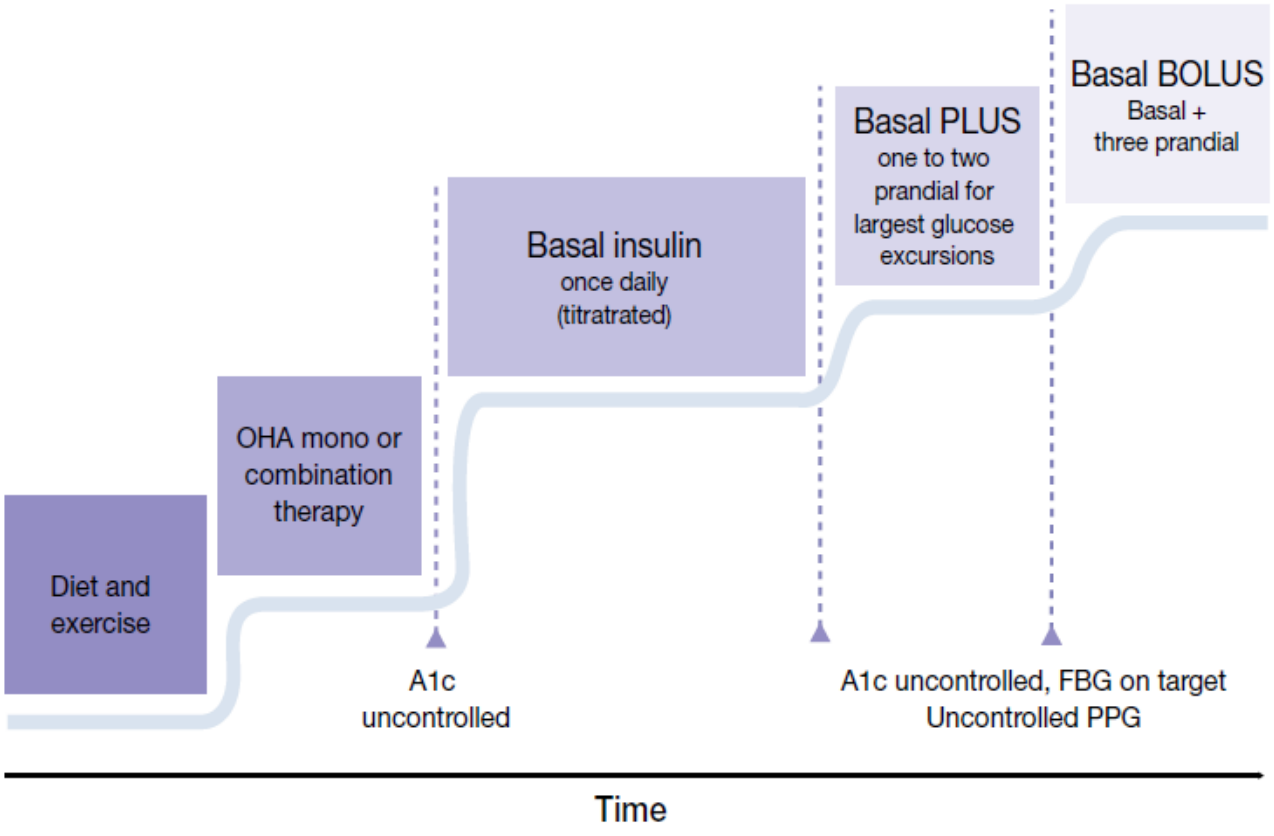
- ☆ **Rapid-acting insulin** is <u>not</u> necessarily needed at initiation[1]

- ☆ **Premixed insulin** is <u>not</u> recommended during dosage adjustment period[2]

- ☆ Insulin regimens should be designed taking **lifestyle** and **meal schedule** into account[2]

1. DA/RACGP Diabetes management in general practice 2009/10. 2. Nathan D *et al*. *Diabetes Care* 2009; 32: 193–203.

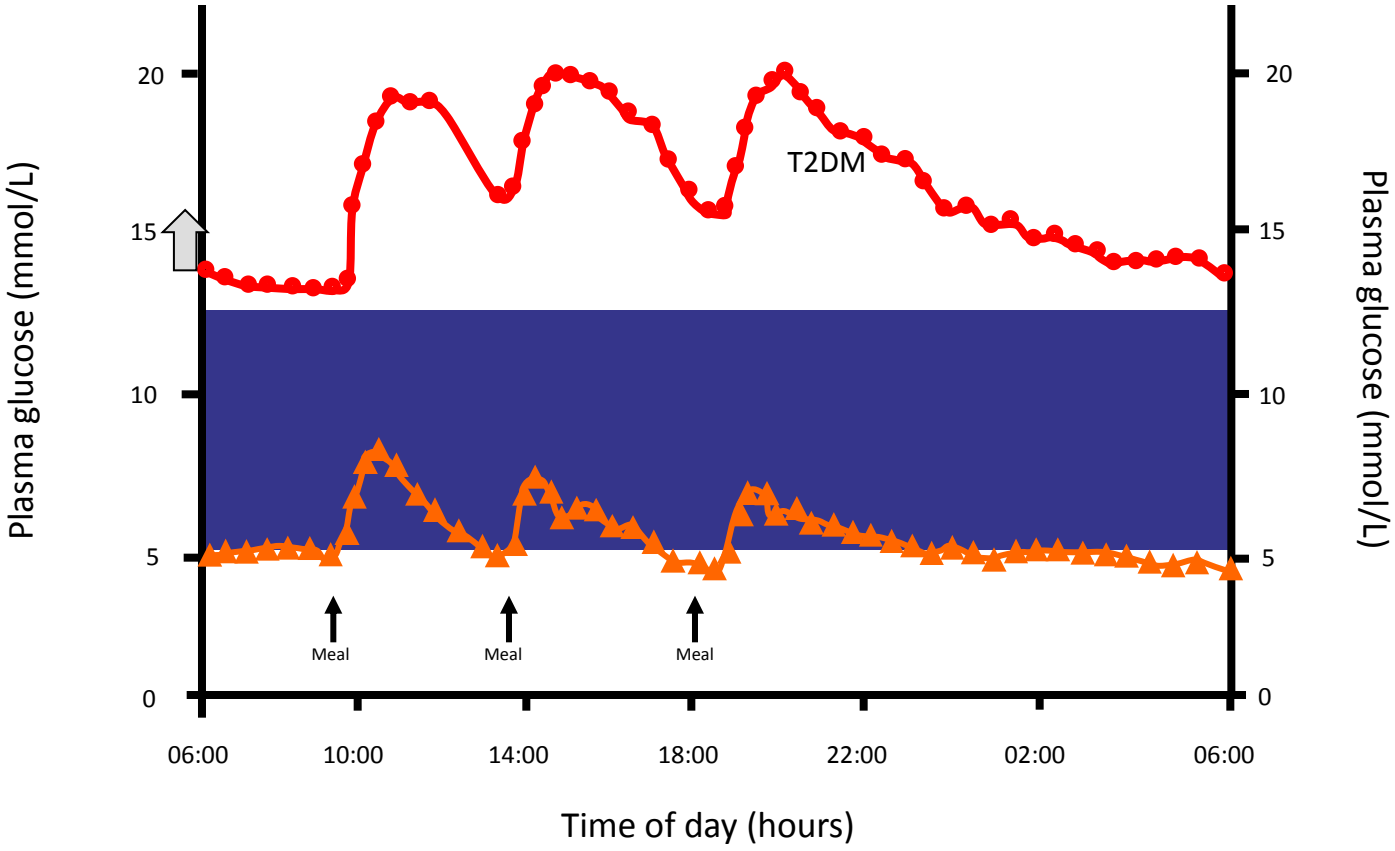
Stepwise approach for T2D with progressive deterioration of beta cell function



Adapted from Raccah 2008'. OHA = Oral hypoglycaemic agent, FBG = Fasting blood glucose, PPG = Post-prandial blood glucose.

Why start with basal insulin?

Comparison of 24-hour glucose levels in untreated vs treated patients with diabetes



Adapted from Hirsch I *et al. Clin Diabetes* 2005; 23: 78–86.

Which basal insulin?

You decide to start Linda on a basal insulin to address her fasting BGL. Which basal insulin would you recommend for Linda?

Which basal insulin would you recommend for Linda and why?

1. **Intermediate-acting, human ispophane/NPH insulin**
2. **Long-acting insulin analogue, insulin glargine**
3. **Long-acting insulin analogue, insulin detemir**
4. **Not sure**

Which basal insulin?

	Onset	Peak	Duration	Funded
Intermediate-acting				
Isophane (OD/BD)	**1 – 2 h**	**4 –12 h**	**16 – 24 h**	**Yes**
Long-acting				
Glargine (OD)	**2 – 4 h**	**None**	**24 h**	**Yes***
Detemir (OD/BD)	**1 – 2 h**	**6 – 12 h**	**20 – 24 h**	**No**

Adapted from Clinical Practice Guidelines: Type 1 Diabetes in Children and Adolescents by Australian Paediatric Endocrine Group. p58

Starting insulin dose

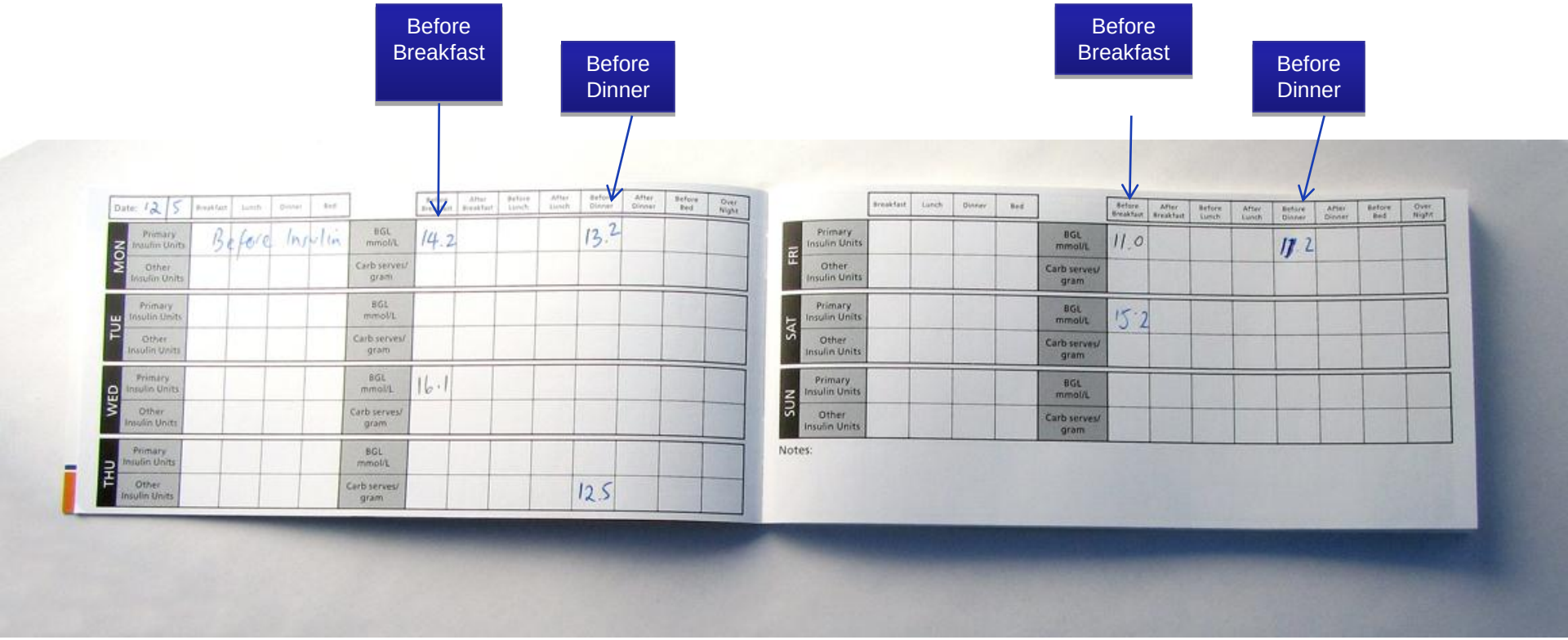
You decide to start Linda on insulin NPH.

What starting dose would you select?

1. 1 U/kg
2. 10 U/day
3. 20 U/day
4. Not sure

Linda's BGLs during past week (before starting insulin)

12 May



Initiating insulin therapy

You decide to start Linda on 10 U of insulin NPH.

Would it be best to start Linda on a morning or evening basal dose?

1. **Morning**
2. **Evening**
3. **Not sure**

Timing of single insulin dose

Morning or evening is acceptable

Timing depends on blood glucose profile:

- **If fasting BGL is high → give at bedtime**
- **If fasting BGL on target but evening BGL high → give in morning**
- **If both are high → give bd NPH or once daily glargine/detemir (not funded)**

*** Usually the fasting BG target is ≤6.0mmol/L; however, targets may vary from one person to the next.**

1. Phillips PJ *Medicine Today*, 2007; 8 (3): 23-34; 2. Davies M *et al*. *Diabetes Care* 2005; 28: 1282-88;
3. Rosenstock J *et al*. *Diabetologia* 2008; 51(3): 408-16. 4. Diabetes Australia/RACGP. Diabetes management in general practice. Guidelines for type 2 diabetes 15th ed, 2009/10.

Insulin management – next steps

You start Linda on 10 U at bedtime of insulin NPH and discuss that her dose will need to increase over the next few months to achieve a target FBG of approx 6.0 mmol/L.

This will be done with the help of your Practice Nurse

You explain that it could take a very long time to reach a high enough insulin dose if the dose is increased slowly.

Linda is a little concerned about potential weight gain and wants to increase the dose slowly initially and is willing to try a faster dose increase down the track.

Linda's summary to this point

- **Elevated A1C on optimal doses of two (2) OHAs**
- **Lifestyle measures reviewed, no secondary causes of hyperglycaemia**
- **Insulin therapy is appropriate**
- **Basal insulin is most appropriate at this time**
- **Bedtime injection of 10 U insulin NPH to reduce Linda's fasting BGL**

☆ **Up-titration to be self-managed in consultation with Practice Nurse**

- **Linda to return for review in 3 months with lab tests completed prior to visit**

Titrating insulin therapy

Linda was started on 10 U of insulin NPH at bedtime. You instructed her to self-manage the dose up-titration in consultation with your Practice Nurse.

Which schedule would you choose to advise Linda regarding up-titrating her dose in consultation with your Practice Nurse?

1. Slow schedule: increase 2 U every 3 days
2. Fast schedule: increase by 2-8 units of insulin depending on fasting BGL over previous 3 days
3. Not sure

Dose adjustment – first fix fasting

Two dose adjustment schedules possible:

1. SLOW SCHEDULE (CAN BE PATIENT-LED)

   Increase by 2 units of insulin every 3 days

   continue until fasting BGL is ≤6.0 mmol/L

Adapted from RACGP 2009/10 and Davies et al 2005.

Increase dose only if FBG >4 mmol/L and accordingly decrease dose if FBG is <4 mmol/L.
Titration reviewed by HCPs at each contact.

Dose adjustment – first fix fasting

2. FAST SCHEDULE (PHYSICIAN-MANAGED)

Increase by 2–8 units of insulin depending on fasting BGL over previous 2–3 days

Mean fasting blood glucose (mmol/L)	Increase in insulin dose
<4	* See below
4–5.9	No change
6–6.9	2 units
7–7.9	4 units
8–10	6 units
>10	8 units

Starting dose 10 units, adjust dose twice weekly to reach the target FBG of <6mmol/L
Insulin dose may be decreased (small decreases of 2 to 4 units) if there is severe hypoglycaemia (requiring assistance) or if BGL <3.0 mmol/L in preceding week.
Do not increase insulin dose if fasting BGL <4 mmol/L at any time in preceding week.

Adapted from Phillips PJ. *Medicine Today* 2007; 8(3): 23–34.

Linda: 3 month review after starting insulin

- **Presents for regular review of her type 2 diabetes following insulin initiation 3 months ago**

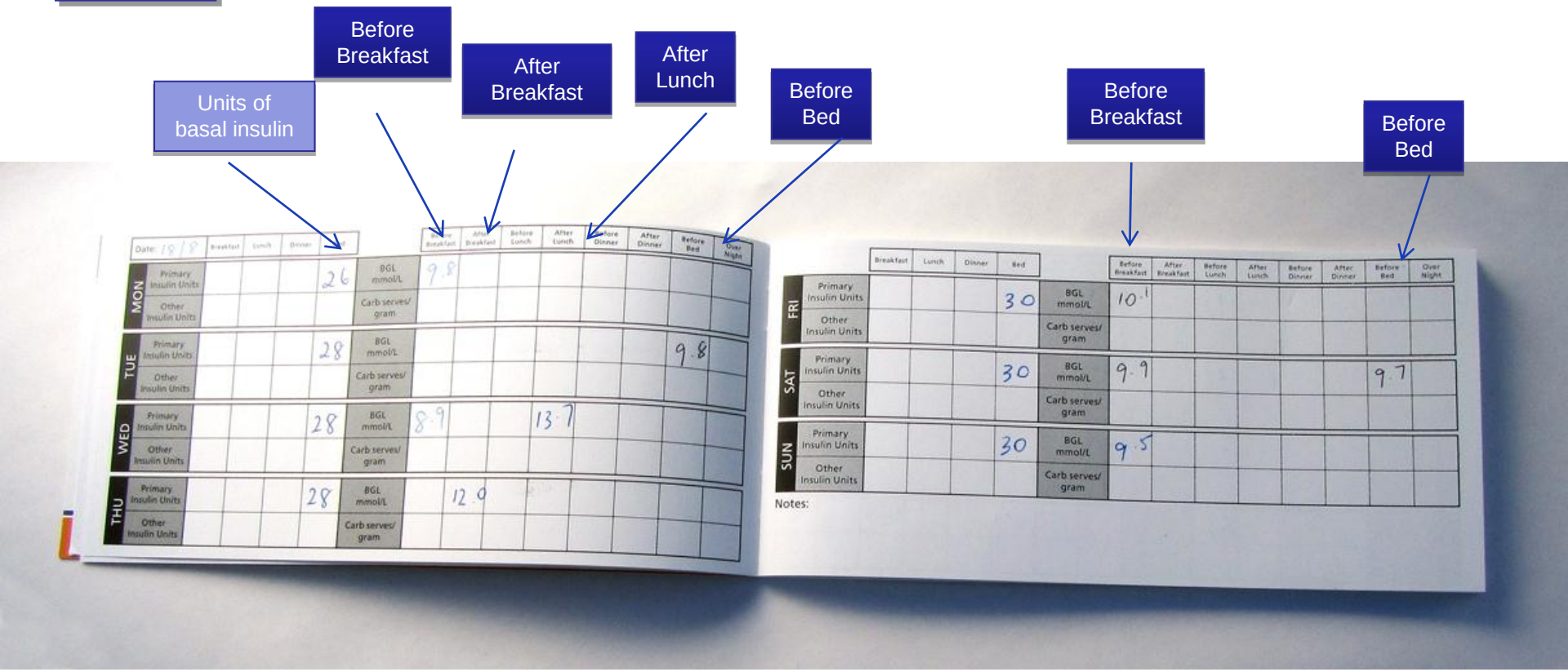
- **Medication:**

Insulin NPH	30 U at bedtime
Metformin	**1000 mg bd**
Gliclazide	**120 mg morning**
Aspirin	**100 mg daily**
Atorvastatin	**40 mg daily**
cilazapril	**10 mg daily**

Review: 3 months

Linda's A1c is 8.9% (down from 11.2%) – been on 'slow' titration schedule

18 August



Next steps

Linda has increased her daily activity and only gained ½ kg since starting insulin and has enjoyed the support of the CDE during the up-titration process. She is however frustrated that her FBGs are still not in range.

What would you do now?

1. Add a dose of bolus insulin?
2. Increase the dose of insulin NPH using a ‘faster’ titration schedule
3. Increase the dose of insulin NPH using the ‘slow’ titration schedule
4. Add a second dose of insulin NPH?

Next steps

You organise for the Practice Nurse to work with Linda to more rapidly uptitrate the dose of insulin NPH to achieve a FBG of ≤6.0 mmol/L.

You also ask the Practice Nurse to discuss hypoglycaemia and sick day management with Linda. Linda is requested to return to you in 3 months time.

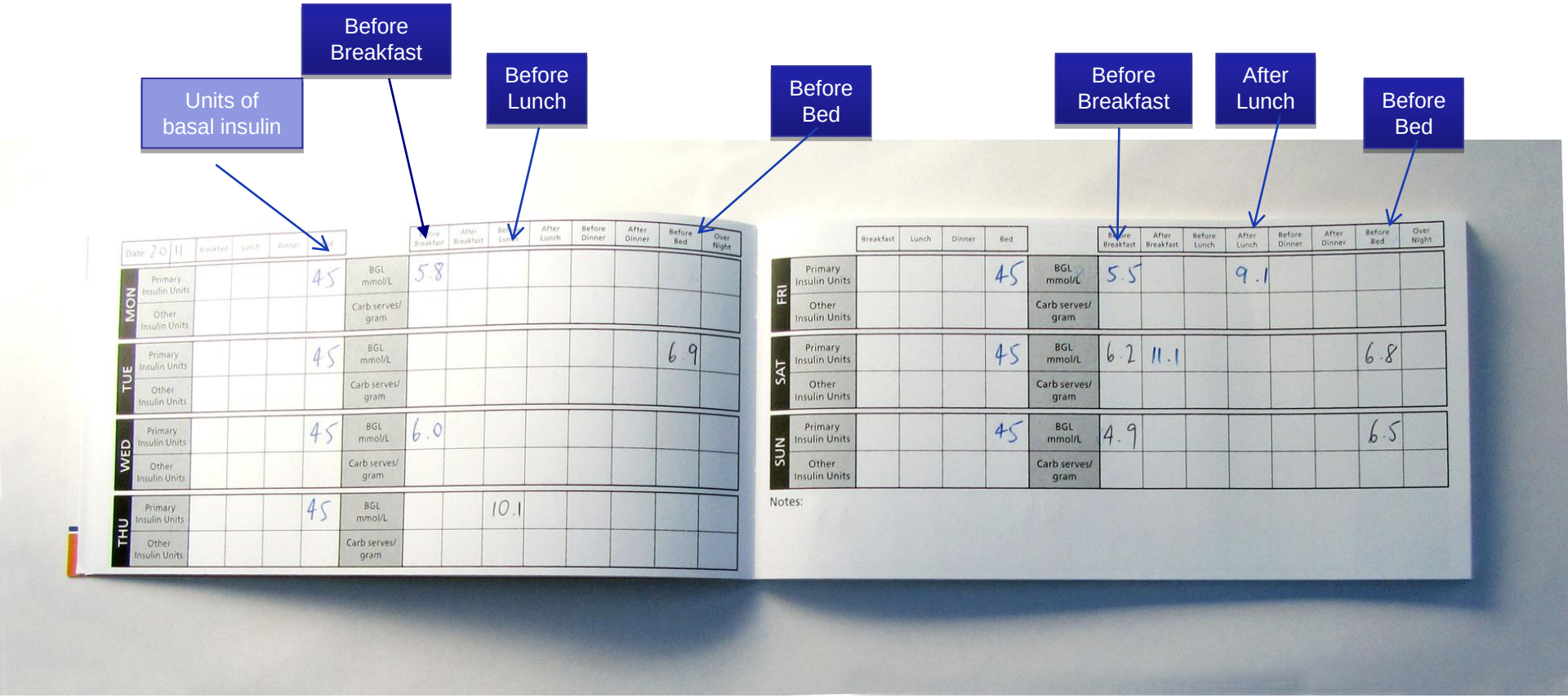
Review: 6 months

- **Linda returns to check lipid profile, A1c and spot urinary microalbumin test (ACR)**
- **Linda's FBG readings ≤6 mmol/L**
- **OHAs remain unchanged**
- Insulin NPH 45 U
- **Her BP, urinalysis – all okay**
- **Pathology results:**
  - **A1c 7.7%**
  - **No evidence of microalbuminuria, and a satisfactory lipid profile**

Review: 6 months

Linda's A1c is 7.7% (down from 8.9%) – been on 'fast' titration schedule

20 November



Reviewing OHA use

Linda is doing well on basal insulin and had no problems with the rapid up-titration process. Linda is now stable at 45 units of basal insulin daily. Linda asks if she still needs her OHAs.

Would you rationalise Linda's OHAs at this point?

1. Stop all her OHAs straight away
2. Consider stopping one after A1C is under control
3. Definitely not to stop any OHAs
4. Not sure

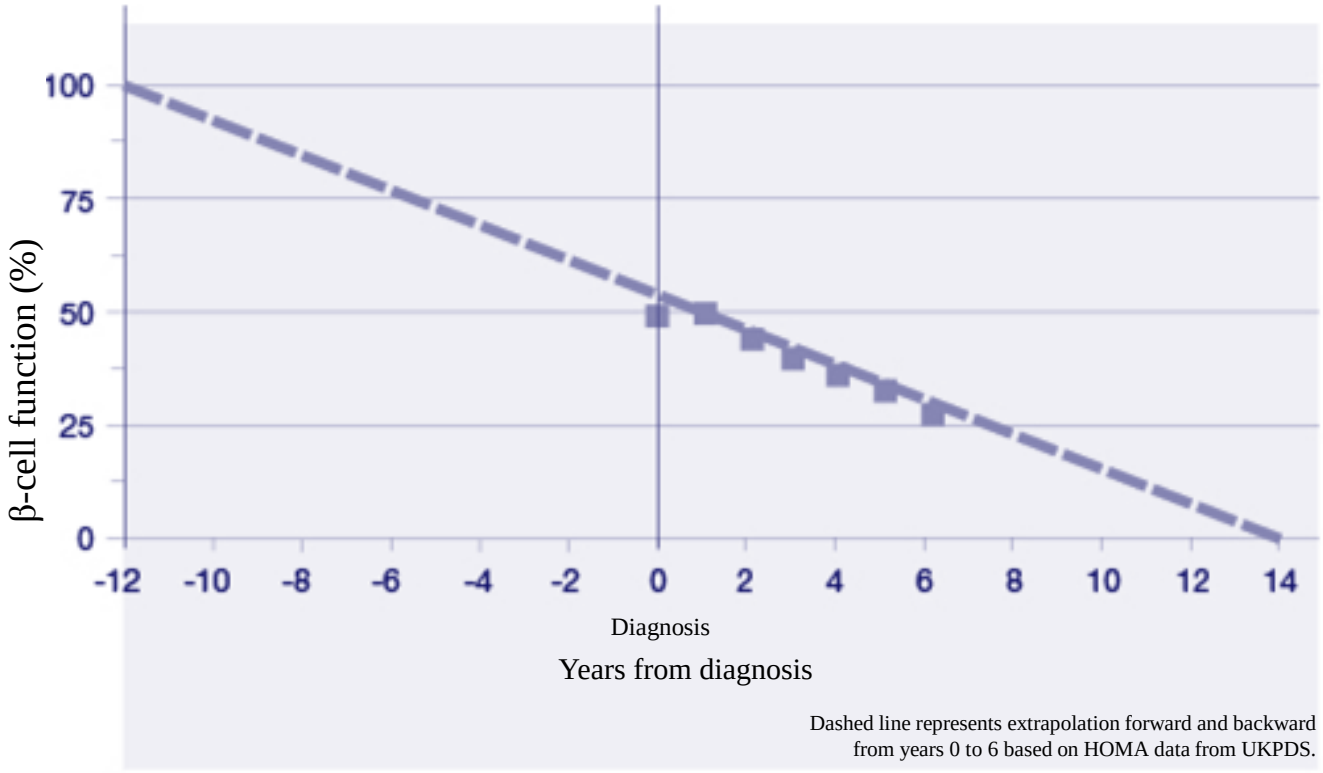
Linda's OHAs

- Don't stop OHAs immediately
  - Stopping OHAs may require more insulin
  - Get A1c under control and consider stopping OHAs later
- Understand what each drug does
  - Metformin [& glitazones] = insulin sensitisers
    - should be continued
  - Sulphonylureas = insulin secretagogues
    - will need to be removed when ß-cells stop secreting insulin
- Discontinue if side effects are an issue
  - Metformin:
  - SU:
- Glitazone: fluid retention, weight gain, cardiovascular risks

1. Phillips PJ. Medicine Today 2007; 8(3): 23-34; 2. Phillips PJ. Aust Fam Physician, 2006; 35: 975-78; 3. Phillips PJ. Medicine Today 2007; 8(6): 43-52; 4. Nathan D et al. Diabetologia 2008; 52: 8-11; 5. Nathan D et al. Diabetologia 2006: 49: 1711-21.

ß-cell failure defect in T2D

Patients have only about 50% of normal ß-cell function at time of diagnosis, and it continues to decline



Dashed line represents extrapolation forward and backward from years 0 to 6 based on HOMA data from UKPDS.

Lebovitz H. Diabetes Rev. 1999;7:139–153.

Improving glycaemic control

You congratulate Linda on her fasting & bedtime BGLs, but you are still concerned that her A1C is still too high.

What should you look for at this stage?

1. Nocturnal hypoglycaemia
2. Postprandial hypoglycaemia
3. Hidden hyperglycaemia
4. Not sure

Find hidden hypers

- ✓ Fasting preprandial BGL on target (4 – 6 mmol/L)
- ✓ 2 hour postmeal BGL on target (4 – 8 mmol/L)

Is A1C 6-12 weeks later at target?

Yes → Continue with current schedule

No → Find and fix the hidden hyperglycaemia

a) check 2 hours after breakfast & before bed to check for morning and evening postprandial hyperglycaemia

b) check during the night (only if really necessary!)

Diabetes Management in General Practice, 2009/10; Phillips 2007 8(3): 23-34

Finding hidden hypers

You discuss with Linda that you suspect that there are periods of hyperglycaemia causing her A1C to remain elevated. You discuss that she will need to monitor her BGLs at different times of the day to see when they are occurring. You suspect her large breakfast may be contributing to her elevated A1C.

What BGL testing would you advise Linda to do over the next weeks?

1. 2 hours after breakfast
2. Before lunch
3. 2 hours after lunch
4. Before bed
5. Other

Review: another 3 months later

Linda's A1c remains elevated at 7.6%

10 Feb

Improving glycaemic control

You inform Linda that her BGLs 2 hours after breakfast are consistently high indicating hyperglycaemia after breakfast.

What treatment options would you discuss with Linda?

1. Exercise after breakfast (brisk walk)
2. Seek dietitian's advice on carbohydrate intake for breakfast
3. Consider altering existing insulin therapy
4. All of the above

Adjusting insulin therapy

You discuss options with Linda and agree that modifying the insulin schedule is the best option for her.

What alterations in Linda's insulin schedule would you recommend?

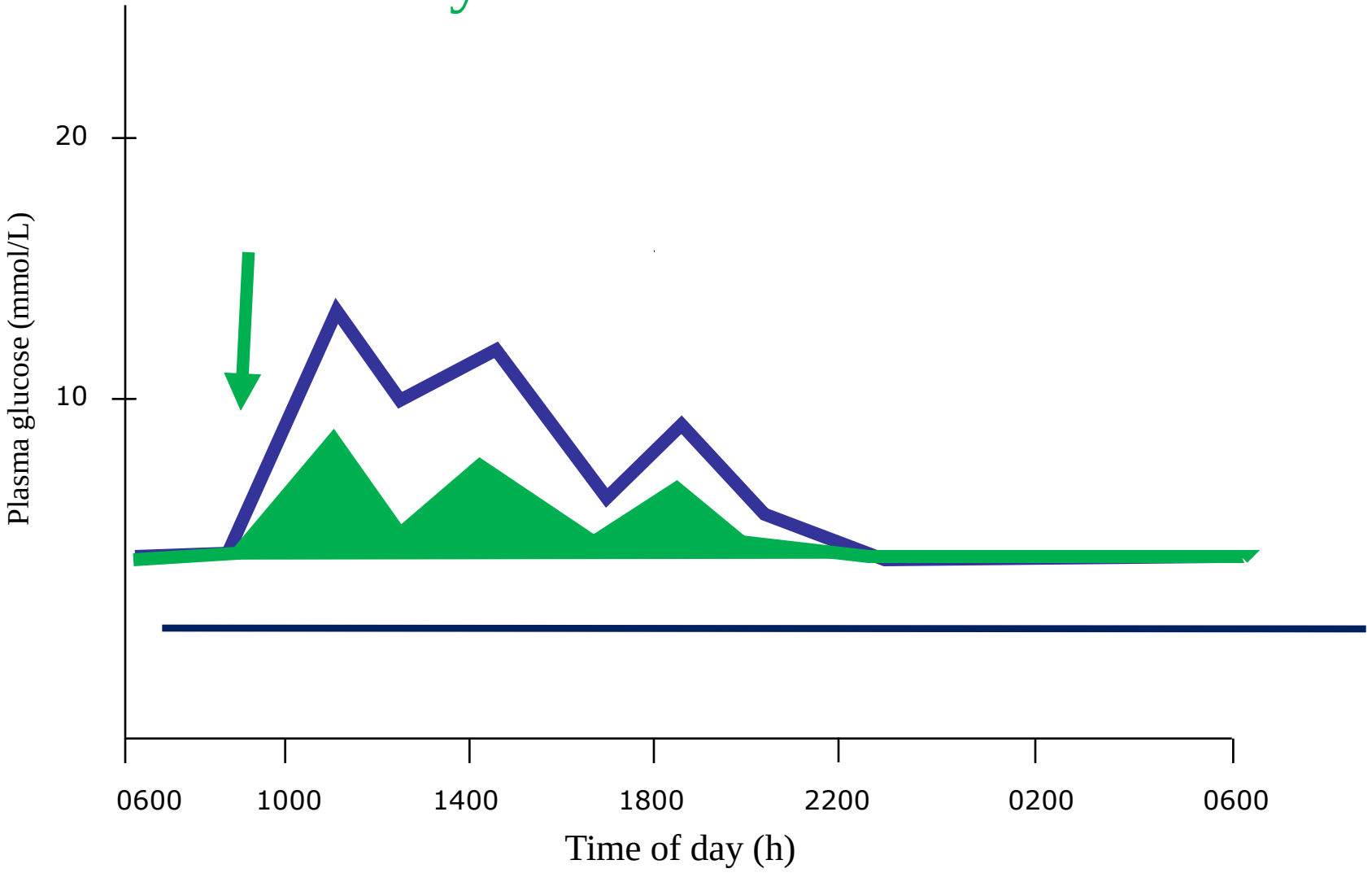
1. Increasing the basal insulin dose
2. Add a single dose of rapid-acting insulin at lunch
3. Add a single dose of rapid-acting insulin at breakfast
4. Not sure

Starting second insulin injection

A second injection can be added according to the when the glucose excursion is occurring.

Time at which BG is out of range	Type of Insulin	When to add
Pre-lunch	Prandial	Breakfast
Pre-Dinner	NPH	Breakfast
	Prandial	Lunch
Pre-Bedtime	Prandial	Dinner

Then Tackle The Meal Responsible for the Greatest Glycaemic Excursion



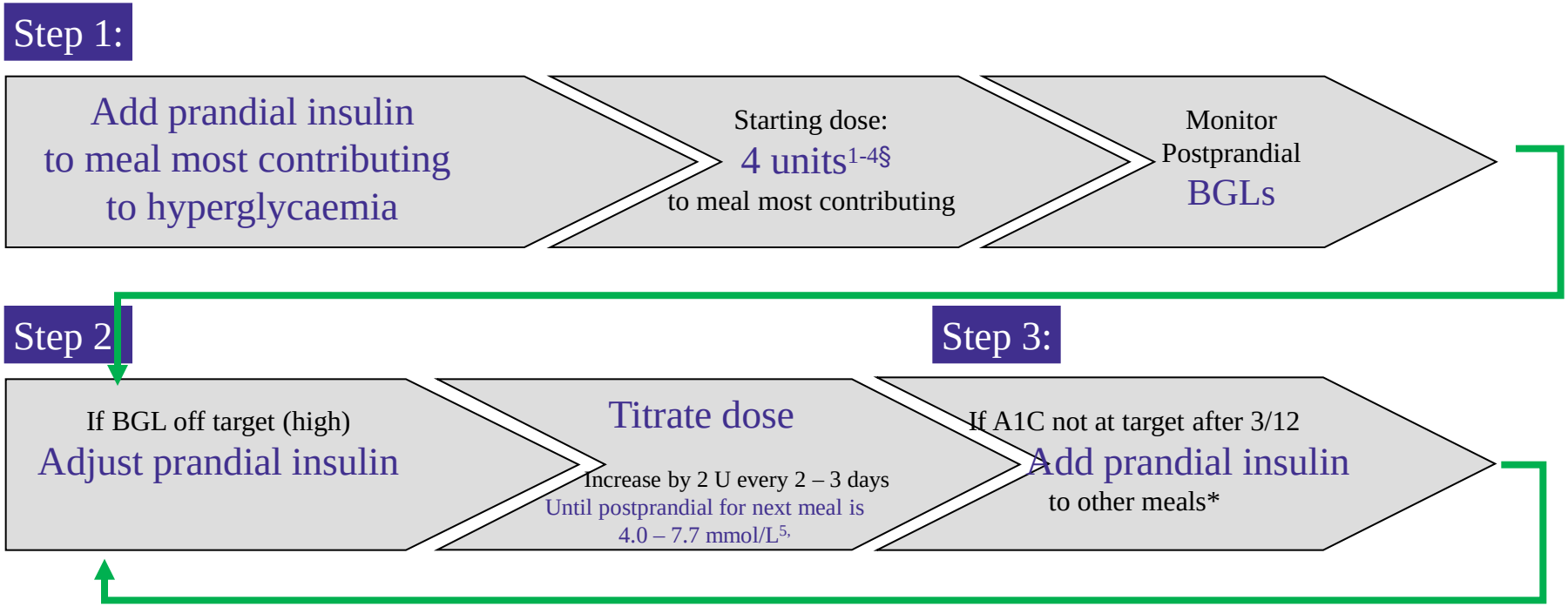
Starting prandial insulin

You discuss treatment options and you both agree that adding a single dose of prandial insulin prior to the meal contributing most to hyperglycaemia would be appropriate as she finds it difficult to change her morning eating habits and exercise schedule.

How would you calculate the initial dose of prandial or bolus insulin?

1. One-third the basal dose
2. 4 units
3. Start low, go slow
4. Not sure

Start prandial insulin at 4 Units



§ These dosing guidelines are based on recommendations from a number of authors. They are provided for guidance only. All insulin dosing and titration / adjustments require professional judgment and should be individualised to patient circumstances .

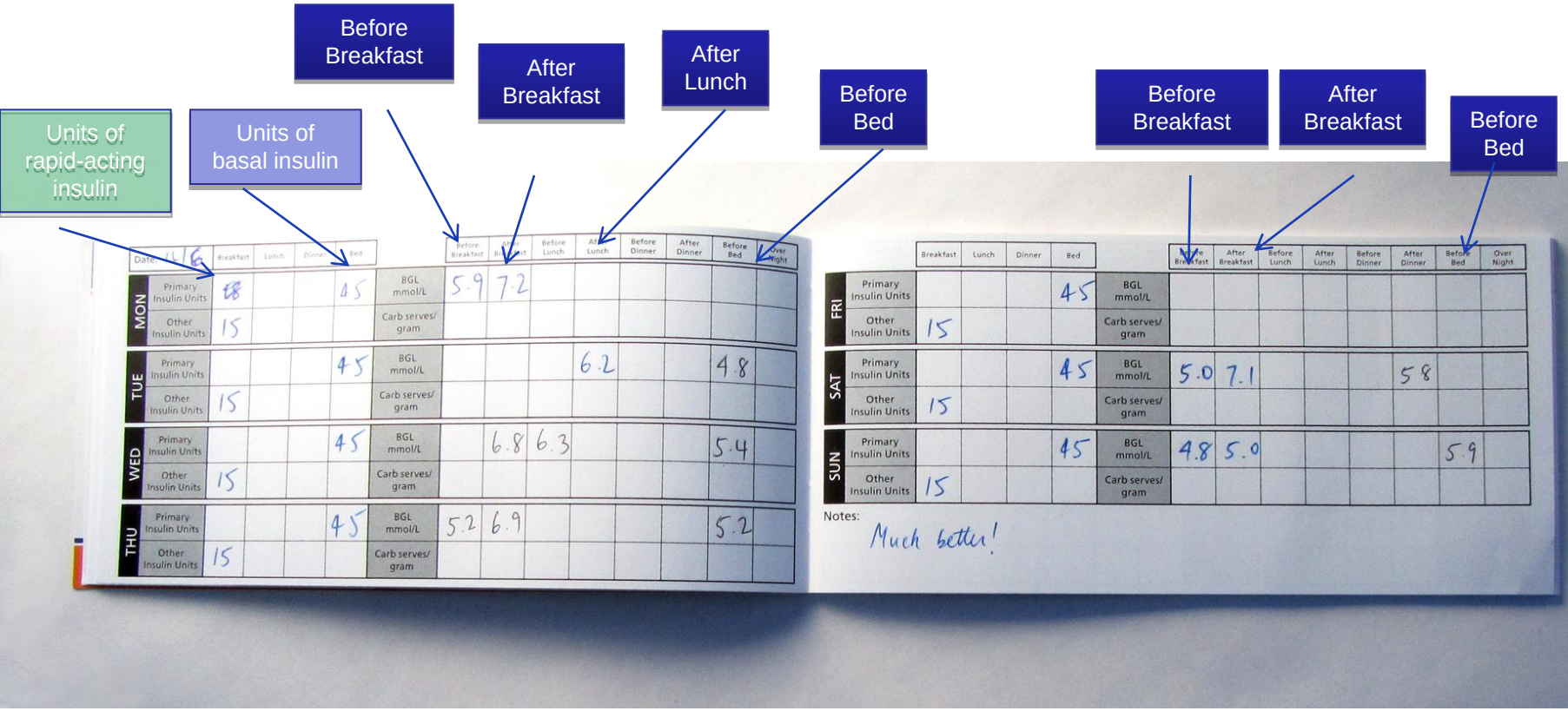
Once prandial insulin is added, insulin secretagogues may be discontinued

1.Garg S, et al. J Fam Pract April 2006. Suppl_S1-S12. 2. Raccah D, et al. Diabetes Metab Research and Reviews. 2007; 23: 257-264. 3. Tibaldi J, American Journal of Medicine. 2008; 121 (6A) S20-S29

4. Nathan D, et al. Diabetologia 2006; 51:8-11. 5. RACGP/Diabetes Australia. Diabetes Management in General Practice, 2009/10.

Reviewing BGLs:4 weeks later
Linda shows you her BGL readings after 3 weeks of prandial insulin (15U) at breakfast

10 Feb



Reviewing BGLs: 4 weeks later (2)

- **You congratulate Linda on achieving great readings**
- **Her BGLs are all within range**
- **Linda comments that she feels “so much better”**
- **You suggest Linda keep her basal dose at 45 U**
- **You ask Linda to maintain her bolus dose at 15 U**
  - **With further review in 3 months**
- **Linda is asked to return in another 12 weeks**
  - **You check that the CDE will remain in contact with her in the interim**
  - **Reminder letter and pathology request will be sent prior to the next visit**

Linda: summary

- **Linda self-titrated insulin dose from 10 U to 45 U (slow titration schedule initially and changed to rapid titration)**
- **6 months after starting basal insulin Linda's fasting BGLs were on target**
- **Hidden hyperglycaemia suspected with A1C slightly elevated**
- **Post-breakfast hyperglycaemia identified with more regular BGL testing**
- **Prandial insulin considered appropriate treatment**
- **15 U at breakfast improved glycaemic control**

☆ **Regular review with Practice Nurse**

- **Linda to return for review in 3 months**

Protaphane/Humulin N dose self-adjustment sheet

Mean capillary blood glucose (mmol/l)	Protaphane/Humulin N dose adjustment
< 4	Return to previous dose tolerated
4.1 - 6	Unchanged
6.1 - 8	+2
8.1 - 12	+4
> 12.1	+6

Date	Fasting blood glucose	Mean fasting blood glucose	Current dose	New dose

Glargine/Detemir dose self-adjustment sheet

Mean capillary blood glucose (mmol/l)	Glargine/Detemir dose adjustment
< 4	Return to previous dose tolerated
4.1 - 6	Unchanged
6.1 - 8	+2
8.1 - 12	+4
> 12.1	+6

Date	Fasting blood glucose	Mean fasting blood glucose	Current dose	New dose

Practice points

- Don’t delay insulin initiation
- Keep it simple for you and patient – 10 units basal insulin
- Ensure patient has expectation that basal dose will increase and what the dose may end up at
- Titrate! Fix the fasting first! Then look for hidden hypers

Starting a patient with type 2 diabetes on basal insulin – a check list

Before starting basal insulin

- A1c persistently above target (i.e. A1c >7%)[1]
- Address other possible causes of hyperglycaemia:[1]
  - Lack of compliance
  - Suboptimal use of oral hypoglycaemic medications (OHAs)
  - Secondary causes (e.g. lifestyle, exercise, diet, co-morbidities) or other medications
- Discuss barriers to/concerns about starting insulin with patient[1]
- Arrange GP Management Plan/Team Care Arrangement if necessary – explain role of other healthcare professionals in patient education and monitoring

Starting basal insulin

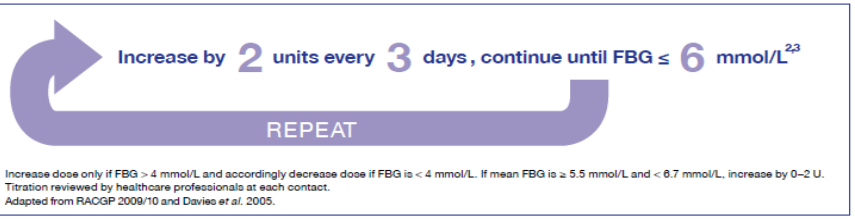
Step 1: **Select basal insulin and basal insulin device**[1]

Step 2: **Commence basal insulin 10 units morning or night – add it to the oral hypoglycaemic agents (OHAs)**[1]

- If fasting blood glucose level (FBG) is high ➔ give basal insulin at **bedtime**[1]
- If FBG is on target but predinner blood glucose level (BGL) is high ➔ give basal insulin in the **morning**[1]

Step 3: **Fix the fasting blood glucose (FBG) – adjust basal insulin dose (according to the schedule below)[2] to reach FBG target of 4–6 mmol/L[3] (adjust target to the individual)**

Patient-led self titration option[2,3]



Increase dose only if FBG > 4 mmol/L and accordingly decrease dose if FBG is < 4 mmol/L. If mean FBG is ≥ 5.5 mmol/L and < 6.7 mmol/L, increase by 0–2 U. Titration reviewed by healthcare professionals at each contact.
Adapted from RACGP 2009/10 and Davies *et al.* 2005.

Alternatively, a faster physician-managed titration option can be followed: adjust basal insulin dose every 2-4 days based on mean FBG over preceding 2 days.[1]

After starting basal insulin

- **Once FBG is on target, check the other (evening) preprandial BGL and bring within target.** If evening preprandial BGL is high, consider adding a second basal insulin† dose if the other preprandial BGL remains high[1]
- **Review A1c at 3 months**
  - Consider stopping sulfonylurea and decreasing dose of metformin and/or glitazone[1]
- **Find hidden hyperglycaemia (if A1c ≥ 7%)**
  - If prepandial BGLs are on target but A1c and postprandial BGLs are not, review need for a dose of rapid-acting insulin (basal plus prandial insulin) to manage postprandial hyperglycaemia[1]

† Unlike isophane insulin and insulin detemir, insulin glargine is not approved for twice daily dosing

References
1. Phillips PJ. *Medicine Today* 2007; 8 (3): 23–34. 2. Davies M *et al. Diabetes Care* 2005; 28: 1282–8. 3. Diabetes Australia/RACGP. Diabetes management in general practice. 14th edn. 2008/9. 4. Riddle M *et al. Diabetes Care* 2003; 26: 3080–86.

Other situations

Example -1

- John is teacher
- Type 2 DM for 7 years
- HbA1c has been 8.5 to 9.7 % over the last 1-2 yrs on max OHAs
  - Metformin 2.5g/d, Glipizide 10mg mane,15 mg nocte
- Seeing you for routine review
- He has been testing mainly before breakfast and occasionally before dinner

John's BG readings

	Fasting	Pre-lunch	Pre-dinner	Post-dinner
Wednesday	9.1			
Thursday	8.8		12	
Friday				
Saturday	10.4			
Sunday	9.8		9.5	
Monday	7.9			
Tuesday	9.5		13.1	
Wednesday	8.7			

You ask him to bring more intensive SMBG test results

John's BG readings

	Fasting	Pre-lunch	Pre-dinner	Post-dinner
Wednesday	9.1	12	11	13.4
Thursday	8.8	9	12	
Friday				
Saturday	10.4	11	9	10.7
Sunday	9.8	10	9.5	12.6
Monday	7.9		8	9.9
Tuesday	9.5	10.7	13.1	15
Wednesday	8.7			

What Insulin regime you are going to propose to John re: insulin therapy?

John's BG readings

	Fasting	Pre-lunch	Pre-dinner	Post-dinner
Wednesday	9.1	12	11	13.4
Thursday	8.8	9	12	
Friday				
Saturday	10.4	11	9	10.7
Sunday	9.8	10	9.5	12.6
Monday	7.9		8	9.9
Tuesday	9.5	10.7	13.1	15
Wednesday	8.7			

"The dietician said he should watch what he eats!"

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Example 2

- Matt is a 70 yr old, Type 2 diabetes for 5 yrs, well managed on Metformin 1g bid, Gliclazide 80mg bid
- Recently been diagnosed with temporal arteritis- started on high dose Prednisone
- His glycaemic control has deteriorated with previous A1c levels of 6.5% has risen to 9.7%
- His SMBGs test results show……

Matt's BG readings show…

	Fasting	Pre-lunch	Pre-dinner	Post-dinner
Wednesday	7.1	12.2	14.8	18.4
Thursday	6.4	10.4	17.4	
Friday				
Saturday	8.1	11	20.1	24.7
Sunday	6.7	9.9	17.6	19.6
Monday	5.9		18.6	20.3
Tuesday	7.4	10.7	16.5	22
Wednesday	6.5		13.9	18.6

What insulin regime would be suitable for him?

Thank you.

Acknowledgement

- A/Prof Tim Kenealy
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