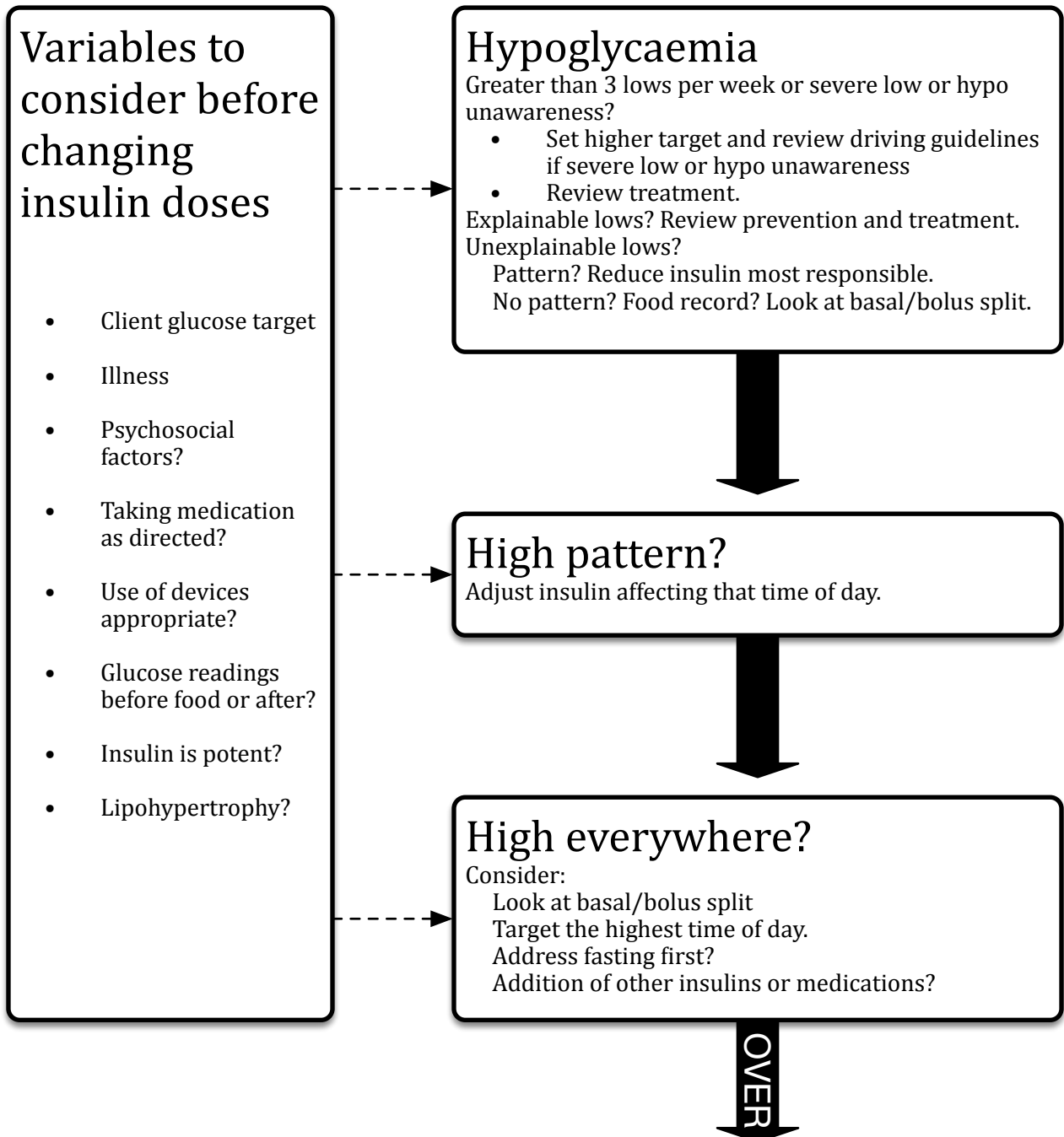# Condensed Guidelines for Insulin Adjustment

This is a condensed version of the Endo/Metab resource "Desktop Guidelines for Insulin Adjustment", and is used for visualization purposes only.

In all cases, look at variables along the left, before recommending insulin dose changes.

## Variables to consider before changing insulin doses

- Client glucose target
- Illness
- Psychosocial factors?
- Taking medication as directed?
- Use of devices appropriate?
- Glucose readings before food or after?
- Insulin is potent?
- Lipohypertrophy?

## Hypoglycaemia

Greater than 3 lows per week or severe low or hypo unawareness?
- Set higher target and review driving guidelines if severe low or hypo unawareness
- Review treatment.

Explainable lows? Review prevention and treatment.
Unexplainable lows?
   Pattern? Reduce insulin most responsible.
   No pattern? Food record? Look at basal/bolus split.

## High pattern?

Adjust insulin affecting that time of day.

## High everywhere?

Consider:
   Look at basal/bolus split
   Target the highest time of day.
   Address fasting first?
   Addition of other insulins or medications?

OVER

# Erratic readings

## Variables to consider before changing insulin doses

- Client glucose target
- Illness
- Psychosocial factors?
- Taking medication as directed?
- Use of devices appropriate?
- Glucose readings before food or after?
- Insulin is potent?
- Lipohypertrophy?

### Assess overnight basal first
(look for stable glucose)

## Meal bolus

### Find pre-meal reading in target
Assess glucose reading before next meal. (Consider whether or not there's a snack between: May need smaller snack or addition of insulin dose)

### If there are no ac readings in target
Look for glucose reading stable from one meal to the next. That represents an appropriate dose for the carb at that meal.

### If pc reading OK but high by next meal
Increase basal working during that time (and reduce bolus)

### Assess correction dose
**Ideal**: High glucose reading - skip meal and use only correction
**If sure about dose for carb:** Look for high reading, and compare reading ac meal to ac next meal

## *Desktop Guidelines for Insulin Adjustment*

This sheet reviews basic insulin adjustment strategies. It was designed by the Endocrinology and Metabolism Program of Calgary zone in Alberta Health Services for use with their health educators. Work down this sheet in order, until you find a situation that applies. Clinical judgment and individual client needs should be considered in all situations.

**Other variables for consideration:** In all situations, consider the following prior to adjustment of insulin, as solutions might exist here:

- Psychosocial considerations
- Doses taken vs. prescribed
- When is insulin taken (ac or pc)
- Carb ratios used vs. reported
- Missed injections
- Intramuscular injections
- Correct use of devices
- Insulin expiry

- A1c
- Glucose readings verified as ac or pc
- Target client is correcting to
- Lifestyle changes vs. medication changes if appropriate given A1c
- Site over-usage?
- Recent weight loss?
- Illness

1. **Are there more than 3 lows most weeks (less if elderly) or a severe low?**
   - Troubleshoot prevention of lows as the priority, and set glucose target higher in the case of severe hypoglycemia or hypoglycemia unawareness.
   - If Lows Explainable (exercise, vacuuming etc., over-bolused, under-ate, alcohol, weight loss), review methods for preventing these lows
   - Consider,
     - If pattern exists, reduce insulin(s) most responsible
     - If lows after high readings, check ISF
     - If no pattern, consider asking client to record meal, activity, dose etc. that come before each low to help problem-solve
     - If no pattern, however, significant number of low readings, consider a basal insulin decrease (especially if basal insulin is >60% of total daily dose with lows) or review if client is stacking boluses
     - If on a sliding scale, look to see if the lows are related to using one or two rows specifically of the sliding scale. For example, the lows may be related to always using the 11.1-13 mmol/L range of the supper sliding scale vs. the entire supper scale.

2. **Is there an obvious high pattern?** For example, the majority of readings at breakfast are high, with only a few readings high at other times of the day. Review insulin(s) affecting that time of day & determine best one to adjust.
   A. If adjusting a sliding scale, carefully consider if all glucose ranges on the scale (4-7, 7.1-9, 9.1-11, etc.) need an adjustment, or if just a few of the ranges require an adjustment.

3. **High everywhere?** For example, the vast majority of readings at each time of the day are high. Try one:
   a. Consider increasing basal dose, especially if basal is less than 40%-60% TDD (the usual).
   b. Consider increasing bolus insulins first if basal is > 60% TDD.
   c. Pick the highest of the high readings to target first
   d. Address fasting glucose first (supper bolus might need change to prevent HS elevations)
   e. Increase one of meal boluses to help break the pattern or until a pattern appears.
   f. Investigate addition of other insulin doses or medications (e.g. metformin if overweight/insulin resistant)

4. **Erratic readings?** For example, most meals seem to have a fairly even mix of high and in-target readings with no one time of the day showing mostly high readings.
    A. **Assess overnight basal first if possible**
    B. **Assess if meal boluses for carb (when in target before meals) are adequate**
    C. **Assess corrections (ISF)**

a) If possible, assess and adjust evening basal insulin first, to start the day in target. Stable glucose readings from evening to morning usually indicate appropriate overnight basal dosing in those on meal boluses.
b) Determine if meal boluses are adequate for each meal
    o Find pre-meal readings which are in target for each meal: breakfast, then lunch, then supper.
        ▪ If the subsequent meal readings are mostly in target (with no snack in-between) then the preceding meal bolus is reasonable. eg. B'fast 6.1 mmol →Lunch 7.1 mmol
        ▪ If the subsequent meal readings are mostly elevated (with no snack in-between), increase the preceding meal bolus or subtract carb from breakfast ratio.eg. B'fast 6.1 mmol →Lunch 8.9 mmol so increase b'fast insulin e.g. ICR 1:10 goes to 1:8
        ▪ If the subsequent meal readings are mostly low (with no snack bolus), then decrease the preceding meal bolus or add carb to breakfast ratio*. E.g. B'fast 6.1 mmol → Lunch 3.2 mmol so decrease b'fast meal bolus or adjust the ICR (e.g. ICR 1:10 goes to 1:12)
        ▪ If the subsequent meal readings are mostly elevated with a snack in-between, and the glucose reading before the snack is in target, then either the snack needs decreasing or the snack requires a bolus (physician order required).
        E.g. Lunch 6.7 mmol; before snack 7.8 mmol (in target as 2 hr pc) and ac supper 13.3 mmol.
    o If no premeal readings in target, find a dose that most often keeps the reading stable from one meal to the next e.g. Breakfast 11.4 mmol with 7 units rapid total (meal bolus + correction) with result of lunch 12.5 mmol/L. In this case, it appears 7 units is appropriate for the new meal bolus. The correction dose would still need to be added to this new meal bolus.
    o If pc lunch is in target and ac supper is above target, morning basal insulin likely needs increasing. This may require the reduction of lunch bolus insulin to prevent hypoglycemia.
    o **\*Carb ratio notes:**

| If glucose results too high, reduce carb ratio | If glucose results too low, increase carb in in the the ratio |
|---|---|
| • E.g. 1:20 goes to 1:15 | • E.g. 1:15 goes to 1:20 |
| • E.g. 1:15 goes to 1:12 | • E.g. 1:12 goes to 1:15 |
| • E.g. 1:12 goes to 1:10 | • E.g. 1:10 goes to 1:12 |
| • E.g. 1:8 goes to 1:7 | • E.g. 1:7 goes to 1:8 |

The ICR may need to change significantly more than conservative estimates above based on client's glucose records. For example, if a client is frequently giving 3-4 units of correction insulin at supper, the lunch ICR would need to change to reflect at least a 3 unit increase in the lunch bolus.

Verify that changes will be appropriate. Work through two mock meal boluses to see if new dosing appropriately addresses the glucose pattern and if client can demonstrate proper use of new ratio.

c) Determine if correction doses are appropriate per meal.
    o Ideal data: If client missed meal but took a correction bolus, assess. E.g. 12 mmol at breakfast, gave correction but no meal eaten/no meal bolus and was 6.5 mmol at lunch (this worked).. --or--

- o If you feel confident the meal bolus is appropriate, find meal readings above-target:
  - ▪ If the subsequent meal readings are mostly in target then the preceding meal correction dose is likely fine. E.g. Breakfast 14.0 mmol/L, gave meal and correction bolus, Lunch 6.5 mmol/L
  - ▪ If the subsequent meal readings are mostly elevated, the preceding meal correction dose likely requires increasing. E.g. Breakfast 14.0 mmol/L, gave meal and correction dose, Lunch 9.1 mmol/L
  - ▪ If the subsequent meal readings are often low with no explanation, then the preceding meal correction dose likely requires decreasing. E.g. Breakfast 14.0 mmol/L, gave meal and correction dose, Lunch 3.2 mmol/L
- d) If using a sliding scale, consider using either of the following procedures.

Method 1 Sliding Scale: Analyze the sliding scale in sections:
For example, look to see if the dose recommended when 4-7 mmol /L for breakfast works.  Then check to see if the dose recommended when 7.1- 9.0 mmol/L at breakfast works, etc. etc.  This can be time consuming as it requires repeatedly skimming large amounts of data numerous times to identify readings within certain ranges. The second method below is often shorter and easier.

Method 2 Sliding Scale: Analyze with checkmarks & arrows
This method requires you look each piece of data in the logbook only once. Have the client read out breakfast blood glucose result, pause, then the corresponding lunch reading, and pause. The educator will code the sliding scale with arrows and checkmarks according to how the corresponding bolus worked. This is a relatively quick way to analyze the cells in a sliding scale or algorithm. Although it seems awkward to read through, after doing it a few times it becomes very quick to analyze all the cells in a sliding scale. Clients quickly catch on and by the next appointment and can expect to do this.  Start with analyzing the breakfast column.
- Ask the client (or a partner) to read out a "before breakfast glucose reading," Educators may choose to do this part themselves; however the process is often quicker with another reading out the glucose values. E.g. 11.3 mmol/L at b'fast
- Find the part of the sliding scale the client would be using to determine insulin dose with that blood sugar. E.g. 11.1-13 mmol/L part of the scale at b'fast
- Ask for the corresponding after-breakfast or before-lunch reading for that same day. E.g. 12 mmol at lunch
  - o Place an arrow up in that part of the sliding scale if the result was higher than target (as is the case with this example above.
  - o Place a checkmark in that part of the sliding scale if the pc-breakfast or ac-lunch test was in target.
  - o Place an arrow down in that part of the sliding scale if the result was lower than target.
- Do this for each of the before breakfast readings for the past 2-3 weeks to see how all of the cells in the breakfast column work. This should take only take only a minute or two. Here is an example analyzing how the breakfast bolus for each part of the sliding scale works:

| Blood Glucose | B'fast units rapid insulin give these results in red | Lunch units rapid insulin, give these results in red | Supper units rapid insulin, give these results in red | NPH insulin |
|---|---|---|---|---|
| Less than 4.0 | Treat with glucose until in target!! | | | Bedtime 21 NPH |
| 4.0-7.0 | 7 ✓✓✓✓ | 2 | 4 | |
| 7.1-9.0 | 8 ✓↓↓↓ | 3 | 5 | |

| 9.1-11.0 | 9 no data | 4 | 6 | |
|---|---|---|---|---|
| 11.1-13.0 | 10 ↑↑↑ | | 7 | |
| 13.1-15.0 | 11 | | 8 | |
| Over 15.0 | 12 | | 9 | |

- Continue to do the same with lunch and supper to complete the chart. To make it less confusing seeing numbers, you may consider using a blank sliding scale or blocking out the units used for this analysis part like below.

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| Blood Glucose | B'fast units rapid insulin **give these results in red** | Lunch units rapid insulin, **give these results in red** | Supper units rapid insulin, **give these results in red** | NPH insulin |
|---|---|---|---|---|
| Less than 4.0 | Treat with glucose until in target!! | | | Bedtime 21 NPH |
| 4.0-7.0 | ✓✓✓✓ | | | |
| 7.1-9.0 | ✓↓↓↓ | | | |
| 9.1-11.0 | No data | | | |
| 11.1-13.0 | ↑↑↑ | | | |
| 13.1-15.0 | | | | |
| Over 15.0 | | | | |

Once you've analyzed the sliding scale, review the arrows/checks to determine if that part of the sliding scale requires the dose be adjusted. For example, cells in the sliding scale that have mostly "up arrows" likely require an increase in the dose; those that have mostly checkmarks, can be left alone; those with mostly "down arrows" require a decrease in insulin dose.