Initiating insulin in people with type 2 diabetes

Due to its progressive nature, many people with type 2 diabetes will eventually require insulin treatment. Insulin initiation is frequently managed in secondary care. However, New Zealand guidelines now recommend that insulin initiation for people with type 2 diabetes be managed in primary care where possible, with additional support as required. It is important that practitioners manage this process effectively, as there are benefits for many patients with type 2 diabetes through the timely and appropriate introduction of insulin treatment.

Insulin depletion is probable over time

Type 2 diabetes is a progressive disease characterised by insulin resistance and a decreasing ability of pancreatic β-cells to produce insulin. Both of these factors contribute to hyperglycaemia. Following lifestyle modifications, most patients with diabetes begin treatment with oral hypoglycaemic medicines. Over time, the efficacy of oral medication frequently diminishes. Treatment with insulin is eventually required, either alone, or more commonly in conjunction with oral medicines such as metformin.

It is possible for people with insulin resistance to delay or, in some cases, even avoid the need for insulin treatment through exercise and significant weight loss, however, patients with type 2 diabetes should be made aware at an early stage of treatment, of the probability that they may require insulin in the future.

Insulin initiation is often delayed

Evidence is accumulating that in all developed countries, many people with diabetes are failing to meet glycaemic targets.[1, 2] As insulin has a greater blood glucose lowering ability than any other hypoglycaemic medicine, it is important that initiation of insulin treatment is considered in all patients with poor glycaemic control, following appropriate lifestyle changes and the use of oral hypoglycaemic medicines. In the United Kingdom, a large ten year population-based study of treatment practices for people with type 2 diabetes reported a median delay of 7.7 years between introduction of the first oral medicine and the initiation of insulin. This report concluded that many patients may benefit from earlier transition from oral medicine to insulin.[3] Other studies suggest that if insulin is initiated early enough then β-cell damage and disease progression may be slowed.[4, 5]

Overcoming reluctance to initiate

General Practitioners may be reluctant to begin insulin treatment due to:[6, 7]

- The complexity of the training required to educate the patient
- A lack of time and resources to perform adequate consultations and follow-up
- A lack of practice training and access to educators
- Concerns that insulin increases the risk of hypoglycaemia
- Concern that patients will view insulin as a "shortcut" and become less compliant with oral hypoglycaemic medication and lifestyle changes
- The possibility of weight gain that is associated with insulin treatment


INITIATING INSULIN
START
FINISH
EDUCATION
Your patient starts regular exercise, healthy eating and gives up smoking.
MOVE FORW

These issues need to be carefully considered and practice strategies put in place to address any barriers to providing treatment.

In addition, patients may be reluctant to begin insulin treatment due to:[8]

- The fear of injections and the inconvenience of performing them
- The need for regular monitoring of blood glucose levels
- Social discomfort surrounding the need for injections, or fear of loss of employment if their job involves driving
- A feeling that insulin initiation means that they have failed and are "at the end of the line"
- Concern over adverse effects such as weight gain and hypoglycaemia that are associated with insulin

In order to allay concerns, it is important that patients understand that having type 2 diabetes means they have a progressive shortage of insulin to manage glucose levels over time and that medicine needs will change – beginning insulin does not mean that they have failed. Insulin types and delivery systems have improved over the years and injections now cause minimal discomfort while allowing discreet use. Many patients also report increased energy levels and well-being following insulin initiation.

It is usually beneficial to include the patient's partner or family in discussions about insulin initiation. If patients are particularly reluctant, a two month trial period can also be suggested, after which point the patient can reassess their decision.

Making the decision to initiate insulin

In most people with type 2 diabetes, insulin is considered in conjunction with, or following:[8]

1. Lifestyle modification – physical activity, dietary changes and smoking cessation advice
2. Initiation of metformin
3. Addition of a sulphonylurea

Patients should be referred to hospital when there are immediate health concerns such as significant hyperglycaemia, ketonuria and weight loss. Newly diagnosed patients displaying these symptoms may be considered for immediate initiation of insulin.

Initiating insulin in primary care requires additional funding

Starting a patient on insulin requires a series of consultations and follow-up to ensure compliance with the treatment plan and in order to titrate the insulin dose. The financial cost to the patient and practice through this process can be significant. A portion of this extra cost may be covered in some PHOs where patients are eligible for a High User Health Card or for entry into the Care Plus programme.

An example of a PHO providing support to General Practices initiating patients on insulin is occurring in the Southern PHO. An eight step process has been linked to an electronic decision support tool used by many practices. There is funding available for patients who meet eligibility criteria at each stage of the insulin initiation process, including follow-up phone calls and face-to-face meetings. Other PHOs are likely to launch similar programmes for primary care insulin initiation (if they have not already done so), particularly as the annual diabetes "Get Checked" programme will be replaced with the diabetes care improvement package from 1 July, 2012.

When to consider insulin?

New Zealand guidelines recommend that any person with type 2 diabetes should be considered for insulin treatment where their measured HbA_{1c} level is not close to a previously agreed target, or where there are symptoms of hyperglycaemia despite:[8]

- Appropriate focus on diet, physical exercise, behavioural strategies and other lifestyle interventions
- Appropriate compliance with and dose optimisation of oral hypoglycaemic medicines

As a general rule, most people with a HbA_{1c} > 65 mmol/mol should be considered for insulin treatment (see Page 18 for a list of HbA_{1c} values and associated outcomes).[8] However, consideration should also be given to: age, presence of symptoms and the long-term risk of complications, ability to manage insulin treatment, appropriate family/caregiver support and patient acceptance of the need for insulin.

Choosing an insulin regimen

There are a variety of recommended insulin regimens. Selection of a regimen should be guided by the pattern of blood glucose results and individual patient factors.

There are three types (analogues) of insulin currently subsidised on the Pharmaceutical Schedule in New Zealand for the treatment of type 2 diabetes:

Isophane – recommended as the first-line insulin treatment for type 2 diabetes in New Zealand. Isophane is an intermediate-acting form of insulin with a maximal effect at four to 12 hours.[9] There are currently two fully funded brands of isophane available in New Zealand – Protaphane and Humulin NPH.[10] Isophane is usually administered once daily – at night, if the pre-breakfast glucose is high, or before breakfast if the patient has progressive daytime hyperglycaemia. Metformin and sulphonylurea medicine should be continued. If twice daily isophane is required, sulphonylurea medicine should cease.[8] See opposite and over page for examples of isophane treatment regimens.

Basal insulin analogues – long-acting forms of insulin such as glargine (currently fully funded).[10] Glargine is given morning or night where hypoglycaemia is a concern and is titrated to normalise the pre-breakfast glucose levels.

As of 1 February 2012 the restriction has been removed requiring that glargine be prescribed either following a three month trial of another insulin regimen, or to people who require assistance in administering insulin. Glargine can now be considered as an alternative to twice daily isophane.

Premixed insulin – preparations containing a fixed ratio of short-acting and intermediate-acting forms of insulin, designed to be given either once or twice a day. Premixed insulin can be considered where a patient already taking insulin has consistently high blood glucose levels following meals, and where HbA_{1c} targets are not being met.[8] This type of insulin is not commonly used when first initiating insulin. If a premixed insulin is being considered, referral to a diabetes clinic is recommended.

Advice about insulin regimen should also be sought from a diabetes clinic in cases where:[8]

- The patient is a child or adolescent
- The patient is very lean or has lost weight rapidly – in which case testing for glutamic acid decarboxylase autoantibodies (GAD) indicating type 1 diabetes may be appropriate
- There is repeated hypoglycaemia
- The patient is a vocational driver
- HbA_{1c} levels remain above target following insulin initiation and titration

Examples of isophane treatment regimens

Once daily at night – indicated if, following one week of self-monitoring of blood glucose (SMBG) the patient has high pre-breakfast glucose levels that decrease or stay the same during the day. Start isophane at eight to ten units at bedtime and continue with metformin and a sulphonylurea. The insulin dose should be titrated as indicated in Table 1 every four to five days.[8] Patients should be alert for the symptoms of nocturnal hypoglycaemia with doses over 20 units.

Once daily before breakfast – indicated if, following one week of SMBG the patient has acceptable pre-breakfast glucose, but levels rise during the day. Start isophane at eight to ten units before breakfast and continue with metformin and a sulphonylurea. The insulin dose should be titrated as indicated in Table 1.[8] Patients should be alert for pre-lunch and nocturnal hypoglycaemia.

Twice daily – indicated if, following one week of SMBG, the patient has high blood glucose levels during night and day, or at point of considering insulin is significantly hyperglycaemic (HbA_{1c} > 75 mmol/mol). Start with six to ten units of isophane, twice daily, before breakfast and evening meal. The patient should continue on metformin, although if taking a

Table 1: Isophane dose titration[8]

Isophane once daily at night dose titration	
Pre-breakfast blood glucose (mmol/L)	**Dose titration (units)**
	Starting dose eight to ten units
Generally > 8 and never < 4	Increase by four to six units
Generally 6 to 8 and never < 4	Increase by two to four units
Once patient taking > 20 units per day – three consecutive fasting blood glucose over the individually agreed target AND blood glucose never < 4	Increase daily dose by 10–20%

Isophane once daily before breakfast dose titration	
Pre-evening meal blood glucose (mmol/L)	**Dose titration (units)**
	Starting dose eight to ten units
Generally > 8 and never < 4	Increase by four to six units
Generally 7 to 8 and never < 4	Increase by two to four units
Once patient is taking > 20 units a day, three consecutive pre-evening meal blood glucose over the individually agreed target AND blood glucose never < 4	Increase daily dose by 10–20%

Twice daily isophane dose titration	
	Dose titration (units)
	Starting dose six to ten units, twice daily
Pre-breakfast blood glucose (mmol/L)	
Generally > 8 and never < 4	Increase night dose by four to five
Generally 6 to 8 and never < 4	Increase night dose by two to four
Pre-evening meal blood glucose (mmol/L)	
Generally > 8 and never < 4	Increase pre-breakfast dose by four to five
Generally 7 to 8 and never < 4	Increase pre-breakfast dose by two to four
Once patient is taking > 20 units a day, three consecutive pre breakfast or evening meal blood glucose over the individually agreed target AND blood glucose never < 4	Increase the day or night dose by 10–20% of daily dose

sulphonylurea this should now be discontinued (due to the increased risk of hypoglycaemia). The insulin dose is titrated as indicated in Table 1.[8]

Patient education

Patients require adequate education and training before they begin SMBG and self-administering insulin. It should be made clear that the initial dose of insulin is merely a starting point from where titration will be based – a common error is to initiate but not to titrate the dose effectively. Patients can be safely taught to self-adjust insulin doses in response to blood glucose levels, however, follow-up is essential. The need for continued exercise to prevent weight gain should also be emphasised. Practice staff training patients with type 2 diabetes to self-administer insulin need to have a thorough working knowledge of all the practical aspects of insulin treatment. In some DHBs training programmes for health professionals are run by diabetes nurse educators. In some cases it may be necessary for practices to contact manufacturers for specific product training.

After the initiation of insulin, twice weekly phone calls to the patient are recommended in combination with face-to-face meetings as required, until satisfactory glycaemic control is achieved. From this point, regular contact between the patient and the practice should be maintained, as blood glucose levels may be affected by other illnesses and insulin dose adjustments may be required. A face-to-face meeting approximately one month after initiation is also recommended to assess the need for regimen adjustment.

It should be emphasised to all patients, before they begin taking insulin, that medication is not a substitute for a healthy lifestyle and that behavioural strategies such as exercise, healthy eating and smoking cessation should still continue. Alcohol consumption should be moderate as this increases the risk of hypoglycaemia in patients taking insulin.

It may be possible for some people with type 2 diabetes, following significant voluntary weight loss, to stop taking insulin, especially if they have had diabetes for a short period and now have a body mass index (BMI) < 30.

The Ministry of Health has published clinical guidelines for weight management in New Zealand adults available from: **www.health.govt.nz/publication/clinical-guidelines-weight-management-new-zealand-adults.**

Self-monitoring of blood glucose

SMBG should be performed for approximately one week prior to deciding which insulin treatment regimen a patient would benefit from the most. This can be done before each meal and ideally, two hours after the evening meal and breakfast. After insulin is started it is recommended that patients continue to monitor blood glucose regularly so that insulin doses can be adjusted if required.

There are several different kinds of **blood glucose testing meters** currently fully subsidised. When selecting a blood glucose meter, patient preference and the familiarity of practice staff with the different models of meter are two important considerations.

A comparison of blood glucose monitoring devices is available from: **www.pharmac.govt.nz/2011/04/08/2011-04%20Blood%20glucose%20monitors%20comparison.pdf**

Each type of blood glucose meter requires the use of specific **blood glucose testing strips**. A supply sufficient for up to four tests per day for three months should usually be prescribed.

Choice of **insulin pen** is dependent on the type of insulin used. Insulin pens can be obtained at no cost from the suppliers, usually through diabetes societies. The Diabetes New Zealand website contains a list of insulin pens which match specific insulin types (search under diabetes products/insulin pens) and links to contact details for local diabetes societies: **www.diabetes.org.nz**

Individual patient preference may also play a role in selecting a delivery device. In order to ensure that the dose of insulin is successfully delivered, the instructor needs to have a thorough working knowledge of the delivery device, including:

- Cartridge loading
- Needle attachment
- Priming the device and "dialling" up a dose
- Injection technique
- Confirmation that a full dose has been given (dial returned to zero)
- Cap replacement

Spare insulin should always be available and injections should occur at regular times. Used needles should be disposed of safely and responsibly. Sharps containers can be purchased at some community laboratories at an estimated cost of $15,

including disposal. Although manufacturers advise using a fresh needle for each injection, in practice needles can be re-used up to four times.

The use of **logbooks** allows the systematic recording of blood glucose levels. Logbooks are available from diabetes clinics or diabetes medicine manufacturers. A logbook can also be ordered from: **www.pharmaconline.co.nz**

For ease of interpretation it is suggested that blood glucose levels be recorded in columns rather than in graphical form. Software can also be downloaded from manufacturers allowing analysis of blood glucose readings on home computers. When reviewing blood glucose profiles, occasional abnormal recordings due to food or alcohol "binges" may be overlooked, but the patient should be advised to note the effect of these events.

Prescribing insulin safely

Ensure that the patient knows (and can repeat back):

- The name of the insulin they have been prescribed
- The correct dose
- Whether the insulin is short, intermediate, long-acting or premixed
- What cartridge/vial size they need
- How to correctly match their insulin with the required delivery device (i.e. type of pen or syringe)

In order to reduce the risk of a prescription error occurring clinicians can:

- Use the full brand name of the insulin when prescribing
- Inform the patient of the details of the insulin preparation being prescribed and the importance of describing it accurately (e.g. appearance of liquid, label and packaging)
- Ensure that any changes in insulin regimen are explained to the patient and clearly understood

Insulin storage and administration

Insulin should be stored in the door of the fridge, although insulin in use can be stored at room temperature for up to 28 days. Degradation can occur at high temperatures (e.g. being left in a car during summer) or by being inadvertently frozen. Insulin that may have degraded or that has passed its expiry date should be discarded.

Insulin is always administered by subcutaneous injection, with a pen (3 mL cartridges) or syringe (10 mL vials). The needle

Driving advice

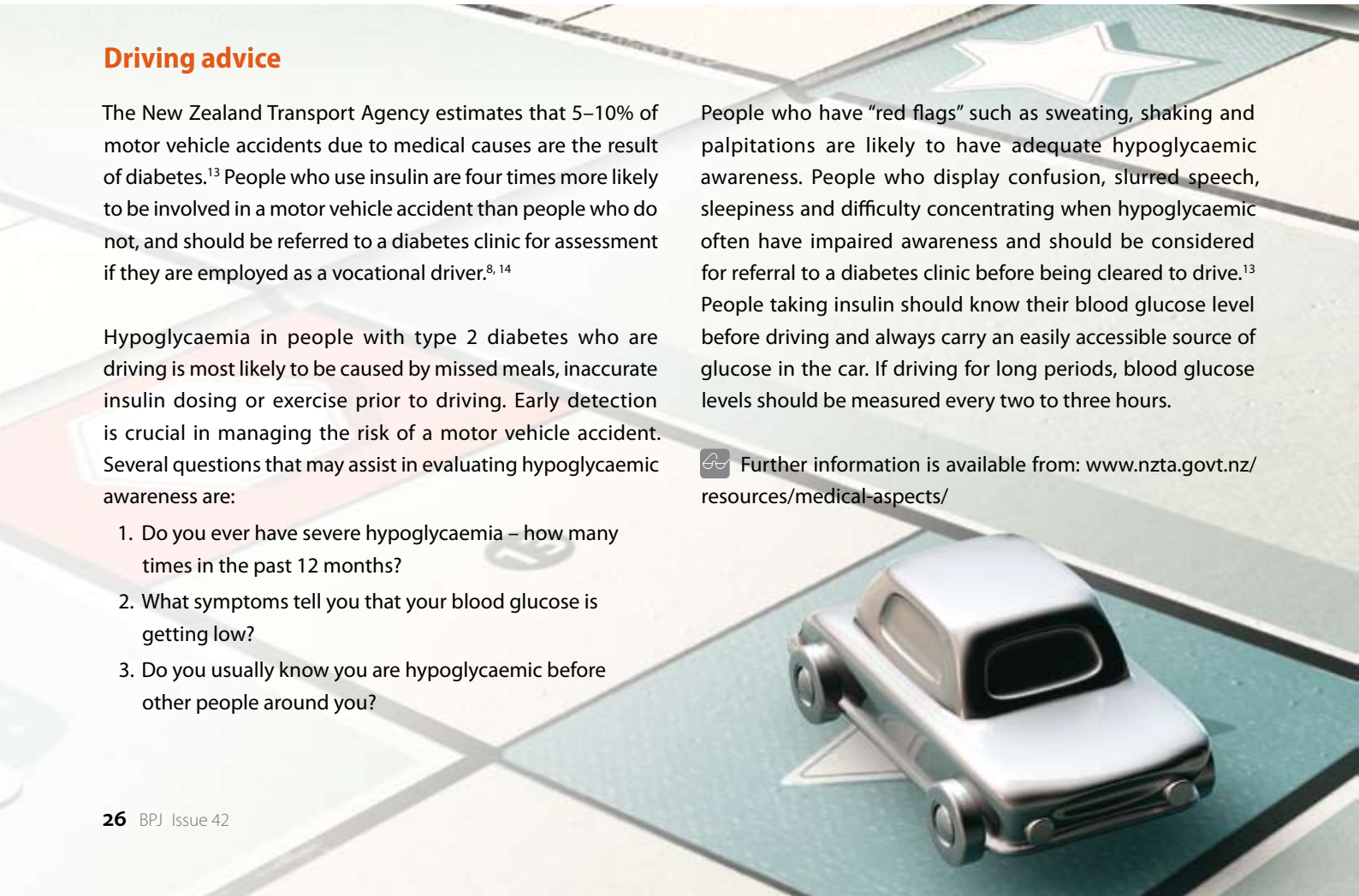
The New Zealand Transport Agency estimates that 5–10% of motor vehicle accidents due to medical causes are the result of diabetes.[13] People who use insulin are four times more likely to be involved in a motor vehicle accident than people who do not, and should be referred to a diabetes clinic for assessment if they are employed as a vocational driver.[8, 14]

Hypoglycaemia in people with type 2 diabetes who are driving is most likely to be caused by missed meals, inaccurate insulin dosing or exercise prior to driving. Early detection is crucial in managing the risk of a motor vehicle accident. Several questions that may assist in evaluating hypoglycaemic awareness are:

1. Do you ever have severe hypoglycaemia – how many times in the past 12 months?
2. What symptoms tell you that your blood glucose is getting low?
3. Do you usually know you are hypoglycaemic before other people around you?

People who have "red flags" such as sweating, shaking and palpitations are likely to have adequate hypoglycaemic awareness. People who display confusion, slurred speech, sleepiness and difficulty concentrating when hypoglycaemic often have impaired awareness and should be considered for referral to a diabetes clinic before being cleared to drive.[13] People taking insulin should know their blood glucose level before driving and always carry an easily accessible source of glucose in the car. If driving for long periods, blood glucose levels should be measured every two to three hours.

Further information is available from: www.nzta.govt.nz/resources/medical-aspects/



should be short (5–8 mm) and fine (31 gauge).[11] Immediately prior to each injection the expiry date should be checked and the insulin (especially isophane) shaken thoroughly to ensure homogeneity. The injection should be administered in varying sites around the abdomen.

Managing hypoglycaemia

Symptomatic hypoglycaemia can occur when a person's blood glucose levels falls below 4.0 mmol/L.[12] People taking insulin need to be alert for the symptoms of hypoglycaemia and know how to manage the condition. The most common reasons for hypoglycaemia occurring in a person with type 2 diabetes are a lack of food, an increase in physical activity, administration of insulin or less commonly, a sulphonylurea, or consumption of alcohol without food.[12]

Symptoms of hypoglycaemia include:[12]

- Hunger
- Blurred vision, headache, light-headedness
- Loss of concentration, confusion, irritability
- Sweating, tingling around mouth and lips, trembling, weakness and possible loss of consciousness

What to do? A person with diabetes who suspects they are hypoglycaemic should stop what they are doing, sit down and check their blood glucose level. The consumption of 10–15 g of glucose (six jellybeans, two or three glucose tablets or a small glass of non-diet soft-drink) may help alleviate the symptoms. After five to ten minutes blood glucose levels should be reassessed and more glucose taken if required. This process should continue until blood glucose levels are above 4.0 mmol/L. A meal, or a snack such as a slice of bread or a pottle of yoghurt should then be eaten.[12] Patients should be encouraged to report any episodes of hypoglycaemia to their general practice as a change in insulin dose may be needed. The use of a MedicAlert bracelet is also recommended.

Best Practice tip: Patients who believe they may be experiencing nocturnal hypoglycaemia can confirm this by setting an alarm and performing a blood glucose test during the night (e.g. at 3am) on several occasions.

Further resources

Diabetes group education classes are offered by local Diabetes Centres. Diabetes New Zealand provides additional information on subjects such as healthy eating and exercise as well as providing links to support groups and research publications.

Pamphlets for patients can be ordered through Diabetes Supplies Ltd at: **www.diabetessupplies.co.nz** or by phoning 0800 DIABETES, or downloaded from **www.diabetes.org.nz/resources/pamphlets**

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