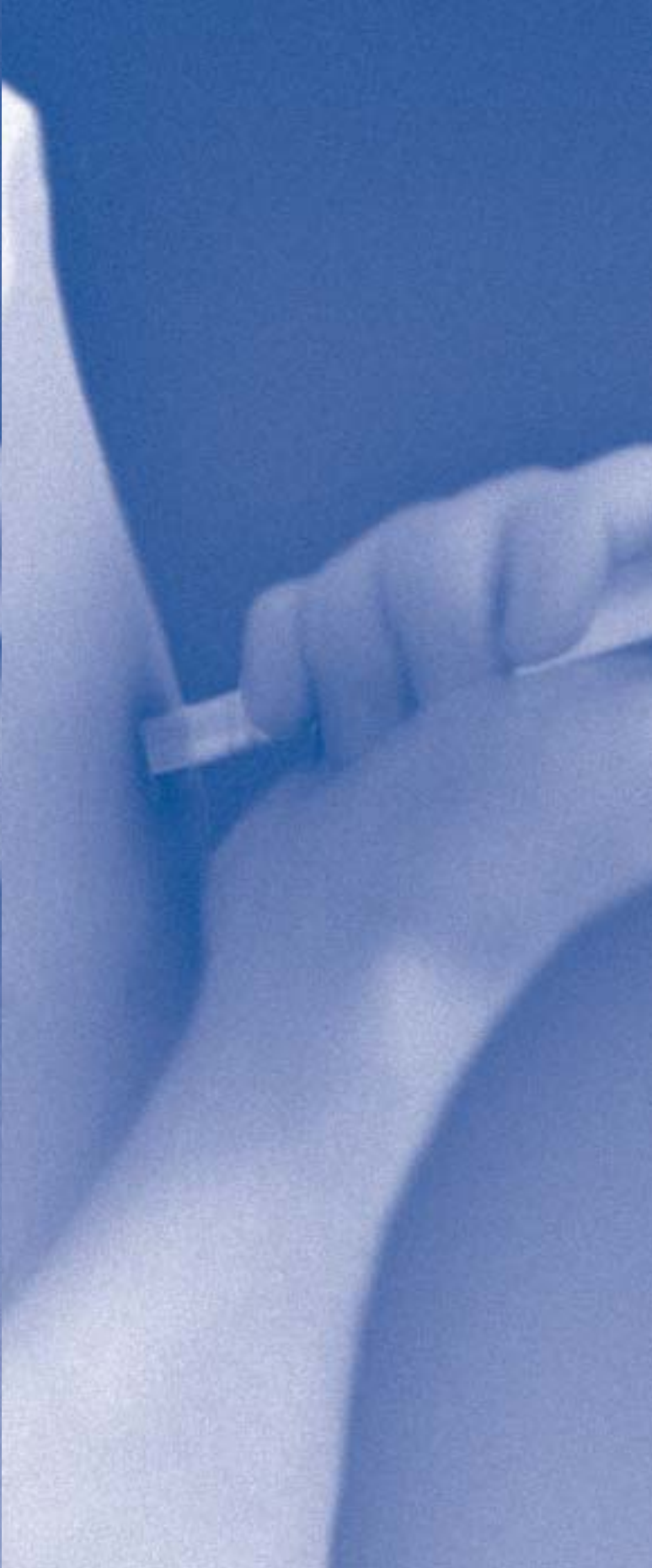




Royal College  
of Nursing

# Starting insulin treatment in adults with Type 2 diabetes

*RCN guidance for nurses*





## Using this guide

Traditionally, insulin therapy has been managed by specialist diabetes services. The recent shift of responsibility for routine diabetes management to primary care, reinforced by the publication of the National Service Framework for Diabetes (DH, 2002), means there is now an expectation that nurses in primary care will become much more involved in the initiation of insulin therapy in people with Type 2 diabetes.

This booklet is written by members of the RCN Diabetes Nursing Forum Committee, who all have many years' experience of initiating insulin treatment. It is intended as a resource for nurses new to insulin therapy, and includes an overview of the underlying principles for starting insulin along with practical tips on education, adjustment of doses, and dealing with difficult situations. There is also a glossary of terms associated with diabetes and its treatment (see page 23).

It does not aim to be a complete or definitive guide, and should be used with reference to the Skills for Health competencies for starting insulin therapy ([www.skillsforhealth.org.uk](http://www.skillsforhealth.org.uk)) and in conjunction with local protocols, and the support, training and facilitation offered by your local specialist diabetes team. **Please note that the guidance is intended for nurses working with adults only.**

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### Disclaimer

In this text it has not been feasible to avoid individual names of products or manufacturers. In none of these instances should the appearance of such a name be taken as a recommendation.

# Starting insulin treatment in adults with Type 2 diabetes

*RCN guidance for nurses*

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The UK Prospective Diabetes Study has shown that every step towards achieving normal blood glucose levels represents a reduction in the risk of long-term complications of diabetes.

# Foreword

More than 90 per cent of people with diabetes have Type 2 diabetes. Their risk of heart disease and stroke is two to four times higher than in the general population, and their life expectancy five to ten years lower. Despite major efforts to improve the management of the condition, diabetes remains the leading cause of blindness, end stage renal disease and lower extremity amputations in industrialised nations. The problem is growing - by 2025, estimates suggest that more than 300 million people worldwide will have diabetes.

The UK Prospective Diabetes Study (UKPDS) showed that intensive control of blood glucose, using sulphonylurea or insulin - and, for overweight people, metformin - could reduce the risk of diabetic complications substantially. As a result, modern guidance for the management of Type 2 diabetes stress the need to achieve and maintain the best possible glycaemic control.

In addition, the study showed that Type 2 diabetes is characterised by a steady decline in beta cell function that leads to progressive hyperglycaemia despite continued therapy with sulphonylurea or metformin. To offset this, most people with Type 2 diabetes will, in time, need insulin therapy.

Starting insulin poses considerable challenges. It can be hard to convince people it is necessary, and that the time to start injecting has arrived. The sheer number of people who need to be shown how to take insulin and how to adjust their insulin doses means that the wider health care community will need to get involved. Insulin resistance means that most people with Type 2 diabetes will need larger doses of insulin than those with Type 1 diabetes, so understanding how to find the right dose is vital if good glycaemic control is to be achieved as soon as possible. Although hypoglycaemia is less common in Type 2 diabetes, it does occur and people need to be reassured that the risk has been minimised as far as possible.

I welcome this RCN initiative, which will provide a much needed and valuable resource for nurses new to insulin therapy. The emphasis on insulin therapy in Type 2 diabetes is particularly welcome. I would like to thank all the contributors for their hard work. I believe that their efforts will be of great benefit to many people with Type 2 diabetes.

Professor Rury Holman FRCP  
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## 1

# How insulin works

Put simply, insulin unlocks the 'doors' of cells to let the glucose in and it also suppresses liver glucose production. People with Type 2 diabetes may need supplementary injected insulin if they are insulin deficient and/or insulin resistant as a result of obesity or taking certain drugs, such as steroids, and where diet, physical activity and oral hypoglycaemic agents (OHAs) are no longer sufficiently effective in lowering blood glucose.

## Normal insulin production

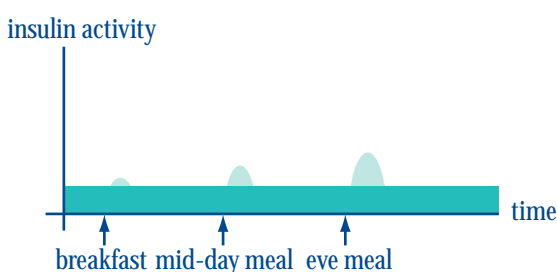
### Normal basal insulin secretion

The liver releases glucose at a relatively constant rate all the time, with a slight dip during the night and a surge before dawn. A steady release of insulin is therefore needed to maintain normal blood glucose levels.



### Normal meal-time insulin

As well as this 24-hour background insulin secretion, there is a burst of insulin at every meal - often called the meal-time bolus. Whenever glucose is released into the bloodstream from food, a matching release of insulin is required for up to two hours in order to move the glucose into the cells. How long this increased insulin level is needed depends on the type of carbohydrate, its glycaemic index, and the fat content of the meal.



## Manufactured insulin

Manufactured insulin aims to mimic these natural patterns. Preparations available in the UK are produced by four companies:

- ◆ Aventis
- ◆ CP Pharmaceuticals
- ◆ Eli Lilly
- ◆ Novo Nordisk

Manufactured insulin can be either synthetic (human) or animal in origin, and falls into five main categories:

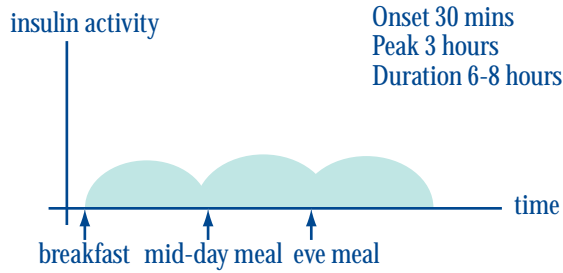
- ◆ rapid-acting
- ◆ short-acting
- ◆ intermediate acting (also called isophane insulin)
- ◆ fixed mixtures (of rapid - or short-acting and intermediate-acting insulin)
- ◆ long-acting

## Time action profiles of manufactured insulin

The following diagrams show how these types of insulin work. An up to date chart, showing the characteristics of all manufactured insulin preparations available in the UK, is published regularly in MIMS and by Diabetes UK (see [www.diabetes.org.uk/products/insulin](http://www.diabetes.org.uk/products/insulin)).

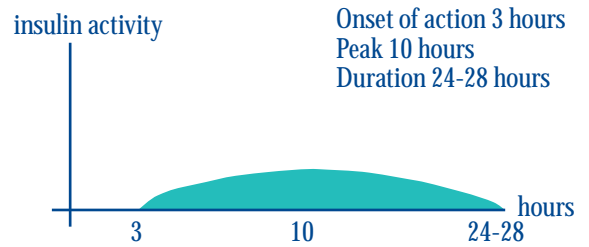
**Short-acting meal-time insulin**

Product names include Actrapid, Humulin S and Insuman Rapid.



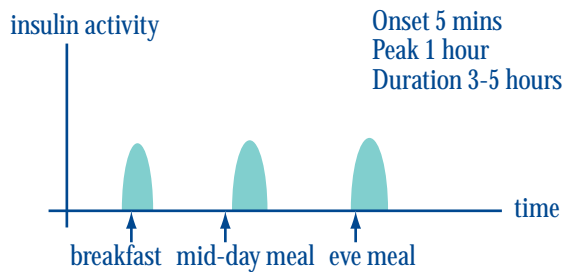
**Long-acting basal insulin with peak**

Product names include Monotard and Hypurin Bovine Lente.



**Rapid-acting meal-time insulin (analogues)**

Product names include NovoRapid and Humalog (insulin lispro).



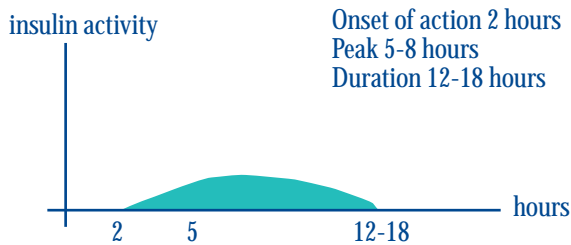
**Long-acting peakless basal analogues**

Lantus and Levemir are currently the only products in this category.



**Intermediate-acting basal insulin with peak**

Product names include Insulatard, Humulin I and Insuman Basal.



## 2

## Indications for insulin treatment

### Who can benefit from insulin treatment?

Potentially, anyone with Type 2 diabetes stands to benefit from insulin treatment.

Strong indications for insulin therapy include:

- ◆ symptoms of hyperglycaemia such as polyuria, thirst, recurrent fungal infections (especially genital thrush) or bacterial infections (especially urine infections)
- ◆ pregnancy or planning pregnancy
- ◆ oral hypoglycaemic treatments not tolerated/ contra-indicated
- ◆ weight loss without dieting in someone of low or normal weight.

Possible indications for insulin therapy include:

- ◆ unsatisfactory glycaemic control, even with the maximum tolerated dose of oral hypoglycaemic agents (OHAs) (HbA1c higher than 7 per cent, self blood glucose monitoring results higher than 7 mmols/litre before meals or 9 mmols/litre two hours after meals)
- ◆ personal preference
- ◆ painful neuropathy
- ◆ foot ulceration and infection.

### Who may *not* benefit from insulin treatment?

- ◆ Some obese people - insulin treatment can lead to further weight gain, with little or no improvement in HbA1c. Could the person change their diet, take more exercise, or use weight-reducing agents like orlistat or sibutramine?
- ◆ People whose oral hypoglycaemic treatment regimen could be improved - would they prefer to change to a more effective oral treatment regimen?
- ◆ Elderly people with a short duration of diabetes and no symptoms of hyperglycaemia - are disabling long-term diabetic complications likely to develop in their lifetime?

- ◆ People with other physical or mental health problems - do the potential benefits of insulin treatment outweigh the potential risks, especially the risk of hypoglycaemia?

### When should insulin treatment be started?

Insulin therapy should be discussed as a treatment option at the time of diagnosis. It should not be used as a threatened punishment for poor compliance.

Treatment should start:

- ◆ as soon as there is evidence of deteriorating glycaemic control
- ◆ after exploring whether the person could change their lifestyle or current medication
- ◆ after a full discussion of all the pros and cons of insulin therapy.

### When people don't want insulin therapy...

Bear in mind that there will be some situations or factors that may put people off starting insulin therapy:

- ◆ driving restrictions - people using insulin cannot hold an LGV or PCV licence, and must undergo a medical assessment before applying for a C1 licence in order to drive vehicles between 3.5 and 7.5 tonnes
- ◆ fear of needles - accurate information can help with this. For example, many people think they need to find a vein to inject into, or that the needles will be large
- ◆ misconceptions - some people overestimate the risk of hypoglycaemia, while others may be basing their ideas on stories about outdated treatments and equipment
- ◆ 'live for today' - some people may prefer to live with the increased risk of complications, particularly if they do not currently have any symptoms
- ◆ employment - people may fear discrimination an/or employment restrictions. For example, some local authorities will not license taxi drivers treated with insulin
- ◆ fear of weight gain - often justifiable, so it may be worth exploring ways to improve diet and increase activity first.

## 3

## Choosing the right insulin regimen

*'Insulin is rarely, if ever, given at the right time, in the right way or in the right amount. It is therefore amazing that anyone with diabetes has any semblance of good blood glucose control.'*

*Professor Edwin Gale,  
Medical School Unit, Southmead Hospital, Bristol*

### Which regimen?

There is no one 'right' choice, and one regimen is not necessarily forever. If it is unsuitable it should be changed.

### Who decides?

Your role is to explain the options and present all the pros and cons. The final decision must be made by the person themselves.

To carry out your role, you will need to understand:

- ◆ how insulin works
- ◆ why insulin is needed
- ◆ the principles of normal insulin production
- ◆ the types of insulin available
- ◆ the benefits and disadvantages of the various delivery devices
- ◆ common insulin regimens.

We have already looked at how insulin works, why people need it and the principles of normal insulin production. We will now look at common insulin regimens.

### Common insulin regimens

Traditionally, people with Type 2 diabetes transferring to insulin therapy would stop taking their oral hypoglycaemic medication. However, there are many advantages to combining insulin with oral agents and this is now much more common. The advantages include:

- ◆ less risk of weight gain
- ◆ less risk of hypoglycaemia
- ◆ a simpler treatment regimen

- ◆ better glycaemic control while insulin is being introduced and the dosage adjusted.

*Note that because of the risks associated with fluid retention, especially in people with heart disease, the glitazones (rosiglitazone, pioglitazone) are not used with insulin in the UK.*

Here are some examples of combination treatments and when they can be used:

- ◆ Once-daily intermediate-acting insulin at bedtime plus OHAs can be effective for people who are insulin resistant due to obesity. It is particularly appropriate where the person's blood glucose is high overnight and in the morning, but comes down once they start their daily activities.
- ◆ Twice-daily pre-mixed insulin plus OHAs can be effective for people with significant hyperglycaemia after meals.
- ◆ Long-acting peakless insulin in the morning (or whenever is convenient, provided it is taken at the same time each day) plus OHAs can be used where the person has high blood glucose during the day and at night, and 'would otherwise need twice-daily basal insulin injections in combination with oral anti-diabetic drugs' (NICE 2002a). NICE also suggests that long-acting basal insulin can be used with OHAs 'for those who require assistance from a carer or health care professional to administer their injection', because it does not have to be given at a particular time of day. This combination can also work well for 'those whose lifestyle is significantly restricted by recurrent symptomatic hypoglycaemic episodes'. Finally, it is also useful for people who are reluctant to consider insulin therapy, as there is only one daily injection involved. However, this needs to be weighed against having the flexibility to deal with increases in blood glucose levels at meal-times and to adjust doses according to activity.

#### Case study: Mr W

'I've been dreading this day for the past 20 years', said Mr W as he came through the door of the nurse's office. His GP's referral spelled it out: 'Mr W has a strong aversion to, or even phobia of, hospitals. Knowing that I might be suggesting insulin therapy, he has had at least two sleepless nights.'

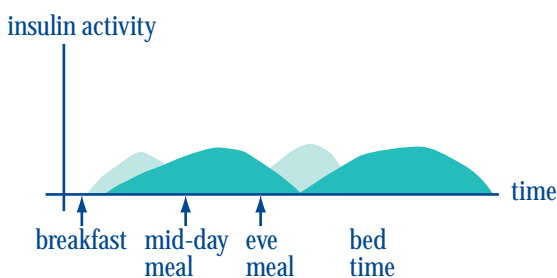
Mr W was tired, and taking little exercise. He could hardly walk upstairs. However, he was eating well and

so had become overweight. His HbA1c was 13.5 per cent, and the results of his home glucose blood tests were consistently between 17 and 28 mmols/litre. He was on maximum doses of OHAs. The nurse explained that he didn't have to find a vein in order to inject insulin and that the needles were tiny, and persuaded him to do a 'dry' injection. Mr W was amazed - not only did it not hurt, he could hardly feel it at all.

Mr W decided to start using once-daily intermediate-acting insulin in combination with his OHAs. Within two months his HbA1c had fallen by 3 per cent. Because he felt so much better, Mr W was able to take more exercise and started eating healthily. As a result, he lost 12lbs.

### Twice-daily pre-mixed insulin

The manufacturer mixes rapid- or short-acting insulin with intermediate-acting basal insulin with a peak. The person then injects the mixture before breakfast and again before their evening meal. Typical mixes include Mixtard 30 (30 per cent Actrapid and 70 per cent Insulatard) and Humalog Mix 25 (25 per cent Humalog with 75 per cent intermediate).



People following this regimen may need regular meals and snacks because the intermediate insulin, which acts as the basal insulin, also provides the 'bolus' for the midday meal when its action peaks. They will often need to eat in the middle of the day, whether they want to or not: once the insulin has been administered, it needs to be balanced. Similarly, there is a night-time peak, so they may also need a bedtime snack in order to prevent hypoglycaemia.

Pre-mixed insulins using a standard short-acting insulin such as Mixtard 30 or Humulin M3 predispose people to mid-morning and night-time hypos because the short-action component lasts longer than is actually needed, and therefore tends to overlap with the onset of

the intermediate-acting insulin. Another disadvantage is that these mixtures should be injected half an hour before breakfast and the evening meal, rather than immediately before or after eating. People using pre-mixed insulin analogues such as Humalog Mix 25 or NovoMix 30 can 'jab and eat', and are less likely to need snacks between meals and at bedtime.

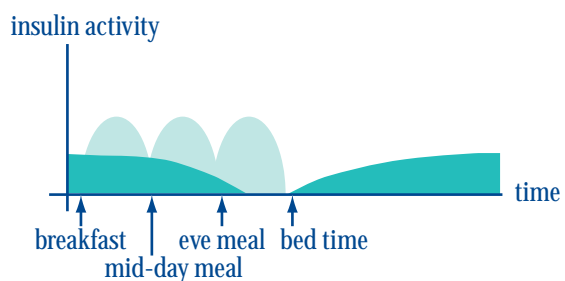
### Case study: Rosemary

Rosemary, 66, has had Type 2 diabetes for 16 years. She is extremely overweight, with a BMI of 42. She has coronary heart disease and renal failure. Her HbA1c is 8.5 per cent. She takes 320 mg of gliclazide a day, but has stopped taking metformin because of her renal disease. Rosemary is trying hard to keep her weight steady, so she doesn't want to have to eat too many snacks.

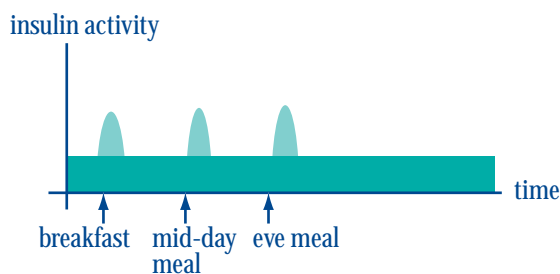
She therefore chooses NovoMix 30 before breakfast and her evening meal. She likes the FlexPen, and the convenience of being able to 'jab and eat'. She has had no hypos and her HbA1c is the lowest it's been for a long time at 7.3 per cent. Rosemary needs 56 units in the morning and 64 in the evening; the pen can deliver up to 70 units at a time.

### Multiple injection therapy (basal/bolus)

This regimen is closer to the way the body works naturally. The person uses 'basal' insulin once a day, at the same time each day, with a 'bolus' at meal-times. This gives people much greater flexibility over when and what they can eat. Taking intermediate basal insulin with peaks, such as Insulatard or Humulin I at bedtime, in combination with a short-acting bolus such as Actrapid or Humulin S half-an-hour before meals, is usually effective in Type 2 diabetes.



The peak of intermediate-acting insulin activity during the night, and the long duration of the older short-acting insulin taken before the evening meal, can cause hypoglycaemia in some people. It may be appropriate to switch to the newer insulin analogues, which are physiologically more suitable, if bedtime snacks fail to prevent night hypos, or if blood glucose levels are too high before the evening meal because the bedtime dose of intermediate insulin has run out. Intermediate-acting insulin could be replaced with one of the newer long-acting peakless insulins once daily, and/or the short-acting insulin could be replaced with a rapid-acting bolus such as Humalog or NovoRapid just before or just after eating. However, this approach is not recommended by the NICE guidelines for routine use in Type 2 diabetes (NICE 2002a).



### Case study: Barry

Barry, 38, has had Type 2 diabetes for three years. He is quite slim, with a BMI of 23, and is starting to lose weight. He is on maximum OHAs, and his HbA1c is 10.6 per cent. Barry works shifts in a bakery, and is scared of hypos, as he often works alone at night with extremely hot ovens.

Barry knows he needs to start insulin, but he is concerned about whether a twice-daily pre-mixed insulin would fit into his erratic lifestyle. He would therefore prefer a more flexible multiple injection regimen, with long-acting peakless insulin at 6 pm every evening, and a rapid-acting insulin analogue when he eats.

## Matching the regimen to the person

For every person, there will be a range of possible treatments and no one 'right' choice. Whichever option is chosen, there must always be a clear rationale behind the decision. Here are some considerations:

Basal with OHAs may be a good choice for people:

- ◆ who are overweight and insulin resistant
- ◆ who are reluctant to start insulin (for example, due to needle phobia)
- ◆ who are unable to inject themselves
- ◆ for whom optimising control is not vital (for example, an older person with no complications or undue symptoms) but hypoglycaemia is unacceptable.

Twice-daily pre-mixed insulin may be a good choice for people:

- ◆ with fairly regular lifestyles, who eat similar amounts at similar times each day
- ◆ who are becoming insulin-depleted, and where OHAs are no longer stimulating efficient insulin production leading to high blood glucose after meals.

Multiple injection therapy may be a good choice for people:

- ◆ who need flexibility because of an erratic lifestyle, shiftwork, regular travelling across time zones, or regular sport
- ◆ who need to optimise blood glucose control because of complications, illness or a wound.

The brand of insulin will usually depend on what kind of injection device the person prefers. A complete up to date list of insulin injection devices available in the UK, with full colour illustrations, is published regularly in MIMS for nurses.

## 4

## A step-by-step guide to starting insulin treatment

This section provides a practical guide to starting insulin, from choosing the most appropriate course of treatment to managing supplies of medication and equipment.

### Prepare yourself

Don't jump in with both feet. Have you used the Skills for Health *Diabetes National Workforce Competence Framework Guide (2004)* to identify the competencies required for starting insulin? Make sure you understand exactly what's involved. Is this within the scope of your professional practice? If not, seek help and supervision. Spend time with a diabetes specialist nurse and observe some insulin starts.

### Some key questions

Is there a clear need for insulin? Does the patient fully understand and agree? If they are still reluctant to start insulin, suggest a three-month trial period: very few people want to stop insulin once they have started, but the idea using it 'for life' can be daunting. If they refuse outright, you must respect their choice. It may be worth encouraging them to talk to someone who has already started insulin and is doing well.

Have you done a dummy injection? Many people think they will have to use a large needle, and inject into a vein. It's important to allay their fears, and show them how easy and painless injecting can be. They will then be able to concentrate on the rest of the discussion.

#### Dealing with dummy injections

Get it over with as soon as possible! Ask the person to simply insert the needle for a 'dry run'. It can be very reassuring for people to try this soon after diagnosis, long before insulin treatment is actually required.

Have you checked that the person already knows how to monitor their own blood glucose?

### First appointment, first injection

As a general guide, you should allow between half-an-hour and an hour for the first appointment. The amount of time you need will depend on the complexity of the chosen regimen and the person's mental alertness. You will need to cover the following points.

- ◆ Agree a date and time for the first injection. Ask the person to choose a convenient time, preferably when they will not need to drive for a few days. Some may wish to postpone it until after a holiday, or after Ramadan.
- ◆ Agree a place. Insulin starts can take place in an outpatient clinic, on a hospital ward, at a GP's surgery, or in the person's home. You can start people individually, or in groups.
- ◆ Encourage them to bring a partner or friend. Two heads are better than one when it comes to remembering what to do when alone at home. Most people will manage their injections themselves, but some will need support from a partner, carer or district nurse.
- ◆ Discuss whether or not they plan to carry on taking OHAs. NICE recommends continuing metformin, if tolerated (NICE, 2002b).
- ◆ Think about re-referring them to a dietitian for a full dietetic appraisal. This will increase understanding of where carbohydrates are found, how different carbohydrates affect blood glucose levels, and how to eat similar amounts at the same time each day.
- ◆ Provide a contact number for advice.

### Follow-up appointments

Ideally, the first injection would be near the beginning of the week so the person is fairly confident before the weekend. Telephone them the day after their first injection, and see them as often as necessary, gradually spacing out the appointments as their confidence grows.

### Choosing a delivery device

There are two main types of injection devices on the market. Some 'pens' come 'pre-loaded' with insulin, and are disposable. Others use cartridges of insulin that are inserted into a re-usable device. Pre-loaded injection devices can be easier to use, but are more expensive. Most cartridge pens are available on prescription. See the BNF (under 'Hypodermic equipment') or *MIMS for*

nurses (under 'Diabetes') to check the compatibility of pens and cartridges.

Give people the chance to try out different devices, and involve them in the final decision. You must take into account the person's manual dexterity - how heavy is the pen, and how easy is it to push in the insulin - and the size of dose they are likely to need. Some devices will deliver a bigger maximum dose than others.

If the person is visually impaired, you should also consider:

- ◆ whether the pen has an audible click on dialling
- ◆ the size of the numbers on the dial
- ◆ whether appropriate magnifiers are available.

People who are frightened of needles may wish to use the NovoPen Penmate, which conceals the needle, while those with severe needle-phobia may want a completely needle-free device like the mhi-100. Traditional syringes and vials are still available if they prefer them.

## Teaching injection technique

- ◆ Make sure the person assembles the pen, attaches the needle, dials the dose and gives the injection themselves. You may need to guide them - but don't do it for them.
- ◆ Don't forget to do an air shot before each injection, especially if a new cartridge and/or needle has been fitted. An air shot will make sure the plunger is connecting, and expel air from the pen.
- ◆ If using intermediate or pre-mixed insulin, invert or rotate the pen at least 20 times to mix the insulin.
- ◆ Inject into clean skin with clean hands. Alcohol wipes are not recommended. Alcohol is an astringent and can make the injection more painful, as well as hardening the skin.
- ◆ To 'pinch up' or not to 'pinch up'? Insulin should be injected into soft fat, not muscle. To avoid intramuscular injection, slim people, or those using injection sites without much subcutaneous fat, may need to 'pinch up' and/or use a shorter needle length.
- ◆ Inject at a 90° angle.
- ◆ Push the needle in all the way.
- ◆ Needles come in 5, 6, 8, 12 and 12.7 mm lengths. Shorter needles reduce the fear of injections, and suit most people regardless of age or weight. A few people

prefer longer needles, but they may need to 'pinch up' or inject at an angle less than 90° to avoid injecting into a muscle.

- ◆ After the injection, leave the needle in the skin for 5 to 10 seconds to avoid leakage. With large doses, it may need to be left in for longer.
- ◆ Occasionally, there may be bleeding after the needle is withdrawn. Reassure the person, and advise them to apply gentle pressure for a couple of minutes to minimise bruising. They should not rub the area, as this may increase the rate of insulin absorption.

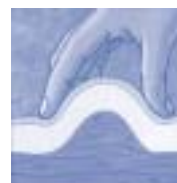
## Correct 'pinch up'

Use the thumb and index finger to pinch up the subcutaneous fat, leaving the muscle behind. Using the whole hand tends to pull up the muscle.

Correctly lifted skin fold



Incorrectly lifted skin fold



Lifted skin fold



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## Choosing an injection site

There are a number of alternatives.

- ◆ Abdomen - fastest absorption, usually plenty of subcutaneous fat, making it easy to do a pinch up. A good option for fast-acting insulin.
- ◆ Thighs - slower absorption. Best with intermediate-acting insulin, or the evening dose of a twice-daily insulin regimen. Very little subcutaneous fat laterally, so use a pinch up and/or short needles.
- ◆ Arms - medium to fast absorption. Make sure there is sufficient fat, and use short needles.
- ◆ Buttocks - slowest absorption. Use for intermediate or long-acting insulins. Plenty of subcutaneous fat, so no 'pinch up' is needed.

## Rotating injection sites

Repeatedly injecting into the same small area results in lumps (lipohypertrophy) which hinder insulin absorption and can be unsightly. Alternate between the left and right side on a weekly basis, and rotate sites within the same area. Each injection should be at least a

finger's breadth away from the last one. Check for lumps on a regular basis. If lipohypertrophy is found, that area should not be used for injection until it has become soft again. This may take weeks or even months, depending on the severity of the lipohypertrophy.

### Examples of lipohypertrophy



Lipohypertrophy of thighs



Lipohypertrophy of lower abdomen

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### Getting the dose right

Once-daily regimens often start with 10 units. Most twice-daily regimens start with 6-10 units twice daily, depending upon the person's build. There is no such thing as a 'correct' dose: starting low and working up will build the person's confidence and your own.

You should aim for a gradual improvement in blood glucose levels. Sudden normalisation of long-standing high blood glucose can sometimes cause rapid progression of diabetic retinopathy, insulin neuritis (see page 20) or 'pseudo hypos' (hypo symptoms at normal glucose levels).

See section 6 for detailed guidance on adjusting insulin dosage.

### Some points to remember

- ◆ Exercise - insulin will be absorbed faster by an exercising muscle. Advise the person not to inject into their arm if they're about to do the ironing, or into the thigh if planning to walk the dog or go shopping.
- ◆ Temperature - heat also speeds up the absorption of insulin. People should therefore avoid injecting immediately before or after a hot bath or shower.
- ◆ Injecting through clothing - people sometimes feel they need to do this, for example while travelling or in social situations, but it should be discouraged.

Injecting through the clothes affects the lubrication of the needle and makes it difficult to pinch up and/or check for bleeding.

### Storing insulin

- ◆ Spare insulin should be kept in the fridge at between 4 and 8° C.
- ◆ Cold insulin may take longer to absorb, and cause stinging. Give the insulin at least half-an-hour at room temperature before injecting.
- ◆ Insulated pouches will keep insulin cool in hot weather. Contact FRIO on 01437 741 700 or visit their website at [www.friouk.com](http://www.friouk.com)
- ◆ The insulin device or cartridge in use can be kept at normal room temperature for one month.
- ◆ Keep insulin away from children.
- ◆ Always check the expiry date.

### Supplies checklist

People must have:

- ◆ enough insulin (cartridges or pre-filled pens)
- ◆ an injection device and a spare (for people not using pre-filled devices)
- ◆ a box of needles
- ◆ a sharps bin
- ◆ written information including:
  - how to use the injection device
  - how to deal with hypoglycaemia
  - the name of the insulin product and doses advised
  - contact numbers
  - how to manage diabetes when unwell
- ◆ a blood glucose monitoring diary.

Finally, make sure the person knows how, when and where to get another prescription.

### Disposing of sharps

One-litre sharps bins are available on prescription. See the BNF under 'Sharpsbin'.

Check your local policy for disposing of full bins. In some places, they can be returned to GP surgeries, provided the premises are licensed with the Environment Agency.

The BD Safe Clip™, which cuts off used needles, is available on prescription. (See the BNF under 'Needle clipping device').

### Reusing needles

Manufacturers recommend that needles should be used once only. People with diabetes should be informed that after use:

- ◆ the needle will no longer be sterile
- ◆ insulin may block the needle
- ◆ the needle may be blunt or damaged - and that damaged needles can bend or break
- ◆ extremes of temperature can cause insulin to leak from the needle if it is not removed from the pen. This could change the relative concentrations of short- or intermediate-acting insulin in a mixture
- ◆ air may enter the insulin through the needle, which can lower the dose.

*Please note, it is important that the person is informed of the risk of sharps injury to family members, household visitors and refuse collectors. Careful and appropriate handling and disposal of sharps is of paramount importance.*

## 5

## Essential education

*'Structured education can improve knowledge, blood glucose control, weight and dietary management, physical activity and psychological wellbeing, particularly when this is tailored to the needs of the individual, and includes skills-based approaches to education.'*

*National Service Framework for Diabetes: Standards 2001*

Most people starting insulin should be aiming for self-management. The National Service Framework for Diabetes encourages the use of patient-held records and personal care plans. Understanding their condition - and taking responsibility for their own treatment - helps people maintain their independence, minimises the impact of their condition on their everyday life, and equips them to deal with any problems or complications that may arise.

Effective education is therefore essential. This can be broken down into three stages.

1. Immediate, ie education that takes place when starting insulin treatment.
2. Topics to be covered within the first few weeks of starting insulin.
3. Topics to be covered later, once the person is feeling more confident.

The subjects to be covered at each stage are outlined below. If you feel you are not qualified to teach any of these topics, ask your local diabetes specialist team for advice or consider referring your patient on.

### Stage 1 - immediate education

- ◆ Doses and timing - write it down!
- ◆ Injection technique, including rotating sites and disposing of sharps.
- ◆ Titration of doses, if appropriate at this stage. Some diabetes units use algorithms - ask at your local unit.
- ◆ Carbohydrates - regular intake of starchy carbohydrates will help stabilise blood glucose levels. People may need to be reminded which food groups these are.

- ◆ Hypoglycaemia - signs and symptoms, treatment and prevention (see below). Give the person an ID card showing that they are treated with insulin.
- ◆ Driving - people having insulin treatment must tell DVLA and their insurance company. Explain the dangers of hypoglycaemia while driving, as well as the driving restrictions that apply. For more information, see the Diabetes UK website at [www.diabetes.org.uk](http://www.diabetes.org.uk)
- ◆ Blood glucose monitoring - timing and frequency of tests, and interpreting the results.
- ◆ Weight gain - many people put on weight when they start insulin. They may need to cut their food intake if they want to maintain their current weight.
- ◆ Follow up and contact numbers - arrange a further appointment, and provide both a routine contact and an emergency number, for example the NHS Direct number (0845 4647) or a helpline run by the insulin manufacturer.

### The symptoms of hypoglycaemia

Hypoglycaemia is the main potential side effect of insulin therapy and it is essential that the person starting insulin, and their immediate family, know what symptoms to expect, how to reduce the risks of hypos and how to treat them.

Hypos occur when blood glucose levels are too low. Technically, hypoglycaemia occurs when blood glucose levels fall below 4 mmols/litre, but many people experience hypo symptoms at higher levels, depending on their own usual blood glucose levels. Too many hypos can lead to loss of hypo awareness.

Symptoms vary between individuals. Early symptoms may include: pallor; sweating; fast heart rate; trembling; anxiety; irritability; hunger; and tingling lips. Late hypo symptoms include: headache; poor concentration; poor co-ordination; glazed eyes; slurred speech; confusion; aggressive behaviour; double vision; weak legs; drowsiness; loss of consciousness; and seizures.

### Information is not enough

Providing information is not enough. Understanding hypoglycaemia, and knowing how to deal with it, is essential, so you will need to repeat the information several times and reinforce it in writing. Ask the person to repeat key facts and instructions back to you to check their understanding.

### Treating hypoglycaemia

Treat mild hypoglycaemia with 10-20g of fast-acting carbohydrate, for example three to six glucose tablets; 90 to 180 ml of a fizzy drink or squash (not the diet version); two teaspoons of sugar added to a cup of drink; or 50 to 100 ml of Lucozade.

This should cause the blood glucose to rise rapidly. Wait ten minutes for this to happen and, if it's a while before the next meal, this should be followed by some longer-acting, starchy carbohydrate, for example, a sandwich or some biscuits. If a meal is due, add some extra carbohydrate, for example bread, potatoes or pasta, to the meal. Chocolate has a low glycaemic index (because of its fat content) and is therefore not a good choice for treating hypoglycaemia.

In moderate hypoglycaemia, the patient may not be able to treat themselves, so their carer, partner, family and friends will need to know what to do. Hypostop dextrose gel, may be useful, but it must not be given to someone who is unconscious.

Severe hypoglycaemia, with loss of consciousness, where the patient needs glucagon, is extremely unlikely in Type 2 diabetes, but can happen in cases of renal failure, or when people are trying to keep their glucose levels as close to normal as possible, for example, during pregnancy.

### Identifying the causes of hypoglycaemia

- ◆ Did the person take their insulin at the appropriate time?
- ◆ Are they missing insulin doses, then overcompensating later?
- ◆ Are they missing meals?
- ◆ Are they changing the quality/quantity of food they eat - for example, in order to lose weight - without changing their insulin dose?
- ◆ Are hypos occurring on particular days of the week, for example, at weekends?
- ◆ Was alcohol a contributory factor?
- ◆ Was exercise a contributory factor?
- ◆ Was the hypo related to pre- or post-menstrual changes in blood glucose levels?
- ◆ Have the injection sites been checked for signs of lipohypertrophy?
- ◆ Does the person rotate injection sites frequently enough?
- ◆ If using pre-mixed or intermediate insulin, are they mixing it properly by inverting the pen at least 20 times?
- ◆ Is their blood glucose monitoring technique reliable?
- ◆ Do they need to review their diet?
- ◆ Are blood glucose levels being affected by hot weather, or by the person taking a hot bath or shower before their insulin injection?
- ◆ Is the person's insulin regimen right for them?
- ◆ Are they taking the right oral hypoglycaemic medication, and are they taking it as prescribed?

List adapted from the Glasgow Diabetes Project, *Guidelines for insulin initiation and adjustment in primary care in Type 2 diabetes*, 2003.

### A word of warning

*A 75 year old gentleman, new to insulin, had a hypoglycaemic coma in the doctor's waiting room. He had injected his morning insulin, but didn't stop for breakfast before driving to the surgery in case he was late for his appointment. The nurse, who had explained the risk of hypo many times, was enormously relieved that his journey to the surgery had been without incident.*

The trend for more people to be treated with insulin has led to increased frequency and severity of hypoglycaemia. The importance of checking the patient's understanding of hypo, especially in relation to driving, cannot be over-estimated.

## Stage 2 - the first few weeks

- ◆ Repetition - keep going over the information you covered in stage 1.
- ◆ Use the person's own experiences to demonstrate the effects of food, exercise and insulin on blood glucose levels. If they've had a hypo, try to work out how it could have been prevented, and what they can do differently in the future. See the checklist above.
- ◆ Adjusting the dose - discuss blood glucose levels, and teach dose titration.
- ◆ Sick day rules - make sure the person knows they must not stop taking insulin, even when unwell. They should test their blood more frequently, as a higher insulin dose may be required during illness. Suggest food substitutes they can use when suffering from nausea or vomiting. If blood glucose levels remain high, they should seek medical advice.
- ◆ Alcohol - explain that alcohol increases the risk of delayed hypoglycaemia, and that they should therefore eat while drinking alcohol. Extra insulin is not required.
- ◆ Eating out - advise the person on adjusting doses or altering the timing of their injections for special occasions.

## Stage 3 - ongoing education

Later on, people may need advice and guidance on the following areas.

- ◆ Forgotten injections - in Type 2 diabetes, missing the occasional injection should not cause any problems.
- ◆ Travel advice (see Holidays and travel, page 20).
- ◆ Fasting - for example, during Ramadan, will have a significant effect on blood glucose levels.
- ◆ The possible long-term complications of diabetes and how to reduce the risks.
- ◆ Screening and annual reviews.
- ◆ Contraception and pregnancy, where appropriate.
- ◆ Progression of the disease - people with Type 2 diabetes can expect a slow decline in glycaemic control over time, and will therefore need to keep reviewing their treatment regimen.

*'The provision of information, education and psychological support that facilitates self-management is the cornerstone of diabetes care.'*

*National Service Framework for Diabetes:  
Standards 2001*

## 6

## Adjusting the dose

### Remember:

High glucose levels - a higher insulin dose is needed

Low glucose levels - a lower insulin dose is needed

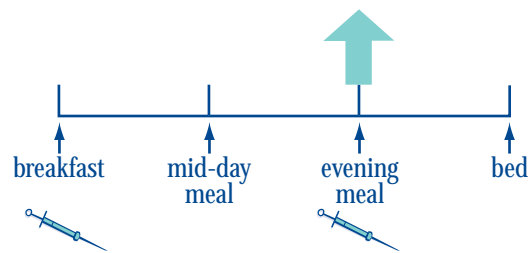
### Some basic principles

- ◆ Individual blood glucose target ranges should be agreed with the person.
- ◆ Don't adjust the dose in response to a single high result - look for patterns. Use the person's blood glucose monitoring diary to get the overall picture. The individual columns will show what's happening at different times of the day. You should also check the comments column: is there a connection between blood glucose levels and the person's comments?
- ◆ Consider the person's insulin type and doses. Does this have a bearing on their results? A large rise or fall in blood glucose over a short period of time, for example, between breakfast and lunch, may be related to diet, but it may also indicate that the insulin type or mixture is not appropriate for that person.
- ◆ Ask the person what they think of the results, and what action they think is needed. This will help them build up the confidence to adjust their own insulin doses.
- ◆ Generally, insulin doses are increased in 10 per cent increments.
- ◆ Preventing hypoglycaemia should always take precedence over correcting hyperglycaemia. Where hypoglycaemia has been a problem, insulin doses should be reduced by at least 20 per cent. Hypoglycaemia is potentially dangerous, and can seriously knock the person's confidence. If the reduction is too great, you can always cautiously increase the dose again.
- ◆ After considering what action is required (and before giving advice) consider the knock-on effect of your proposed action. Are you solving one problem only to create another?

### Adjusting twice-daily insulin

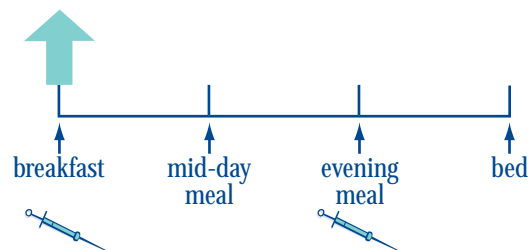
The morning dose controls blood glucose levels throughout the day, while the evening dose controls glucose levels after the evening meal and throughout the night. Twice-daily insulin doses can be adjusted from day-to-day, according to the person's planned level of physical activity.

#### Raised glucose levels before the evening meal



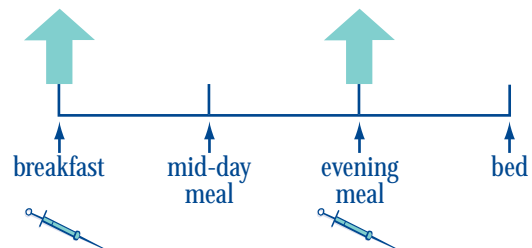
Increase morning insulin by 10 per cent. For example, if the usual morning dose is 20 units, increase it to 22 units.

#### Raised glucose levels before breakfast



Increase evening insulin by 10 per cent. For example, if the usual evening dose is 18 units, increase it to 20 units.

#### Raised glucose levels before breakfast and the evening meal



Increase both doses of insulin by 10 per cent. For example, a morning dose of 44 units would be increased to 48 units, and an evening dose of 36 units would be increased to 40 units.

## Adjusting once-daily insulin

Once-daily insulins such as Lantus or Levemir are designed to work throughout a 24-hour period. Pre-breakfast (fasting) blood glucose levels give a good indication of their effectiveness. After starting insulin treatment (usually with about 10 units daily) the dose should be titrated every 3-7 days according to a simple schedule, until the target is achieved. For example:

Average fasting blood glucose	Insulin dose increase per day
Over 10 mmol/litre	6-8 units
8-10 mmol/litre	4-6 units
6-8 mmol/litre	2-4 units

Later on, the insulin dose can be increased by 10 per cent if three consecutive fasting blood glucose results are higher than the individual target level agreed.

When fasting glucose levels are satisfactory, monitor blood glucose levels later in the day. 'Peakless' insulins will not usually lower meal-time (prandial) rises in blood glucose. If these rises cannot be adequately controlled with a combination of long-acting insulin and OHAs (generally sulphonylureas), the person will need to add short- or rapid-acting insulin to their regimen.

## Adjusting multiple injection therapy

People who add short- or rapid-acting meal-time insulin to their once-daily insulin regimen can continue their current dose of long-acting insulin, and simply include a dose of fast-acting insulin before each main meal.

For those choosing a multiple injection regimen from the start of insulin treatment, try starting with one-third of the daily total insulin dose as long-acting insulin. Divide the remaining two-thirds - the fast-acting insulin - between the three main meals.

Adjust the long-acting insulin to achieve satisfactory pre-breakfast blood glucose levels: reduce the dose if the blood glucose is too low during the night or before breakfast, and increase the dose if glucose levels are too high before breakfast.

Adjust the short-acting insulin to achieve satisfactory glucose levels after meals.

## Dose adjustment in practice

This is John's chart. He is taking 22 units of Humulin M3 in the morning and 18 units in the evening. He feels tired. What would you advise?

### John's chart

Date	Breakfast	Lunch	Evening meal	Bed	Comment
May 1	12.4				
2		14.3			
3			11.7		
4				15.7	
5	13.0				
6		15.1			
7	15.4		14.4		
8				18.9	
9	11.2				
10		14.6			
11			14.8		
12				15.6	
13	15.5				
14		14.9			
15			14.1		

Suggested advice: Increase both insulin doses by 10 per cent and review weekly.

Mrs Stevenson has been on insulin for five weeks. She takes 16 units of Mixtard 30 in the morning and 16 in the evening. Looking at her chart, can you see what the problem is? What should she do about it?

#### Mrs Stevenson's chart

Date	Breakfast	Lunch	Evening meal	Bed	Comment
July 1	7.1				
2		9.3			
3			12.6		
4				12.2	
5	8.4				
6		10.1			
7			14.4		
8				13.9	
9	6.2				
10		9.7			
11			11.1		
12				15.0	
13	7.0				
14		11.1			
15			14.9		

Suggested advice: Mrs Stevenson is not taking enough insulin before breakfast, so her blood glucose levels are rising throughout the morning and afternoon. She should increase her morning dose by 10 per cent. Later, when her blood glucose level is improved (lower) before her evening meal, she may need to reduce her evening dose to prevent early morning hypos.

Mrs Reynolds has been on insulin for 18 years. She takes 64 units of Mixtard 30 in the morning, and 48 units in the evening. She is feeling poorly, and thinks it might be her diabetes. What advice would you give her?

#### Mrs Reynolds' chart

Date	Breakfast	Lunch	Evening meal	Bed	Comment
Jan 11	12.9				
12					
13					
14					
15	13.8				
16					
17				7.1	
18					
19					
20					
21					
22					
23					
24					
25			10.1		

Suggested advice: Increase the number of tests to get a clearer picture of Mrs Reynolds' blood glucose profile. She may need to see her GP in the meantime if she continues to feel unwell.

Jason is on 30 units of Humulin M3 in the morning, and 20 units in the evening. He is worried about his high blood glucose levels. What should he do about it?

### Jason's chart

Date	Breakfast	Lunch	Evening meal	Bed	Comment
Dec 1			7.4		
2				12.2	
3	10.6				
4		5.3			
5			8.1		
6				13.3	
7	11.0				
8		6.1			
9			7.9		
10				10.9	
11	14.9				
12		8.6			
13			8.2		
14				11.6	
15	16.3				

Suggested advice: increase the evening dose by 10 per cent. Once his pre-breakfast readings have improved, Jason may also need to make a corresponding reduction to the morning dose to prevent late morning hypos.

Jane has lost weight recently, and started taking regular exercise. She takes 40 units of Humulin M3 in the morning and 36 units in the evening. Would you change anything?

Date	Breakfast	Lunch	Evening meal	Bed	Comment
May 7	4.4				
8		3.3	14.6		Hypo lunch
9			7.1		
10				4.7	
11	3.2				
12		4.1			
13			4.3		
14				8.2	
15	4.0				
16		4.9			
17			hypo		
18				3.7	
19	5.1				
20		3.6			
21			2.9		

### Jane's chart

Suggested advice: reduce both doses by 20 per cent. Jane is currently likely to be feeling tired, and possibly worried about hypos. Her diabetes control is too tight. You should reiterate the principles of hypo prevention and management. In the light of recent changes to her lifestyle, Jane may also want to consider a different insulin regimen.

## 7

## Dealing with problems and challenges

### Needle phobia

The NovoPen 3 PenMate, for use with the NovoPen3 injection pen, hides the needle and pushes it through the skin at the touch of a button. It costs £10 from the Unidrug Distribution Group (tel 01773 510123).

Autoinject 2, available from Owen Mumford (tel 01993 812021), hides a syringe. A single press of the button pushes the needle through the skin and delivers the insulin dose.

The mhi-500 needle-free insulin delivery system (available on prescription) is cumbersome, but can be useful for those (rare) individuals with true needle phobia.

### Insulin allergy

Occasionally, people may have a localised allergic reaction to injected insulin. The usual cause is sensitivity to a particular preservative. Different insulin manufacturers use different preservatives, so the problem can usually be solved by switching products. Ask your local specialist team for advice.

### Insulin neuritis

‘You told me insulin would make me feel better, but the pains in my legs are unbearable. I feel worse than before.’

Rapid improvement of glycaemic control following the initiation of insulin can trigger acute symptomatic neuropathy. Fortunately, this will only be temporary.

### Insulin oedema

Salt and water retention can cause temporary oedema after starting insulin treatment.

### Insulin treatment in palliative care

The aim of the insulin treatment should be to control the symptoms only. Consider simplifying the insulin regimen, for example replacing multiple injections with once- or twice-daily insulin. If there is no history of ketosis, you could consider discontinuing insulin treatment altogether.

### Altered vision

Changes in blood glucose can lead to altered vision. Again, this should only be temporary. You should advise people against changing their glasses until their blood glucose levels have settled down.

### Religious and cultural considerations

Although people with health problems are usually exempt from religious fasts, some people who are on insulin nevertheless prefer to observe them. People who are fasting all day and eating in the evening, for example during Ramadan, may need to significantly reduce the morning insulin dose and increase the evening dose. Another option could be a once-daily dose of rapid-acting insulin before the meal at sunset, with a once-daily long-acting insulin at bedtime.

### Steroid-induced hyperglycaemia

Insulin doses will usually need to be significantly increased during steroid treatment. Likewise, to avoid hypoglycaemia when steroid treatment is discontinued, insulin doses should be reduced.

### Holidays and travel

Aiming for perfect control is unrealistic. Remember to take into account time differences, particularly when travelling from east to west. Injections taken further apart than usual are unlikely to cause problems, but injections taken too close together could lead to hypoglycaemia.

Insulin must not be stored in the aircraft's baggage hold, where it would be denatured by the freezing temperatures. It's a good idea to carry some spare insulin and equipment in a separate bag in case luggage is lost or stolen. A FRIO bag (with cooling gel activated by cold water) may be useful for insulin storage in hot countries.

The person should carry an ID card, such as a Diabetes UK card, with their photo and their doctor's signature. Some airlines require a doctor's letter.

People should carry some extra snacks. Advise against ordering 'diabetic' meals, which often don't have enough carbohydrate.

Travel insurance should cover diabetes and insulin treatment. However, some companies will not cover people for the first six months after they start insulin.

### Shift work

A once-daily injection of one of the new long-acting insulin analogues (Lantus or Levemir), given at the same time each day, can be supplemented with rapid-acting insulin or an oral prandial glucose regulator (for example, repaglinide) before meals, whenever those meals are taken.

### Diabetes and other conditions

The specialist team will usually get involved when diabetes is complicated by other conditions such as renal impairment, coeliac disease or thyroid disease. Ante-natal care for pregnant women with diabetes will usually be provided at joint clinics staffed by a consultant diabetologist, a consultant obstetrician, a diabetes specialist nurse and a specialist midwife.

## 8

## Conclusion

The shift of responsibility for the routine management of diabetes brings exciting new challenges and opportunities for nurses.

Throughout this guide, we have encouraged readers to seek specialist advice at every opportunity, in order both to ensure the highest possible standards of patient care, and to develop their own knowledge and expertise.

Patients should also be encouraged to take responsibility for their own care as far as possible. A good understanding of their own condition and how to treat it increases the chances of effective control of blood glucose levels, which will minimise the risk of complications. Educating people with diabetes, their carers, partners and families is therefore a vitally important part of the nurse's role.

We hope that reference to this booklet - in conjunction with local guidance and input from diabetes specialists - will lead to increased knowledge and expertise for both nurses and patients, and improved health and wellbeing for people with Type 2 diabetes requiring insulin treatment.

# Glossary

## **BNF**

British National Formulary

## **Glucagon**

A hormone produced by the alpha cells in the islets of Langerhans in the pancreas. Glucagon stimulates the conversion of liver glycogen to glucose. Injecting a manufactured preparation of glucagon can treat severe hypoglycaemia

## **Glycaemic index (GI)**

A method of measuring the effect of particular foods on blood glucose levels. Slowly absorbed foods have a low GI rating, while quickly absorbed foods have a high rating

## **HbA<sub>1c</sub> (Glycated haemoglobin)**

An indicator of glycaemic control during the previous six to eight weeks. The lowest risk of long-term diabetic complications is in people whose average HbA<sub>1c</sub> is closest to the normal range (below 6.0%)

## **Hypostop**

A dextrose gel, available on prescription, for the treatment of hypoglycaemia

## **Insulin analogue**

A modern insulin preparation genetically engineered (by changing the nucleic acid sequence of the insulin gene) so that its action more closely resembles the normal physiological action of insulin in a person without diabetes

## **Ketosis**

A state of severe insulin deficiency. Untreated, ketosis can lead to coma and death

## **Metformin**

First line oral treatment for Type 2 diabetes, especially for overweight people. It reduces insulin resistance. Glucophage (metformin) SR has the advantage of being a once-daily dose and may also be less likely to cause gastro-intestinal side effects.

## **MIMS**

Monthly Index of Medical Specialties. MIMS and MIMS for nurses are available free of charge to individuals meeting the publisher's criteria. Call 0800 626387 for details

## **Sulphonylurea**

A class of common oral medication for Type 2 diabetes derived from sulphonamides. Drugs in this group stimulate insulin secretion. Gliclazide is an example

## **Type 1 diabetes**

Raised blood glucose levels caused by insulin deficiency. People with Type 1 diabetes are dependent on injections of insulin to survive

## **Type 2 diabetes**

Raised blood glucose probably due to a combination of impaired insulin secretion and resistance to the action of insulin on the target cells. Type 2 diabetes is usually a progressive disease, which often eventually requires treatment with insulin to achieve optimal glucose control. However, insulin is not essential for survival

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Skills for Health (2004) *Diabetes National Workforce Competence Framework Guide*. Available at [www.skillsforhealth.org.uk](http://www.skillsforhealth.org.uk)

UK Prospective Diabetes Study. Available online at [www.dtu.ox.ac.uk/index.html?maindoc=/ukpds/](http://www.dtu.ox.ac.uk/index.html?maindoc=/ukpds/)

## Useful contacts

Aventis Pharma Ltd  
Telephone: 01732 584000

BD Medical - Diabetes Care  
[www.bddiabetes.co.uk](http://www.bddiabetes.co.uk)  
Telephone: 01865 748844

CP Pharmaceuticals Ltd  
Telephone: 01978 661261

Diabetes UK  
[www.diabetes.org.uk](http://www.diabetes.org.uk)  
Telephone: 020 7424 1000

Eli Lilly and Co Ltd  
Telephone: 01256 315999

NICE (National Institute for Clinical Excellence)  
[www.nice.org.uk](http://www.nice.org.uk)

Novo Nordisk Pharmaceuticals Ltd  
Telephone: 01293 613555

RCN diabetes nursing forum  
[www.rcn.org.uk/diabetes](http://www.rcn.org.uk/diabetes)

RCN Direct  
24-hour information and advice for RCN members  
Telephone: 0845 772 6100

The Safer Needles Network campaign  
[www.saferneedlesnow.net](http://www.saferneedlesnow.net)

UK association of diabetes specialist nurses  
[www.diabetesnurse.org.uk](http://www.diabetesnurse.org.uk)  
Telephone: 0115 927 3742





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