

How can the DSN help overcome barriers to insulin use?

Mike Smith

ARTICLE POINTS

1 The DSN can help people with diabetes to make informed choices about available treatment strategies.

2 Barriers to insulin use include the device for insulin delivery, weight gain and hypoglycaemia.

3 People with diabetes differ in confidence, physical dexterity and visual skills and these factors have an impact on the selection of injection device.

4 New insulins are being developed which reduce the risk of hypoglycaemia and weight gain that is associated with older insulins.

5 DSNs are well placed to ensure that people with diabetes use the most appropriate insulin regimen and device for their individual needs.

KEY WORDS

- Insulin therapy
- Barriers
- DSN
- Side-effects
- Individual needs

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Introduction

DSNs have a central role in the education of people with diabetes about the effective use of insulin therapy. Barriers to adherence to insulin regimens can be removed and people with diabetes be made aware of new and improved devices and insulins that could help them. This article considers three of the barriers to adherence to insulin use: hypoglycaemia, weight gain and the injection device. Suggestions for helping remove these barriers are made and the latest advances in insulin treatment are highlighted.

It is well established that good blood glucose control can prevent or delay the onset of complications of diabetes (DCCT Group, 1993; UKPDS Group, 1998; ADA, 2001; Diabetes UK, 2003).

'For people with type 1 diabetes, insulin is the mainstay of blood glucose management and is essential for survival. For people with newly diagnosed type 2 diabetes, the majority of whom are overweight, weight loss and increased physical activity are the first intervention, followed by the addition of oral medication, as appropriate.' (DoH 2001)

There is evidence and arguments to use insulin earlier in type 2 diabetes to achieve better control of this progressive disease early on (Ratzmann, 1991; Van der Does et al, 1996). Initiation of insulin therapy in type 2 diabetes is beneficial in terms of quality of life, cognitive functions and wellbeing (Ratzmann, 1991; Van der Does et al, 1996).

DSNs have a central role in easing patient compliance with insulin therapy. Patients need psychological support and practical guidance to become confident, positive and effective when they inject insulin. The DAWN study (Diabetes, Attitudes, Wishes and Needs) was a psychosocial survey of the perceptions and attitudes of over 5000 people with diabetes and almost 4000 healthcare professionals from 13 countries. Findings from the study indicated that specific social support and emotional wellbeing are pivotal to achieve effective self-management of diabetes (DAWN,

2001). DSNs are arguably the central figures for such psychosocial support of the majority of people with diabetes.

Making an informed choice about treatment options is also a vital part of encouraging patients to select the treatment that is most appropriate for them and gives the patient a stronger sense of control of their diabetes management. Here again, the DSN can have a positive role offering practical advice and experience on the different treatment strategies, including pharmacotherapies as well as lifestyle and behavioural aspects. The pharmacotherapy choices can be daunting and confusing for people with diabetes. Options include various oral antidiabetic drugs taken as monotherapy or in combination with each other, as well as a wide variety of insulin formulations, which, again, can be combined with oral drugs or used as monotherapy in differing levels of intensity.

The DSN is a mentor in the self-management of injection device and blood glucose readings. DSNs are well placed to ensure that people with diabetes receive the most advanced and convenient device for their individual needs. They are also in a position to identify people who use older insulin products and accept as inevitable side effects such as injection pain, inaccurate dose setting, hypoglycaemic episodes, weight gain and variable blood glucose control. The DSN's understanding and knowledge about up-to-date insulin

preparations and injection devices that reduce these outcomes is important to remove the psychological and physical barriers to the effective, confident use of insulin.

A measurable role

The benefits of the DSN are measurable. An audit by Yong et al (2002) of 43 insulin-treated people with diabetes who received DSN intervention (re-education, dietary advice and insulin dose adjustment) showed that 63% improved HbA_{1c} status, with no increase in body weight or hypoglycaemic episodes. Improvement in control was defined as a final HbA_{1c} <7.0% or a fall of >1% after 6 months. Foulkes and colleagues (1989) studied 213 people with type 2 diabetes in two general practices. Their research showed that structured personal diabetes care based on a nurse-coordinated service increased the proportion of people with diabetes receiving their care entirely from general practice from 22% to 60% in 2 years. Thus, DSNs are able to positively impact on the efficiency of healthcare resource utilisation as well as patient outcomes.

Three barriers to use of insulin

There are a number of significant barriers to insulin therapy that affect the compliance of people with diabetes to insulin regimens. Practical barriers to insulin therapy are funding, education, support, waiting lists, the skills of primary care workers and psychological barriers such as needle-phobia. The three barriers discussed in this article are:

- The device for delivering insulin
- Weight gain
- Hypoglycaemia.

As well as knowing the specific needs of individual patients, DSNs need to maintain an awareness of treatment developments that could address these needs, such as insulin analogues with improved pharmacokinetic profiles, or injection devices designed to improve dosing accuracy, discretion or facilitate self-administration in other ways.

Injection device

People with diabetes differ in confidence, physical dexterity and visual skills and these

factors have an impact on the selection of a device. The insulin pen is undoubtedly the most popular insulin delivery device for people with diabetes, especially as these devices are becoming smaller and more discrete to use.

State-of-the-art injection devices

The first insulin pen was produced in 1985 (the NovoPen). Since then, insulin pens have evolved and been refined, and needles have become finer to make insulin injection easier, safer and less painful. Efforts have been made to eliminate the risk of 'over-dialling' of the insulin dose, and devices have been developed that can be manipulated by those with dexterity problems such as the very young, the elderly and those with arthritic problems. In addition, scales have been made clearer to help those with poor vision.

The evidence

Studies that test the acceptability of new devices to people with diabetes and healthcare professionals have established that these refinements are real advances. Patients' acceptability of the latest generation of devices has been shown in two recent studies.

Lawton and Berg (2001) studied the preferences of 100 patients and 102 healthcare professionals, and found that four out of five of both groups preferred the latest device (FlexPen[®]) to two alternative devices (Humulin[®] Pen or Optiset[®]).

Similarly, in a study by Vora et al (2002) of 137 people with type 2 diabetes, eight out of every nine again preferred using this device (NovoMix[®]30 FlexPen[®]) to an alternative (Humalog[®] Mix 25TM Pen).

Weight gain with insulin

The anticipation of weight gain with insulin therapy and the discipline needed to counteract it are huge psychological burdens that can often make some patients feel negative about insulin therapy (Bryden et al, 1999).

Insulin omission in women with type 1 diabetes is common. In a recent study, 30% of women surveyed admitted to under-using insulin to reduce their weight (Bryden et al, 1999). In a study of 341 women aged 13-60

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2 The delivery of insulin through the insulin pen is undoubtedly the most popular and widespread insulin delivery device for people with diabetes, especially as these devices are becoming smaller and more discrete to use.

3 Devices have been developed that can be manipulated by those with dexterity problems such as the very young, the elderly and those with arthritic problems.

4 The anticipation of weight gain with insulin therapy and the discipline needed to counteract it are huge psychological burdens that can often make some people with diabetes feel negative about insulin therapy.

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1 The DSN should ask appropriate questions and carefully listen to the responses to establish whether defensive snacking is a contributing factor to weight gain.

2 Insulin detemir will soon be available in the UK, and shows promise in reducing the weight gain and hypoglycaemia side-effects of insulin therapy.

3 Standl et al (2002) found that insulin detemir lowered the risk of hypoglycaemia during the night.

4 Clinical trials have consistently shown that people with type 1 diabetes who are treated with insulin detemir do not gain weight in contrast to those treated with NPH insulin; significantly less weight gain with insulin detemir has also been reported in type 2 diabetes.

years with type 1 diabetes, 31% reported intentional insulin omission, and 8.8% reported frequent insulin omission (Polonsky et al, 1994). The women who omitted insulin had poorer glycaemic control, more diabetes-related hospitalisations, greater psychological distress, more fear of hypoglycaemia and higher rates of retinopathy and neuropathy.

For people with type 2 diabetes, weight gain can be an even more important issue because many are already overweight and have a poor cardiovascular risk profile. The prospect of further weight gain can therefore be a major barrier to the initiation or intensification of insulin for both patients and healthcare providers (Korytkowski, 2002). In addition, increased weight in type 2 diabetes is associated with increased insulin resistance, so weight gain may even compromise the efficacy of treatment (Albu and Raja-Khan 2003).

For many people with diabetes, the fear of hypoglycaemia can lead to eating regular snacks to protect against hypoglycaemic events, thus resulting in weight gain. This strategy may be used by patients who have a fear of night-time hypoglycaemia. The selection of a longer, smoother acting and more consistently performing insulin could enable the patient to have the confidence to break a habit that may be adding to their problems.

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Hypoglycaemia with insulin

Neutral Protamine Hagedorn (NPH) insulin currently accounts for over 80% of the insulin prescribed for basal therapy in the UK (NICE, 2003). NPH insulin is usually given at bedtime. Its peak tends to occur when the glucose levels are low at night, making nocturnal hypoglycaemia a risk. NPH insulin also needs to be resuspended thoroughly before injection. It is easy to fail to do this and so the injected dose can vary, and furthermore the absorption rate of NPH insulin from the injection site is highly variable. As a result, the effects of apparently similar doses injected by the same individual on different days are

variable. This unpredictability further increases the risk of hypoglycaemia.

Although the early analogue insulins have undoubtedly reduced episodes of hypoglycaemia, there is room for improvement.

State-of-the-art insulin

The new insulin analogue, insulin detemir (Levemir™), will soon be available in the UK, and shows promise in reducing the weight gain and hypoglycaemia side-effects of insulin therapy.

Hypoglycaemic episodes

Insulin detemir, along with other insulin analogues such as insulin glargine, has been shown to reduce the risk of hypoglycaemia in type 1 diabetes compared with NPH insulin (Standl et al, 2002; de Leeuw et al, 2002; Vague et al, 2002; Russell-Jones et al, 2003).

Vague et al (2002) carried out a 6 month study of 448 participants who had type 1 diabetes. The results showed that the overall risk of hypoglycaemia was 22% lower when insulin detemir was used instead of NPH insulin ($p < 0.05$), and 34% lower for nocturnal hypoglycaemia ($p < 0.005$). The advantage in nocturnal hypoglycaemia was maintained over 12 months in an extension of this study by de Leeuw and colleagues (2002).

In a study by Russell-Jones et al (2003), insulin detemir incurred a 26% lower risk of hypoglycaemia during the night ($p = 0.003$), while in a 12 month study by Standl et al (2002) a 29% risk reduction for nocturnal hypoglycaemia just failed to reach statistical significance ($p = 0.067$). It should be noted that in each of these studies, glycaemic control was at least as good with insulin detemir as with NPH insulin.

Weight gain

Relative benefits with respect to weight are also encouraging with insulin detemir. Comparative studies of people with type 1 diabetes have consistently shown that those individuals treated with insulin detemir have not gained weight on average, whereas those treated with NPH insulin have gained weight, the difference between treatments being statistically significant in every case (De Leeuw et al, 2002; Standl et

al, 2002; Vague et al, 2002; Russell-Jones et al, 2003). For example, in the long-term study by Standl et al (2002) the average body weight of people treated with insulin detemir and NPH insulin diverged over the study such that baseline-adjusted body weight was significantly lower with insulin detemir after 12 months. A weight loss of 0.3 kg was seen in the detemir group, while a 1.4 kg weight gain was observed in the NPH insulin group. Thus, the difference after 12 months was 1.7 kg ($p = 0.002$).

In type 2 diabetes, insulin detemir has also been reported to incur a reduced risk of weight gain. In a 6 month comparative study of 505 people with type 2 diabetes by Haak et al (2003), those treated with insulin detemir gained 0.9 kg, whereas those receiving NPH insulin gained 1.6 kg ($p = 0.02$).

The mechanism underlying the lack of weight gain seen with insulin detemir may be related to the reduced risk of nocturnal hypoglycaemia. This could perhaps lead to a reduction in the amount of 'defensive eating' by the patient to guard against these episodes. However, it is possible that the pharmacology of insulin detemir is directly responsible.

Conclusion

DSNs are well placed to ensure that patients receive the most advanced and convenient device for their individual needs. They are also in a position to identify patients who use older insulins who may have side effects that could be controlled if they were switched to a different insulin or insulin administration system. Awareness of modern insulin preparations that reduce the risk of hypoglycaemia, and weight gain, and of devices that are easy to use are important in removing the psychological and physical barriers to the effective, confident use of insulin. ■

ADA Position Statement (2001). Standards of medical care for patients with diabetes mellitus. *Diabetes Care* **24** (Suppl 1):S33-43

Albu J, Raja-Khan N. (2003) The management of the obese diabetic patient. *Primary Care* **30**(2):465-91

Bryden KS, Neil A, Mayou RA et al. (1999) Eating habits, body weight, and insulin misuse. A longitudinal study of teenagers and young adults with type 1 diabetes. *Diabetes Care* **22**:1956-60

DAWN Study (2001) <http://www.dawnstudy.com>

De Leeuw I, Vague P, Selam HJ, Skeie S, Elte JWF, Lang H, Draeger E (2002) Lower risk of nocturnal hypoglycaemia and favourable weight development in type 1 diabetic subjects after 12 months treatment with insulin detemir vs NPH insulin. *Diabetologia* **45**(Suppl.2): P799

DoH (2001) *National Service Framework for Diabetes: Standards*. Department of Health, London.

Diabetes Control and Complications Trial (DCCT) Research Group (1993) The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *New England Journal Medicine* **329**(14): 977-86

Diabetes UK. Position statement (1999). UKPDS - Implications for the care of people with type 2 diabetes. www.diabetes.org. Diabetes UK, London

Foulkes A, Kinmonth AL, Frost S, MacDonald D (1989) Organized personal care - an effective choice for managing diabetes in general practice. *Journal Royal College General Practitioners* **39**(328):444-47

Haak T, Tiengo A, Waldhausl W, Draeger E (2003) Treatment with insulin detemir is associated with predictable fasting blood glucose levels and favorable weight development in subjects with type 2 diabetes. *Diabetes* **52**(Suppl.1):A120

Korytkowski M (2002) When oral agents fail: practical barriers to starting insulin. *International Journal Obesity & Related Metabolic Disorders* **26**(Suppl. 3):S18-24

Lawton S, Berg B (2001) Comparative evaluation of FlexPen, a new pre-filled insulin delivery system, among patients and healthcare professionals. *Diabetes* **50** (Suppl 2): A440

NICE (2003) *Technology Appraisal Guidance No.53 Guidance on the use of long-acting insulin analogues* http://www.nice.org.uk/pdf/53_Insulin_analogues_full_guidance.pdf NICE, London

Polonsky WH, Anderson BJ, L, Lohrer PA et al. (1994) Insulin omission in women with IDDM. *Diabetes Care* **17**:1178-85

Ratzmann KP (1991) Psychological problems in diabetics with secondary failure of sulfonylureas. *Deutsche Medizinische Wochenschrift* **116**: 87-90

Russell-Jones D, Bolinder J, Simpson R et al. (2003) Once daily dosing with insulin detemir offers advantages compared to NPH insulin in subjects with type 1 diabetes. *Diabetes* **52** (Suppl1):A132 Abstract 565-P

Standl E, Roberts A, Lang H (2002) Long-term efficacy and safety of insulin detemir in subjects with type 1 diabetes. Favourable weight development and risk reduction of nocturnal hypoglycaemia. *Diabetes* **51** (Suppl 2): A115 Abstract 467-P

United Kingdom Prospective Diabetes Study (UKPDS) Group. (1998) Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet* **352**:837-53

Vague P, Selam JL, Skeie S et al. (2002) Insulin detemir is associated with more predictable glycaemic control and lower risk of hypoglycaemia compared to NPH insulin in subjects with type 1 diabetes. *Diabetes* **51**(Suppl 2): Abstract 473

Van der Does FEE, De Neeling JND, Snoek FJ, Kostense PJ, Grootenhuys PA, Bouter LM, Heine RJ (1996) Symptoms and well-being in relation to glycaemic control in type 2 diabetes. *Diabetes Care* **19**: 204-10

Vora JP, Nygaard-Pedersen L, Erichsen K, Hansen AB, Niskanen L (2002) *Patients with type 2 diabetes prefer using NovoMix 30 FlexPen™ than Humalog Mix 25™ Pen for administration of biphasic insulin analogue*. Poster no. 792, presented at: European Association for the Study of Diabetes annual meeting, Budapest, Hungary, September 2, 2002

Yong A, Power E, Gill G (2002) Improving glycaemic control of insulin-treated diabetic patients: a structured audit of specialist nurse intervention *Journal of Clinical Nursing* **11**(6):773-6

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