NICE National Institute for Health and Care Excellence

Type 1 diabetes

Diagnosis and management of type 1 diabetes in children, young people and adults

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Management from diagnosis

Children and young people with type 1 diabetes should be offered an ongoing integrated package of care by a multidisciplinary paediatric diabetes care team. To optimise the effectiveness of care and reduce the risk of complications, the diabetes care team should include members with appropriate training in clinical, educational, dietetic, lifestyle, mental health and foot care aspects of diabetes for children and young people.

At the time of diagnosis, children and young people with type 1 diabetes should be offered home-based or inpatient management according to clinical need, family circumstances and wishes, and residential proximity to inpatient services. Home-based care with support from the local paediatric diabetes care team (including 24-hour telephone access to advice) is safe and as effective as inpatient initial management.

Education

Children and young people with type 1 diabetes and their families should be offered timely and ongoing opportunities to access information about the development, management and effects of type 1 diabetes. The information provided should be accurate and consistent and it should support informed decision-making.

Monitoring glycaemic control

Children and young people with type 1 diabetes and their families should be informed that the target for long-term glycaemic control is an HbA_{1c} level of less than 7.5% without frequent disabling hypoglycaemia and that their care package should be designed to attempt to achieve this.

Diabetic ketoacidosis

Children and young people with diabetic ketoacidosis should be treated according to the guidelines published by the British Society for Paediatric Endocrinology and Diabetes.

Screening for complications and associated conditions

Children and young people with type 1 diabetes should be offered screening for:

- coeliac disease at diagnosis
- thyroid disease at diagnosis and annually thereafter until transfer to adult services
- retinopathy annually from the age of 12 years
- microalbuminuria annually from the age of 12 years
- blood pressure annually from the age of 12 years.

Psychosocial support

Children and young people with type 1 diabetes and their families should be offered timely and ongoing access to mental health professionals because they may experience psychological disturbances (such as anxiety, depression, behavioural and conduct disorders and family conflict) that can impact on the management of diabetes and well-being.

Key messages: adults

The Guideline Development Group reviewed the recommendations and summarised these key messages for implementation.

Patient-centred care

The views and preferences of individuals with type 1 diabetes should be integrated into their healthcare. Diabetes services should be organised, and staff trained, to allow and encourage this.

Multidisciplinary team approach

The range of professional skills needed for delivery of optimal advice to adults with diabetes should be provided by a multidisciplinary team. Such a team should include members having specific training and interest to cover the following areas of care:

- education/information giving
- nutrition
- therapeutics
- identification and management of complications
- foot care
- counselling
- psychological care.

Education for adults with diabetes

Culturally appropriate education should be offered after diagnosis to all adults with type 1 diabetes (and to those with significant input into the diabetes care of others). It should be repeated as requested and according to annual review of need. This should encompass the necessary understanding, motivation, and skills to manage appropriately:

- blood glucose control (insulin, self-monitoring, nutrition)

- arterial risk factors (blood lipids, blood pressure, smoking)
- late complications (feet, kidneys, eyes, heart).

Blood glucose control

Blood glucose control should be optimised towards attaining DCCT-harmonised HbA_{1c} targets for prevention of microvascular disease (less than 7.5%) and, in those at increased risk, arterial disease (less than or equal to 6.5%) as appropriate, while taking into account:

- the experiences and preferences of the insulin user, in order to avoid hypoglycaemia
- the necessity to seek advice from professionals knowledgeable about the range of available meal-time and basal insulins and about optimal combinations thereof, and their optimal use.

Arterial risk-factor control

Adults with type 1 diabetes should be assessed for arterial risk at annual intervals. Those found to be at increased risk should be managed through appropriate interventions and regular review.

Note should be taken of:

- microalbuminuria, in particular
- the presence of features of the metabolic syndrome
- conventional risk factors (family history, abnormal lipid profile, raised blood pressure, smoking).

Late complications

Adults with type 1 diabetes should be assessed for early markers and features of eye, kidney, nerve, foot and arterial damage at annual intervals. According to assessed need, they should be offered appropriate interventions and/or referral in order to reduce the progression of such late complications into adverse health outcomes affecting quality of life.

1 Guidance

Diabetes is a group of disorders with a number of features in common, of which raised blood sugar is the most evident. This guideline is concerned only with type 1 diabetes, a condition that aetiologically is a pure hormone-deficiency disease. However, because hormone replacement with insulin therapy is sub-optimal, acute and long-term complications are endemic despite the implementation of lifestyle and other disease management measures.

The guidance in Sections 1.1–1.5 relates to the care of children (people younger than the age of 11 years) and young people (those aged 11 years or older and younger than 18 years). The guidance in Sections 1.6–1.12 applies to adults (people aged 18 years or older).

Children and young people

The following guidance applies to children (people younger than 11 years) and young people (those aged 11 years or older and younger than 18 years).

The following terms are used to refer to specific age groups:

- neonates (0 weeks or older, and younger than 4 weeks)
- infants (4 weeks or older, and younger than 52 weeks)
- pre-school children (1 year or older, and younger than 5 years)
- primary school children (5 years or older, and younger than 11 years)
- young people (11 years or older, and younger than 18 years)
- adults (18 years or older).

Where children are too young to make informed decisions, their treatment and care should be discussed in consultation with their parents (or legal guardians). Some aspects of care will also require discussion with, or provision of information for, other family members (such as siblings) and carers who are not part of the family (for example, child minders and school staff).

1.1 Diagnosis and initial management

1.1.1 Diagnosis

1.1.1.1 The diagnosis of type 1 diabetes in children and young people should be based on the criteria specified in the 1999 World Health Organization report on the diagnosis and classification of diabetes mellitus.[1]

The symptoms and signs of type 1 diabetes include: hyperglycaemia (random blood glucose more than 11 mmol/litre), polyuria, polydipsia and weight loss.

1.1.1.2 Children and young people with suspected type 1 diabetes should be offered immediate (same day) referral to a multidisciplinary paediatric diabetes care team that has the competencies needed to confirm diagnosis and to provide immediate care.

1.1.1.3 Consideration should be given to the possibility of other types of diabetes (such as early-onset type 2 diabetes, other insulin resistance syndromes, maturity-onset diabetes in the young and molecular/enzymatic abnormalities) in children and young people with suspected type 1 diabetes who:

- have a strong family history of diabetes
- are obese at presentation
- are of black or Asian origin
- have an insulin requirement of less than 0.5 units/kg body weight/day outside a partial remission phase
- have no insulin requirement
- rarely or never produce ketone bodies in the urine (ketonuria) during episodes of hyperglycaemia
- show evidence of insulin resistance (for example, acanthosis nigricans)
- have associated features, such as eye disease, deafness, or another systemic illness or syndrome.

1.1.1.4 Children and young people with type 1 diabetes should be entered on a population-based, practice-based and/or clinic-based diabetes register.

1.1.2 Management from diagnosis

1.1.2.1 Children and young people with type 1 diabetes should be offered an ongoing integrated package of care by a multidisciplinary paediatric diabetes care team. To optimise the effectiveness of care and reduce the risk of complications, the diabetes care team should include members with appropriate training in clinical, educational, dietetic, lifestyle, mental health and foot care aspects of diabetes for children and young people.

1.1.2.2 Children and young people with type 1 diabetes and their families should be offered 24-hour access to advice from the diabetes care team.

1.1.2.3 Children and young people with type 1 diabetes and their families should be involved in making decisions about the package of care provided by the diabetes care team.

1.1.2.4 At the time of diagnosis, children and young people with type 1 diabetes should be offered home-based or inpatient management according to clinical need, family circumstances and wishes, and residential proximity to inpatient services. Home-based care with support from the local paediatric diabetes care team (including 24-hour telephone access to advice) is safe and as effective as inpatient initial management.

1.1.2.5 Children and young people who present with diabetic ketoacidosis should have their diabetic ketoacidosis treated in hospital according to the guidance outlined in this document.

Guidance relating to the treatment of diabetic ketoacidosis is presented in section 1.3.2.

1.1.2.6 Children with type 1 diabetes who are younger than 2 years of age and children and young people who have social or emotional difficulties, or who live a long way from hospital should be offered inpatient initial management.

1.1.2.7 Children and young people with type 1 diabetes and their families should be offered appropriate emotional support following diagnosis, which should be tailored to emotional, social, cultural and age-dependent needs.

1.1.3 Natural history of type 1 diabetes

1.1.3.1 Children and young people with newly diagnosed type 1 diabetes should be informed that they may experience a partial remission phase (or 'honeymoon period') during which a low dosage of insulin (0.5 units/kg body weight/day) may be sufficient to maintain an HbA_{1c} level of less than 7%.

1.1.3.2 Children and young people with type 1 diabetes should be informed that the use of multiple daily insulin injection regimens or continuous subcutaneous insulin infusion (or insulin pump therapy) will not prolong the partial remission phase, although these forms of therapy may be appropriate for optimising glycaemic control, especially in young people.

1.1.4 Essential education at diagnosis

1.1.4.1 Children and young people with newly diagnosed type 1 diabetes should be offered a structured programme of education covering the aims of insulin therapy, delivery of insulin, self-monitoring of blood glucose, the effects of diet, physical activity and intercurrent illness on glycaemic control, and the detection and management of hypoglycaemia.

1.2 Ongoing management

1.2.1 Education

1.2.1.1 Children and young people with type 1 diabetes and their families should be offered timely and ongoing opportunities to access information about the development, management and effects of type 1 diabetes. The information provided should be accurate and consistent and it should support informed decision-making.

1.2.1.2 Children and young people with type 1 diabetes and their families should be offered opportunities to discuss particular issues and to ask questions at each clinic visit.

1.2.1.3 The method of delivering education and content will depend on the individual and should be appropriate for the child's or young person's age, maturity, culture, wishes and existing knowledge within the family.

1.2.1.4 Particular care should be given to communication and the provision of information when children and young people with type 1 diabetes and/or their parents have special needs, such as those associated with physical and sensory disabilities, or difficulties in speaking or reading English.

1.2.2 Insulin regimens

While the insulin regimen should be individualised for each patient, three basic types of insulin regimen can be considered.

One, two or three insulin injections per day: these are usually injections of short-acting insulin or rapid-acting insulin analogue mixed with intermediate-acting insulin. The insulin preparations may be mixed by the patient at the time of injection.

Multiple daily injection regimen: the person has injections of short-acting insulin or rapid-acting insulin analogue before meals, together with one or more separate daily injections of intermediate-acting insulin or long-acting insulin analogue.

Continuous subcutaneous insulin infusion (insulin pump therapy): a programmable pump and insulin storage reservoir that gives a regular or continuous amount of insulin (usually in the form of a rapid-acting insulin analogue or short-acting insulin) by a subcutaneous needle or cannula.

See section 1.2.3 for more information about different types of insulin.

1.2.2.1 Pre-school and primary school children with type 1 diabetes should be offered the most appropriate individualised regimens to optimise their glycaemic control.

1.2.2.2 Young people with type 1 diabetes should be offered multiple daily injection regimens to help optimise their glycaemic control.

1.2.2.3 Multiple daily injection regimens should be offered only as part of a package of care that involves continuing education, dietary management, instruction on the use of insulin delivery systems and blood glucose monitoring, emotional and behavioural support, and medical, nursing and dietetic expertise in paediatric diabetes, because this improves glycaemic control.

1.2.2.4 Children and young people using multiple daily injection regimens should be informed that they may experience an initial increase in the risk of hypoglycaemia and short-term weight gain.

1.2.2.5 Children and young people with type 1 diabetes and their families should be informed about strategies for the avoidance and management of hypoglycaemia.

See section 1.3.1 for recommendations about management of hypoglycaemia.

1.2.2.6 Young people who do not achieve satisfactory glycaemic control with multiple daily injection regimens should be offered additional support and, if appropriate, alternative insulin therapy (once-, twice- or three-times daily mixed insulin regimens or continuous subcutaneous insulin infusion using an insulin pump).

1.2.2.7 Young people with type 1 diabetes who have difficulty adhering to multiple daily injection regimens should be offered twice-daily injection regimens.

1.2.2.8 Continuous subcutaneous insulin infusion (or insulin pump therapy) is recommended as an option for people with type 1 diabetes provided that:

- multiple-dose insulin therapy (including, where appropriate, the use of insulin glargine) has failed;[2] and
- those receiving the treatment have the commitment and competence to use the therapy effectively.

1.2.2.9 Continuous subcutaneous insulin infusion therapy should be initiated only by a trained specialist team, which should normally comprise a physician with a specialist interest in insulin pump therapy, a diabetes specialist nurse and a dietitian.

1.2.2.10 All individuals beginning continuous subcutaneous insulin infusion therapy should be provided with specific training in its use. Ongoing support from a specialist team should be available, particularly in the period immediately following the initiation of continuous subcutaneous insulin infusion. It is recommended that specialist teams should agree a common core of advice appropriate for continuous subcutaneous insulin infusion users.

1.2.2.11 Established users of continuous subcutaneous insulin infusion therapy should have their insulin management reviewed by their specialist team so that a decision can be made about whether a trial or a switch to multiple-dose insulin incorporating insulin glargine would be appropriate.

1.2.3 Insulin preparations

Different types of insulin are available for use in the insulin regimens for type 1 diabetes. They work for different lengths of time when injected subcutaneously. The appropriate insulin with its particular absorption profile should be matched to the person's needs in an attempt to obtain normal to near-normal blood glucose control. The main categories of insulin are:

- **rapid-acting insulin analogues:** these aim to work like the insulin normally produced to cope with a meal; they have an onset of action of approximately 15 minutes and a duration of action of 2–5 hours
- **short-acting insulins:** these work more slowly than rapid-acting insulin analogues; they have an onset of action of 30–60 minutes and a duration of action of up to 8 hours
- **intermediate-acting insulins:** these have an onset of action of approximately 1–2 hours, maximal effects between 4 and 12 hours and a duration of action of 16–35 hours
- **long-acting insulin analogues:** these can last for a longer period than intermediate-acting insulins; they are normally used once a day and achieve a steady-state level after 2–4 days to produce a constant level of insulin.

A biphasic insulin is a mixture of rapid-acting insulin analogue or short-acting insulin together with intermediate-acting insulin.

1.2.3.1 Children and young people with type 1 diabetes should be offered the most appropriate insulin preparations (rapid-acting insulin analogues, short-acting insulins, intermediate-acting insulins, long-acting insulin analogues or biphasic insulins) according to their individual needs and the instructions in the patient information leaflet supplied with the product, with the aim of obtaining an HbA_{1c} level of less than 7.5% without frequent disabling hypoglycaemia and maximising quality of life.

1.2.3.2 Children and young people with type 1 diabetes using multiple daily insulin regimens should be informed that injection of rapid-acting insulin analogues before eating (rather than after eating) reduces post-prandial blood glucose levels and thus helps to optimise blood glucose control.

1.2.3.3 For pre-school children with type 1 diabetes it may be appropriate to use rapid-acting insulin analogues shortly after eating (rather than before eating) because food intake can be unpredictable.

1.2.3.4 Children and young people with type 1 diabetes who use insulin preparations containing intermediate-acting insulin should be informed that these preparations should be mixed before use according to the instructions in the patient information leaflet supplied with the product.

1.2.4 Methods of delivering insulin

1.2.4.1 Children and young people with type 1 diabetes should be offered a choice of insulin delivery systems that takes account of their insulin requirements and personal preferences.

1.2.4.2 Children and young people with type 1 diabetes using insulin injection regimens should be offered needles that are of an appropriate length for their body fat (short needles are appropriate for children and young people with less body fat; longer needles are appropriate for children and young people with more body fat).

1.2.5 Non-insulin agents (oral antidiabetic drugs)

1.2.5.1 Children and young people with type 1 diabetes should not be offered acarbose or sulphonylureas (glibenclamide, gliclazide, glipizide, tolazamide or glyburide) in combination with insulin because they may increase the risk of hypoglycaemia without improving glycaemic control.

1.2.5.2 Metformin in combination with insulin is suitable for use only within research studies because the effectiveness of this combined treatment in improving glycaemic control is uncertain.

1.2.6 Monitoring glycaemic control

1.2.6.1 Children and young people with type 1 diabetes and their families should be informed that the target for long-term glycaemic control is an HbA_{1c} level of less than 7.5% without frequent disabling hypoglycaemia and that their care package should be designed to attempt to achieve this.

1.2.6.2 Children and young people with type 1 diabetes should be offered testing of their HbA_{1c} levels two to four times per year (more frequent testing may be appropriate if there is concern about poor glycaemic control).

1.2.6.3 Current HbA_{1c} measurements should be made available in outpatient clinics because their availability can lead to immediate changes in insulin therapy and/or diet and so reduce the need for follow-up appointments.

1.2.6.4 Children and young people with type 1 diabetes and their families should be informed that aiming to achieve low levels of HbA_{1c} can lead to increased risks of hypoglycaemia and that high levels of HbA_{1c} can lead to increased risks of long-term microvascular complications.

1.2.6.5 Children and young people with HbA_{1c} levels consistently above 9.5% should be offered additional support by their diabetes care teams to help them improve their glycaemic control because they are at increased risk of developing diabetic ketoacidosis and long-term complications.

1.2.6.6 Children and young people with type 1 diabetes should be encouraged to use blood glucose measurements for short-term monitoring of glycaemic control because this is associated with reduced levels of glycated haemoglobin. Urine glucose monitoring is not recommended because it is less effective and is associated with lower patient satisfaction.

1.2.6.7 Children and young people with type 1 diabetes and their families should be informed that the optimal targets for short-term glycaemic control are a pre-prandial blood glucose level of 4–8 mmol/litre and a post-prandial blood glucose level of less than 10 mmol/litre.

1.2.6.8 Children and young people with type 1 diabetes and their families should be encouraged to perform frequent blood glucose monitoring as part of a continuing package of care that includes dietary management, continued education and regular contact with their diabetes care teams.

1.2.6.9 Children and young people with type 1 diabetes and their families should be offered a choice of appropriate equipment for undertaking monitoring of capillary blood glucose to optimise their glycaemic control in response to adjustment of insulin, diet and exercise.

1.2.6.10 Children and young people using multiple daily injection regimens should be encouraged to adjust their insulin dose if appropriate after each pre-prandial, bedtime and occasional night-time blood glucose measurement.

1.2.6.11 Children and young people using twice-daily injection regimens should be encouraged to adjust their insulin dose according to the general trend in pre-prandial, bedtime and occasional night-time blood glucose measurements.

1.2.6.12 Children and young people with type 1 diabetes who are trying to optimise their glycaemic control and/or have intercurrent illness should be encouraged to measure their blood glucose levels more than four times per day.

1.2.6.13 Children and young people with type 1 diabetes and their families should be informed that blood glucose levels should be interpreted in the context of the 'whole child', which includes the social, emotional and physical environment.

1.2.6.14 Children and young people with type 1 diabetes who have persistent problems with hypoglycaemia unawareness or repeated hypoglycaemia or hyperglycaemia should be offered continuous glucose monitoring systems.

1.2.6.15 Children and young people with type 1 diabetes should be offered blood glucose monitors with memories (as opposed to monitors without memories) because these are associated with improved patient satisfaction.

1.2.6.16 Children and young people with type 1 diabetes should be encouraged to use a diary in conjunction with a blood glucose monitor because recording food intake and events such as intercurrent illness can help to reduce the frequency of hypoglycaemic episodes.

See section 1.4.4 for recommendations about cognitive disorders related to frequent hypoglycaemia.

1.2.7 Diet

1.2.7.1 Children and young people with type 1 diabetes should be offered appropriate dietetic support to help optimise body weight and glycaemic control.

1.2.7.2 Children and young people with type 1 diabetes and their families should be informed that they have the same basic nutritional requirements as other children and young people. The food choices of children and young people should provide sufficient energy and nutrients for optimal growth and development, with total daily energy intake being distributed as follows:

- carbohydrates – more than 50%
- protein – 10–15%
- fat – 30–35%.

The consumption of five portions of fruit and vegetables per day is also recommended. Neonates, infants and pre-school children require individualised dietary assessment to determine their energy needs.

1.2.7.3 Children and young people with type 1 diabetes should be encouraged to develop a good working knowledge of nutrition and how it affects their diabetes.

1.2.7.4 Children and young people with type 1 diabetes and their families should be informed of the importance of healthy eating in reducing the risk of cardiovascular disease (including foods with a low glycaemic index, fruit and vegetables, and types and amounts of fats), and means of making appropriate nutritional changes in the period after diagnosis and according to need and interest at intervals thereafter.

1.2.7.5 Children and young people with type 1 diabetes should be encouraged to consider eating a bedtime snack. The nutritional composition and timing of all snacks should be discussed with the diabetes care team.

1.2.7.6 Children and young people using multiple daily injection regimens should be offered education about insulin and dietary management as part of their diabetes care package, to enable them to adjust their insulin dose to reflect their carbohydrate intake.

1.2.7.7 Children and young people with type 1 diabetes should be offered education about the practical problems associated with fasting and feasting.

1.2.8 Exercise

1.2.8.1 All children and young people, including those with type 1 diabetes, should be encouraged to exercise on a regular basis because this reduces the risks of developing macrovascular disease in the long term.

1.2.8.2 Children and young people with type 1 diabetes and their families should be informed that they can participate in all forms of exercise, provided that appropriate attention is given to changes in insulin and dietary management.

1.2.8.3 Children and young people with type 1 diabetes wishing to participate in restricted sports (such as scuba diving) should be offered comprehensive advice by their diabetes care teams. Additional information may be available from local and/or national patient support groups and organisations.

1.2.8.4 Children and young people with type 1 diabetes and their families should be informed about the effects of exercise on blood glucose levels and about strategies for preventing exercise-induced hypoglycaemia during and/or after physical activity.

1.2.8.5 Children and young people with type 1 diabetes should be encouraged to monitor their blood glucose levels before and after exercise so that they can:

- identify when changes in insulin or food intake are necessary
- learn the glycaemic response to different exercise conditions
- be aware of exercise-induced hypoglycaemia
- be aware that hypoglycaemia may occur several hours after prolonged exercise.

1.2.8.6 Children and young people with type 1 diabetes, their parents and other carers should be informed that additional carbohydrate should be consumed as appropriate to avoid hypoglycaemia and that carbohydrate-based foods should be readily available during and after exercise.

1.2.8.7 Children and young people with type 1 diabetes, their parents and other carers should be informed that additional carbohydrate should be consumed if blood glucose levels are less than 7 mmol/litre before exercise is undertaken.

1.2.8.8 Children and young people with type 1 diabetes and their families should be informed that changes in their daily exercise patterns may require insulin dose and/or carbohydrate intake to be altered.

1.2.8.9 Children and young people with type 1 diabetes, their parents and other carers should be informed that exercise should be undertaken with caution if blood glucose levels are greater than 17 mmol/litre in the presence of ketosis.

1.2.9 Alcohol, smoking and recreational drugs

1.2.9.1 Young people with type 1 diabetes should be informed about the specific effects of alcohol consumption on glycaemic control, particularly the risk of (nocturnal) hypoglycaemia.

1.2.9.2 Young people with type 1 diabetes should be offered alcohol education programmes.

1.2.9.3 Young people with type 1 diabetes who drink alcohol should be informed that they should:

- eat food containing carbohydrate before and after drinking
- monitor their blood glucose levels regularly and aim to keep the levels within the recommended range by eating food containing carbohydrate.

1.2.9.4 Children and young people with type 1 diabetes and their families should be informed about general health problems associated with smoking and in particular the risks of developing vascular complications.

1.2.9.5 Children and young people with type 1 diabetes should be encouraged not to start smoking.

1.2.9.6 Children and young people with type 1 diabetes who smoke should be offered smoking cessation programmes.

1.2.9.7 Children and young people with type 1 diabetes and their families should be informed about the general dangers of substance misuse and the possible effects on glycaemic control.

1.2.10 Long-distance travel

1.2.10.1 Children and young people with type 1 diabetes and their families should be offered education about the practical issues related to long-distance travel, such as when best to eat and inject insulin when travelling across time zones.

1.2.11 Immunisation

1.2.11.1 Children and young people with type 1 diabetes and their families should be informed that the Department of Health[3] recommends annual immunisation against influenza for children and young people with diabetes over the age of 6 months.

1.2.11.2 Children and young people with type 1 diabetes and their families should be informed that the Department of Health[3] recommends immunisation against pneumococcal infection for children and young people with diabetes over the age of 2 months.

1.3 Complications and associated conditions

1.3.1 Hypoglycaemia

Hypoglycaemia can be classified as mild, moderate or severe. With mild hypoglycaemia the patient is aware of, responds to and self-treats the hypoglycaemia. Children aged below 5–6 years can rarely be classified as having mild hypoglycaemia because they are usually unable to help themselves. With moderate hypoglycaemia the patient cannot respond to hypoglycaemia and requires help from someone else, but oral treatment is successful. With severe hypoglycaemia the patient is semi-conscious or unconscious or in a coma with or without convulsions and may require parenteral therapy (glucagon or intravenous glucose).

1.3.1.1 Children and young people with type 1 diabetes, their parents and other carers should be informed that they should always have access to an immediate source of carbohydrate (glucose or sucrose) and blood glucose monitoring equipment for immediate confirmation and safe management of hypoglycaemia.

1.3.1.2 Children and young people, their parents, schoolteachers and other carers should be offered education about the recognition and management of hypoglycaemia.

1.3.1.3 Children and young people with type 1 diabetes should be encouraged to wear or carry something that identifies them as having type 1 diabetes (for example, a bracelet).

1.3.1.4 Children and young people with mild to moderate hypoglycaemia should be treated as follows.

- Take immediate action.

- The first line of treatment should be the consumption of rapidly absorbed simple carbohydrate (for example, 10–20 g carbohydrate given by mouth).
- The simple carbohydrate should raise blood glucose levels within 5–15 minutes.
- Carbohydrate given in liquid form may be taken more easily.
- It may be appropriate to give small amounts of rapidly absorbed simple carbohydrate frequently because hypoglycaemia may cause vomiting.
- As symptoms improve or normoglycaemia is restored additional complex long-acting carbohydrate should be given orally to maintain blood glucose levels unless a snack or meal is imminent.
- Additional complex long-acting carbohydrate is not required for children and young people using continuous subcutaneous insulin infusion.
- Blood glucose levels should be rechecked within 15 minutes.

1.3.1.5 Children and young people with severe hypoglycaemia should be treated as follows.

- In a hospital setting, 10% intravenous glucose should be used when rapid intravenous access is possible (up to 500 mg/kg body weight – 10% glucose is 100 mg/ml).
- Outside hospital, or where intravenous access is not practicable, intramuscular glucagon or concentrated oral glucose solution (e.g. Hypostop) may be used.
- Children and young people over 8 years old (or body weight more than 25 kg) should be given 1 mg glucagon.
- Children under 8 years old (or body weight less than 25 kg) should be given 500 micrograms of glucagon.
- Blood glucose levels should respond within 10 minutes.
- As symptoms improve or normoglycaemia is restored, in children and young people who are sufficiently awake, additional complex long-acting carbohydrate should be given orally to maintain blood glucose levels.

- Some children and young people may continue to have reduced consciousness for several hours after a severe hypoglycaemic episode, and repeat blood glucose measurements will be required to determine whether further glucose is necessary.
- Medical assistance should be sought for children and young people whose blood glucose levels fail to respond and those in whom symptoms persist for more than 10 minutes.

1.3.1.6 Parents and, where appropriate, school nurses and other carers should have access to glucagon for subcutaneous or intramuscular use in an emergency, especially when there is a high risk of severe hypoglycaemia.

1.3.1.7 Parents and, where appropriate, school nurses and other carers should be offered education on the administration of glucagon.

1.3.1.8 Children and young people with type 1 diabetes and their families should be informed that when alcohol causes or contributes to the development of hypoglycaemia, glucagon may be ineffective in treating the hypoglycaemia and intravenous glucose will be required.

See section 1.4.4 for recommendations about cognitive disorders related to frequent hypoglycaemia.

1.3.2 Diabetic ketoacidosis

1.3.2.1 Children and young people with diabetic ketoacidosis should be treated according to the guidelines published by the British Society for Paediatric Endocrinology and Diabetes.

1.3.2.2 Children and young people with diabetic ketoacidosis should be managed initially in a high-dependency unit or in a high-dependency bed on a children's ward.

1.3.2.3 Children and young people with deteriorating consciousness or suspected cerebral oedema and those who are not responding appropriately to treatment should be managed in a paediatric intensive care unit.

1.3.2.4 Children with diabetic ketoacidosis who are younger than 2 years of age should be managed in a paediatric intensive care unit.

1.3.2.5 Children and young people with a blood pH of less than 7.3 (hydrogen ion concentration of more than 50 nmol/litre), but who are clinically well (with no tachycardia, vomiting, drowsiness, abdominal pain or breathlessness) and less than 5% dehydrated, may respond appropriately to oral rehydration, frequent subcutaneous insulin injections and monitoring of blood glucose.

1.3.3 Surgery

1.3.3.1 Children and young people with type 1 diabetes should be offered surgery only in centres that have dedicated paediatric facilities for the care of children and young people with diabetes.

1.3.3.2 Careful liaison between surgical, anaesthetic and diabetes care teams should occur before children and young people with type 1 diabetes are admitted to hospital for elective surgery and as soon as possible after admission for emergency surgery.

1.3.3.3 All centres caring for children and young people with type 1 diabetes should have written protocols concerning the safe management of children and young people during surgery. The protocols should be agreed between surgical and anaesthetic staff and the diabetes care team.

1.3.4 Intercurrent illness

1.3.4.1 Children and young people with type 1 diabetes and their families should be offered clear guidance and protocols ('sick-day rules') for the management of type 1 diabetes during intercurrent illness.

1.3.4.2 Children and young people with type 1 diabetes should have short-acting insulin or rapid-acting insulin analogues and blood and/or urine ketone testing strips available for use during intercurrent illness.

1.3.5 Screening for complications and associated conditions

1.3.5.1 Children and young people with type 1 diabetes should be offered screening for:

- coeliac disease at diagnosis
- thyroid disease at diagnosis and annually thereafter until transfer to adult services
- retinopathy annually from the age of 12 years
- microalbuminuria annually from the age of 12 years
- blood pressure annually from the age of 12 years.

1.3.5.2 Routine screening for elevated blood lipid levels and/or neurological function is not recommended for children and young people with type 1 diabetes.

1.3.5.3 Children and young people with type 1 diabetes should be offered:

- annual foot care reviews
- investigation of the state of injection sites at each clinic visit.

1.3.5.4 Children and young people with type 1 diabetes and their families should be informed that, as for other children, regular dental examinations[4] and eye examinations (every 2 years) are recommended.

1.3.5.5 Children and young people with type 1 diabetes should have their height and weight measured and plotted on an appropriate growth chart and their body mass index calculated at each clinic visit. The purpose of measuring and plotting height and weight and calculating body mass index is to check for normal growth and/or significant changes in weight because these may reflect changing glycaemic control.

1.3.5.6 Children and young people with type 1 diabetes should have their height and weight measured in a private room.

1.3.5.7 The following complications, although rare, should be considered at clinic visits:

- juvenile cataracts
- necrobiosis lipoidica
- Addison's disease.

1.4 Psychological and social issues

1.4.1 Emotional and behavioural problems

1.4.1.1 Diabetes care teams should be aware that children and young people with type 1 diabetes have a greater risk of emotional and behavioural problems than other children and young people.

1.4.2 Anxiety and depression

1.4.2.1 Diabetes care teams should be aware that children and young people with type 1 diabetes may develop anxiety and/or depression, particularly when difficulties in self-management arise in young people and children who have had type 1 diabetes for a long time.

1.4.2.2 Children and young people with type 1 diabetes who have persistently poor glycaemic control should be offered screening for anxiety and depression.

1.4.2.3 Children and young people with type 1 diabetes and suspected anxiety and/or depression should be referred promptly to child mental health professionals.

1.4.3 Eating disorders

1.4.3.1 Diabetes care teams should be aware that children and young people with type 1 diabetes, in particular young women, have an increased risk of eating disorders.

1.4.3.2 Diabetes care teams should be aware that children and young people with type 1 diabetes who have eating disorders may have associated problems of

persistent hyperglycaemia, recurrent hypoglycaemia and/or symptoms associated with gastric paresis.

1.4.3.3 Children and young people with type 1 diabetes in whom eating disorders are identified by their diabetes care team should be offered joint management involving their diabetes care team and child mental health professionals.

1.4.4 Cognitive disorders

1.4.4.1 Parents of pre-school children with type 1 diabetes should be informed that persistent hypoglycaemia, in particular in association with seizures, is associated with a small but definite risk of long-term neurocognitive dysfunction.

1.4.4.2 Diabetes care teams should consider referring children and young people with type 1 diabetes who have frequent hypoglycaemia and/or recurrent seizures for assessment of cognitive function, particularly if these occur at a young age.

1.4.5 Behavioural and conduct disorders

1.4.5.1 Children and young people with type 1 diabetes who have behavioural or conduct disorders, and their families, should be offered access to appropriate mental health professionals.

1.4.6 Non-adherence

1.4.6.1 Non-adherence to therapy should be considered in children and young people with type 1 diabetes who have poor glycaemic control, especially in adolescence.

1.4.6.2 Non-adherence to therapy should be considered in children and young people with established type 1 diabetes who present with diabetic ketoacidosis, especially if the diabetic ketoacidosis is recurrent.

1.4.6.3 Young people with 'brittle diabetes' (that is, those who present with frequent episodes of diabetic ketoacidosis over a relatively short time) should have their emotional and psychological well-being assessed.

1.4.6.4 The issue of non-adherence to therapy should be raised with children and young people and their families in a sensitive manner.

1.4.7 Psychosocial support

1.4.7.1 Diabetes care teams should be aware that poor psychosocial support has a negative impact on a variety of outcomes of type 1 diabetes in children and young people, including glycaemic control and self-esteem.

1.4.7.2 Children and young people with type 1 diabetes, especially young people using multiple daily injection regimens, should be offered structured behavioural intervention strategies because these may improve psychological well-being and glycaemic control.

1.4.7.3 Young people with type 1 diabetes should be offered specific support strategies, such as mentoring and self-monitoring of blood glucose levels supported by problem solving, to improve their self-esteem and glycaemic control.

1.4.7.4 Families of children and young people with type 1 diabetes should be offered specific support strategies (such as behavioural family systems therapy) to reduce diabetes-related conflict between family members.

1.4.7.5 Children and young people with type 1 diabetes and their families should be offered timely and ongoing access to mental health professionals because they may experience psychological disturbances (such as anxiety, depression, behavioural and conduct disorders and family conflict) that can impact on the management of diabetes and well-being.

1.4.7.6 Diabetes care teams should have appropriate access to mental health professionals to support them in the assessment of psychological dysfunction and the delivery of psychosocial support.

1.4.8 Adolescence

1.4.8.1 Diabetes care teams should be aware that adolescence can be a period of worsening glycaemic control, which may in part be due to non-adherence to therapy.

1.5 Continuity of care

1.5.1 Communication between organisations

1.5.1.1 Children and young people with type 1 diabetes and their families should be offered information about the existence of and means of contacting local and/or national diabetes support groups and organisations, and the potential benefits of membership. This should be done in the time following diagnosis and periodically thereafter.

1.5.1.2 Diabetes care teams should liaise regularly with school staff involved in supervising children and young people with type 1 diabetes to offer appropriate diabetes education and practical information.

1.5.1.3 Teaching staff should be informed about the potential effects of type 1 diabetes on cognitive function and educational attainment.

1.5.1.4 Children and young people with type 1 diabetes and their families should be advised how to obtain information about benefits in relation to government disability support.

1.5.2 Transition from paediatric to adult care

1.5.2.1 Young people with type 1 diabetes should be encouraged to attend clinics on a regular basis (three or four times per year) because regular attendance is associated with good glycaemic control.

1.5.2.2 Young people with type 1 diabetes should be allowed sufficient time to familiarise themselves with the practicalities of the transition from paediatric to adult services because this has been shown to improve clinic attendance.

1.5.2.3 Specific local protocols should be agreed for transferring young people with type 1 diabetes from paediatric to adult services.

1.5.2.4 The age of transfer to the adult service should depend on the individual's physical development and emotional maturity, and local circumstances.

1.5.2.5 Transition from the paediatric service should occur at a time of relative stability in the individual's health and should be coordinated with other life transitions.

1.5.2.6 Paediatric diabetes care teams should organise age-banded clinics for young people and young adults jointly with their adult specialty colleagues.

1.5.2.7 Young people with type 1 diabetes who are preparing for transition to adult services should be informed that some aspects of diabetes care will change at transition. The main changes relate to targets for short-term glycaemic control and screening for complications.

Recommendations for screening requirements for adults are presented in the following sections: arterial risk factors, 1.10.1.1; neuropathy, 1.11.4; coeliac disease, 1.12.4.1; thyroid disease, 1.12.4.2. See Section 1.9.1.3 for a recommendation on the terminology to be used when discussing HbA_{1c} with adults with type 1 diabetes.

Adults

The following guidance applies to adults (people aged 18 years or older).

1.6 The diagnosis of type 1 diabetes

1.6.1.1 Diabetes should be confirmed by a single diagnostic laboratory glucose measurement in the presence of classical symptoms, or by a further laboratory glucose measurement. The diagnosis may be supported by a raised HbA_{1c}.

1.6.1.2 Where diabetes is diagnosed, but type 2 diabetes suspected, the diagnosis of type 1 diabetes should be considered if:

- ketonuria is detected, or

- weight loss is marked, or
- the person does not have features of the metabolic syndrome or other contributing illness.

1.6.1.3 When diabetes is diagnosed in a younger person, the possibility that the diabetes is not type 1 diabetes should be considered if they are obese or have a family history of diabetes, particularly if they are of non-white ethnicity.

1.6.1.4 Tests to detect specific auto-antibodies or to measure C-peptide deficiency should not be regularly used to confirm the diagnosis of type 1 diabetes. Their use should be considered if predicting the rate of decline of islet B-cell function would be useful in discriminating type 1 from type 2 diabetes.

1.7 Care process and technologies

1.7.1 Care process and technologies

1.7.1.1 Advice to adults with type 1 diabetes should be provided by a range of professionals with skills in diabetes care working together in a coordinated approach. A common environment (diabetes centre) is an important resource in allowing a diabetes multidisciplinary team to work and communicate efficiently while providing consistent advice.

1.7.1.2 Open-access services should be provided on a walk-in and telephone-request basis during working hours to adults with type 1 diabetes, and a helpline staffed by people with specific diabetes expertise should be provided on a 24-hour basis. Adults with diabetes should be provided with contact information for these services.

1.7.1.3 Each adult with type 1 diabetes should be managed as an individual, rather than as a member of any cultural, economic or health-affected group. Attention should be paid to the recommendations given elsewhere in this guideline with respect to the cultural preferences of individual adults with type 1 diabetes.

1.7.1.4 An individual care plan should be set up and reviewed annually, modified according to changes in wishes, circumstances and medical findings, and the details recorded. The plan should include aspects of:

- diabetes education including nutritional advice (see 'Approach to education', section 1.8.1, and 'Dietary management', Section 1.8.3)
- insulin therapy (see 'Insulin regimens', section 1.9.3, and 'Insulin delivery', section 1.9.4)
- self-monitoring (see 'Self-monitoring of glucose', section 1.8.2)
- arterial risk factor surveillance and management (see 'Control of arterial risk', section 1.10)
- late complications surveillance and management (see 'Identification and management of complications', section 1.11)
- means and frequency of communication with the professional care team
- follow-up consultations including next annual review.

1.7.1.5 Population, practice-based and clinic diabetes registers (as specified by the National Service Framework) should be used to assist programmed recall for annual review and assessment of complications and vascular risk.

1.7.1.6 Conventional technology (telephones), or newer technologies for high-density data transmission of images, should be used to improve process and outcomes.

1.7.1.7 The multidisciplinary team approach should be available to in-patients with diabetes, regardless of the reason for admission (see 'Hospital admission and intercurrent disease', section 1.12.3).

1.7.2 Support groups

1.7.2.1 At the time of diagnosis and periodically thereafter, adults with diabetes should be offered up-to-date information on the existence of and means of contacting diabetes support groups (local and national), and the benefits of membership.

1.8 Education, self-care and patient-centred care

1.8.1 Approach to education

1.8.1.1 A programme of structured diabetes education covering all major aspects of diabetes self-care and the reasons for it should be made available to all adults with type 1 diabetes in the months after diagnosis, and periodically thereafter according to agreed need following yearly assessment.

1.8.1.2 Education programmes for adults with type 1 diabetes should be flexible so that they can be adapted to specific educational, social and cultural needs. These needs should be integrated with individual health needs as dictated by the impact of diabetes and other relevant health conditions on the individual.

1.8.1.3 Education programmes for adults with type 1 diabetes should be designed and delivered by members of the multidisciplinary diabetes team in accordance with the principles of adult education.

1.8.1.4 Education programmes for adults with type 1 diabetes should include modules designed to empower adults to participate in their own healthcare through:

- enabling them to make judgements and choices about how they effect that care
- obtaining appropriate input from the professionals available to advise them.

1.8.1.5 Professionals engaged in the delivery of diabetes care should consider incorporating educational interchange at all opportunities when in contact with a person with type 1 diabetes. The professional should have the skills and training to make best use of such time.

1.8.1.6 More formal review of self-care and needs should be made annually in all adults with type 1 diabetes, and the agenda addressed each year should vary according to the priorities agreed between the healthcare professional and the person with type 1 diabetes.

1.8.2 Self-monitoring of glucose

1.8.2.1 Self-monitoring of blood glucose levels should be used as part of an integrated package that includes appropriate insulin regimens and education to help choice and achievement of optimal diabetes outcomes.

1.8.2.2 Self-monitoring skills should be taught close to the time of diagnosis and initiation of insulin therapy.

1.8.2.3 Self-monitoring results should be interpreted in the light of clinically significant life events.

1.8.2.4 Self monitoring should be performed using meters and strips chosen by adults with diabetes to suit their needs, and usually with low blood requirements, fast analysis times and integral memories.

1.8.2.5 Structured assessment of self-monitoring skills, the quality and use made of the results obtained and the equipment used should be made annually. Self-monitoring skills should be reviewed as part of annual review, or more frequently according to need, and reinforced where appropriate.

1.8.2.6 Adults with type 1 diabetes should be advised that the optimal frequency of self monitoring will depend on:

- the characteristics of an individual's blood glucose control
- the insulin treatment regimen
- personal preference in using the results to achieve the desired lifestyle.

1.8.2.7 Adults with type 1 diabetes should be advised that the optimal targets for short-term glycaemic control are:

- a pre-prandial blood glucose level of 4.0–7.0 mmol/litre and
- a post-prandial blood glucose level of less than 9.0 mmol/litre.

Note: These values are different from those given in the recommendations for

children and young people with type 1 diabetes (See section 1.2.6.7) because of clinical differences between these two age groups.

1.8.2.8 Monitoring using sites other than the fingertips (often the forearm, using meters that require small volumes of blood and devices to obtain those small volumes) cannot be recommended as a routine alternative to conventional self-blood glucose monitoring.

1.8.3 Dietary management

1.8.3.1 Nutritional information sensitive to personal needs and culture should be offered from the time of diagnosis of type 1 diabetes.

1.8.3.2 Nutritional information should be offered individually and as part of a diabetes education programme (see education recommendations in section 1.8.1). Information should include advice from professionals with specific and approved training and continuing accredited education in delivering nutritional advice to people with health conditions. Opportunities to receive nutritional advice should be offered at intervals agreed between adults with diabetes and their advising professionals.

1.8.3.3 The hyperglycaemic effects of different foods a person with type 1 diabetes wishes to eat should be discussed in the context of the insulin preparations chosen to match those food choices.

1.8.3.4 Programmes should be available to adults with type 1 diabetes to enable them to make:

- optimal choices about the variety of foods they wish to consume
- insulin dose changes appropriate to reduce glucose excursions when taking different quantities of those foods.

1.8.3.5 The choice of content, timing and amount of snacks between meals or at bedtime available to the person with type 1 diabetes should be agreed on the basis of informed discussion about the extent and duration of the effects of consumption of different food types and the insulin preparations available to

match them. Those choices should be modified on the basis of discussion of the results of self-monitoring tests.

1.8.3.6 Information should also be made available on:

- effects of different alcohol-containing drinks on blood glucose excursions and calorie intake
- use of high-calorie and high-sugar 'treats'
- use of foods of high glycaemic index.

1.8.3.7 Information about the benefits of healthy eating in reducing arterial risk should be made available as part of dietary education in the period after diagnosis, and according to need and interest at intervals thereafter. This should include information about low glycaemic index foods, fruit and vegetables, and types and amounts of fat, and ways of making the appropriate nutritional changes.

1.8.3.8 Nutritional recommendations to individuals should be modified to take account of associated features of diabetes, including:

- excess weight and obesity
- underweight
- eating disorders
- raised blood pressure
- renal failure.

1.8.3.9 All healthcare professionals providing advice on the management of type 1 diabetes should be aware of appropriate nutritional advice on common topics of concern and interest to adults living with type 1 diabetes, and should be prepared to seek advice from colleagues with more specialised knowledge. Suggested common topics include:

- glycaemic index of specific foods

- body weight, energy balance and obesity management
- cultural and religious diets, feasts and fasts
- foods sold as 'diabetic'
- sweeteners
- dietary fibre intake
- protein intake
- vitamin and mineral supplements
- alcohol
- matching carbohydrate, insulin and physical activity
- salt intake in hypertension
- co-morbidities including nephropathy and renal failure, coeliac disease, cystic fibrosis or eating disorders
- use of peer support groups.

1.8.4 Physical activity

1.8.4.1 Adults with type 1 diabetes should be advised that physical activity can reduce their enhanced arterial risk in the medium and longer term.

1.8.4.2 Adults with type 1 diabetes who choose to integrate increased physical activity into a more healthy lifestyle should be offered information about:

- appropriate intensity and frequency of physical activity
- role of self-monitoring of changed insulin and/or nutritional needs
- effect of activity on blood glucose levels (likely fall) when insulin levels are adequate
- effect of exercise on blood glucose levels when hyperglycaemic and hypoinsulinaemic (risk of worsening of hyperglycaemia and ketonaemia)

- appropriate adjustments of insulin dosage and/or nutritional intake for exercise and post-exercise periods, and the next 24 hours
- interactions of exercise and alcohol
- further contacts and sources of information.

1.9 Blood glucose control and insulin therapy

1.9.1 Clinical monitoring of glucose

1.9.1.1 Clinical monitoring of blood glucose levels by high-precision DCCT[5]-aligned methods of haemoglobin A_{1c} (HbA_{1c}) should be performed every 2–6 months, depending on:

- achieved level of blood glucose control
- stability of blood glucose control
- change in insulin dose or regimen.

1.9.1.2 Site-of-care measurement, or before-clinical-consultation measurement, should be provided.

1.9.1.3 HbA_{1c} results should be communicated to the person with type 1 diabetes after each measurement. The term 'A_{1c}' can be used for simplicity.

1.9.1.4 Total glycated haemoglobin estimation, or assessment of glucose profiles, should be used where haemoglobinopathy or haemoglobin turnover invalidate HbA_{1c} measurement.

1.9.1.5 Fructosamine should not be used as a routine substitute for HbA_{1c} estimation.

1.9.1.6 Continuous glucose monitoring systems have a role in the assessment of glucose profiles in adults with consistent glucose control problems on insulin therapy, notably:

- repeated hyper- or hypoglycaemia at the same time of day

- hypoglycaemia unawareness, unresponsive to conventional insulin dose adjustment.

1.9.2 Glucose control assessment levels

1.9.2.1 Adults with type 1 diabetes should be advised that maintaining a DCCT-harmonised HbA_{1c} below 7.5% is likely to minimise their risk of developing diabetic eye, kidney or nerve damage in the longer term.

1.9.2.2 Adults with diabetes who want to achieve an HbA_{1c} down to, or towards, 7.5% should be given all appropriate support in their efforts to do so.

1.9.2.3 Where there is evidence of increased arterial risk (identified by a raised albumin excretion rate, features of the metabolic syndrome, or other arterial risk factors), people with type 1 diabetes should be advised that approaching lower HbA_{1c} levels (for example, 6.5% or lower) may be of benefit to them. Support should be given to approaching this target if so wished.

1.9.2.4 Where target HbA_{1c} levels are not reached in the individual, adults with diabetes should be advised that any improvement is beneficial in the medium and long term, and that greater improvements towards the target level lead to greater absolute gains.

1.9.2.5 Undetected hypoglycaemia and an attendant risk of unexpected disabling hypoglycaemia or of hypoglycaemia unawareness should be suspected in adults with type 1 diabetes who have:

- lower HbA_{1c} levels, in particular levels in or approaching the normal reference range (DCCT harmonised < 6.1%)
- HbA_{1c} levels lower than expected from self-monitoring results.

1.9.2.6 Where experience or risk of hypoglycaemia is significant to an individual, or the effort needed to achieve target levels severely curtails other quality of life despite optimal use of current diabetes technologies, tighter blood glucose control should not be pursued without balanced discussion of the advantages and disadvantages.

Note: A new chemical standard for HbA_{1c} has been developed by the International Federation of Clinical Chemistry (IFCC). This reads lower by around 2.0% (units), and will be the basis of primary calibration of instruments from 2004 onwards. However, this does not preclude the use of DCCT-harmonised levels, and views from patient organisations and professional bodies at a recent Department of Health meeting (July 2003) are that all HbA_{1c} reports should be DCCT aligned, pending some internationally concerted policy change.

1.9.3 Insulin regimens

1.9.3.1 Adults with type 1 diabetes should have access to the types (preparation and species) of insulin they find allow them optimal well-being.

1.9.3.2 Cultural preferences need to be discussed and respected in agreeing the insulin regimen for a person with type 1 diabetes.

1.9.3.3 Multiple insulin injection regimens, in adults who prefer them, should be used as part of an integrated package of which education, food and skills training should be integral parts.

1.9.3.4 Appropriate self-monitoring and education should be used as part of an integrated package to help achieve optimal diabetes outcomes.

1.9.3.5 Meal-time insulin injections should be provided by injection of unmodified ('soluble') insulin or rapid-acting insulin analogues before main meals.

1.9.3.6 Rapid-acting insulin analogues should be used as an alternative to meal-time unmodified insulin:

- where nocturnal or late inter-prandial hypoglycaemia is a problem
- in those in whom they allow equivalent blood glucose control without use of snacks between meals and this is needed or desired.

1.9.3.7 Basal insulin supply (including nocturnal insulin supply) should be provided by the use of isophane (NPH) insulin or long-acting insulin analogues (insulin glargine). Isophane (NPH) insulin should be given at bedtime. If rapid-acting insulin analogues are given at meal times or the midday insulin dose is small

or lacking, the need to give isophane (NPH) insulin twice daily (or more often) should be considered.

1.9.3.8 Long-acting insulin analogues (insulin glargine) should be used when:

- nocturnal hypoglycaemia is a problem on isophane (NPH) insulin
- morning hyperglycaemia on isophane (NPH) insulin results in difficult daytime blood glucose control
- rapid-acting insulin analogues are used for meal-time blood glucose control.

1.9.3.9 Twice-daily insulin regimens should be used by those adults who consider number of daily injections an important issue in quality of life.

- Biphasic insulin preparations (pre-mixes) are often the preparations of choice in this circumstance.
- Biphasic rapid-acting insulin analogue pre-mixes may give an advantage to those prone to hypoglycaemia at night.

Such twice daily regimens may also help:

- those who find adherence to their agreed lunch-time insulin injection difficult
- adults with learning difficulties who may require assistance from others.

1.9.3.10 Adults whose nutritional and physical activity patterns vary considerably from day to day, for vocational or recreational reasons, may need careful and detailed review of their self-monitoring and insulin injection regimen(s). This should include all the appropriate preparations (see sections 1.9.3.6–8), and consideration of unusual patterns and combinations.

1.9.3.11 For adults undergoing periods of fasting or sleep following eating (such as during religious feasts and fasts or after night-shift work), a rapid-acting insulin analogue before the meal (provided the meal is not prolonged) should be considered.

1.9.3.12 For adults with erratic and unpredictable blood glucose control (hyper- and hypoglycaemia at no consistent times), rather than a change in a previously optimised insulin regimen, the following should be considered:

- resuspension of insulin and injection technique
- injection sites
- self-monitoring skills
- knowledge and self-management skills
- nature of lifestyle
- psychological and psychosocial difficulties
- possible organic causes such as gastroparesis.

1.9.3.13 Continuous subcutaneous insulin infusion (or insulin pump therapy) is recommended as an option for people with type 1 diabetes provided that:

- multiple-dose insulin therapy (including, where appropriate, the use of insulin glargine) has failed;[2] and
- those receiving the treatment have the commitment and competence to use the therapy effectively.

1.9.3.14 Partial insulin replacement to achieve blood glucose control targets (basal insulin only, or just some meal-time insulin) should be considered for adults starting insulin therapy, until such time as islet B-cell deficiency progresses further.

1.9.3.15 Clear guidelines and protocols ('sick-day rules') should be given to all adults with type 1 diabetes to assist them in adjusting insulin doses appropriately during intercurrent illness.

1.9.3.16 Oral glucose-lowering drugs should generally not be used in the management of adults with type 1 diabetes.

1.9.4 Insulin delivery

1.9.4.1 Adults with diabetes who inject insulin should have access to the insulin injection delivery device they find allows them optimal well-being, often using one or more types of insulin injection pen.

1.9.4.2 Adults with type 1 diabetes who have special visual or psychological needs should be provided with injection devices or needle-free systems that they can use independently for accurate dosing.

1.9.4.3 Insulin injection should be made into the deep subcutaneous fat. To achieve this, needles of a length appropriate to the individual should be made available.

1.9.4.4 Adults with type 1 diabetes should be informed that the abdominal wall is the therapeutic choice for meal-time insulin injections.

1.9.4.5 Adults with type 1 diabetes should be informed that extended-acting suspension insulin, for example isophane (NPH) insulin, may give a longer profile of action when injected into the subcutaneous tissue of the thigh rather than the arm or abdominal wall.

1.9.4.6 Adults with diabetes should be recommended to use one anatomical area for the injections given at the same time of day, but to move the precise injection site around in the whole of the available skin within that area.

1.9.4.7 Adults with diabetes should be provided with suitable containers for the collection of used needles. Arrangements should be available for the suitable disposal of these containers.

1.9.4.8 The injection-site condition should be checked annually and if new problems with blood glucose control occur.

1.9.5 Prevention and management of hypoglycaemia

1.9.5.1 Adults with type 1 diabetes should be informed that any available glucose/sucrose-containing fluid is suitable for the management of hypoglycaemic

symptoms or signs in people who are able to swallow. Glucose-containing tablets or gels are also suitable for those able to dissolve or disperse these in the mouth and swallow the products.

1.9.5.2 When a more rapid-acting form of glucose is required, purer glucose-containing solutions should be given.

1.9.5.3 Adults with decreased level of consciousness due to hypoglycaemia who are unable to take oral treatment safely should be:

- given intramuscular glucagon by a trained user (intravenous glucose may be used by professionals skilled in obtaining intravenous access)
- monitored for response at 10 minutes, and then given intravenous glucose if the level of consciousness is not improving significantly
- then given oral carbohydrate when it is safe to administer it, and placed under continued observation by a third party who has been warned of the risk of relapse.

1.9.5.4 Adults with type 1 diabetes should be informed that some hypoglycaemic episodes are an inevitable consequence of insulin therapy in most people using any insulin regimen, and that it is advisable that they should use a regimen that avoids or reduces the frequency of hypoglycaemic episodes while maintaining as optimal a level of blood glucose control as is feasible. Advice to assist in obtaining the best such balance from any insulin regimen should be available to all adults with type 1 diabetes. (See 'Insulin regimens' section 1.9.3 and 'Insulin delivery' section 1.9.4)

1.9.5.5 When hypoglycaemia becomes unusually problematic or of increased frequency, review should be made of the following possibly contributory causes:

- inappropriate insulin regimens (incorrect dose distributions and insulin types)
- meal and activity patterns, including alcohol
- injection technique and skills, including insulin resuspension

- injection site problems
- possible organic causes including gastroparesis
- changes in insulin sensitivity (the latter including drugs affecting the renin-angiotensin system and renal failure)
- psychological problems
- previous physical activity
- lack of appropriate knowledge and skills for self management.

1.9.5.6 Hypoglycaemia unawareness should be assumed to be secondary to undetected periods of hypoglycaemia (< 3.5 mmol/litre, often for extended periods, commonly at night) until these are excluded by appropriate monitoring techniques. If present, such periods of hypoglycaemia should be ameliorated.

1.9.5.7 Specific education on the detection and management of hypoglycaemia in adults with problems of hypoglycaemia awareness should be offered.

1.9.5.8 Nocturnal hypoglycaemia (symptomatic or detected on monitoring) should be managed by:

- reviewing knowledge and self-management skills
- reviewing current insulin regimen and evening eating habits and previous physical activity.
- choosing an insulin type and regimen with less propensity to induce low glucose levels in the night hours, such as:
  - isophane (NPH) insulin at bedtime
  - rapid-acting analogue with the evening meal
  - long-acting insulin analogues (insulin glargine)
  - insulin pump.

1.9.5.9 Adults with type 1 diabetes should be informed that late post-prandial hypoglycaemia may be managed by appropriate inter-prandial snacks or the use of rapid-acting insulin analogues before meals.

1.9.5.10 Where early cognitive decline occurs in adults on long-term insulin therapy, normal investigations should be supplemented by the consideration or investigation of possible brain damage due to overt or covert hypoglycaemia, and the need to ameliorate this.

1.10 Control of arterial risk

1.10.1 Arterial risk identification

1.10.1.1 Arterial risk factors should be assessed annually, and the assessment should include:

- albumin excretion rate
- smoking
- blood glucose control
- blood pressure
- full lipid profile (including HDL and LDL cholesterol and triglycerides)
- age
- family history of arterial disease
- abdominal adiposity.

1.10.1.2 This recommendation has been replaced by recommendation 1.1.9 in the NICE clinical guideline on lipid modification.

1.10.1.3 This recommendation has been replaced by recommendations 1.3.23 and 1.3.24 in the NICE clinical guideline on lipid modification.

1.10.1.4 This recommendation has been replaced by recommendations 1.3.23 and 1.3.24 in the NICE clinical guideline on lipid modification.

1.10.1.5 This recommendation has been replaced by recommendations 1.3.23 and 1.3.24 in the NICE clinical guideline on lipid modification.

1.10.2 Arterial disease

These recommendations assume that arterial risk has been assessed according to the recommendations in section 1.10.1. Blood glucose control, blood pressure control and education programmes for adults with type 1 diabetes are considered elsewhere in this guideline.

1.10.2.1 Adults with type 1 diabetes who smoke should be given advice on smoking cessation and use of smoking cessation services, including NICE guidance-recommended therapies. The messages should be reinforced in continuing smokers yearly if pre-contemplative of stopping and at all clinical contacts if there is a prospect of their stopping.

1.10.2.2 Young adult non-smokers should be advised never to start smoking.

1.10.2.3 Aspirin therapy (75 mg daily) should be recommended in adults in the highest and moderately-high-risk categories.

1.10.2.4 This recommendation has been replaced by recommendations 1.3.23 to 1.3.25 in the NICE clinical guideline on lipid modification.

1.10.2.5 This recommendation has been replaced by recommendations 1.3.45 to 1.3.47 in the NICE clinical guideline on lipid modification.

1.10.2.6 This recommendation has been replaced by recommendation 1.3.45 in the NICE clinical guideline on lipid modification.

1.10.2.7 This recommendation has been replaced by recommendation 1.3.28 in the NICE clinical guideline on lipid modification.

1.10.2.8 Adults who have had myocardial infarction or stroke should be managed intensively, according to relevant non-diabetes guidelines. In the presence of

angina or other ischaemic heart disease, beta-adrenergic blockers should be considered. (For use of insulin in these circumstances, see 'Hospital administration and intercurrent disease', section 1.12.3.)

1.10.3 Blood pressure control

1.10.3.1 Intervention levels for recommending blood pressure management should be 135/85 mmHg unless the person with type 1 diabetes has abnormal albumin excretion rate or two or more features of the metabolic syndrome (see section 1.10.1.3), in which case it should be 130/80 mmHg. See also sections 1.11.2.5–7.

1.10.3.2 To allow informed choice by the person with the condition, the following should be discussed:

- reasons for choice of intervention level
- substantial potential gains from small improvements in blood pressure control
- possible negative consequences of therapy.

See also Sections 1.11.2.5–7.

1.10.3.3 A trial of a low-dose thiazide diuretic should be started as first-line therapy for raised blood pressure, unless the person with type 1 diabetes is already taking a renin-angiotensin system blocking drug for nephropathy (see 'Nephropathy', section 1.11.2). Multiple drug therapy will often be required.

1.10.3.4 Adults with diabetes should be offered information on the potential for lifestyle changes to improve blood pressure control and associated outcomes, and offered assistance in achieving their aims in this area.

1.10.3.5 Concerns over potential side effects should not be allowed to inhibit advising and offering the necessary use of any class of drugs, unless the side effects become symptomatic or otherwise clinically significant. In particular:

- selective beta-adrenergic blockers should not be avoided in adults on insulin

- low-dose thiazides may be combined with beta-blockers
- when calcium channel antagonists are prescribed, only long-acting preparations should be used
- direct questioning should be used to detect the potential side effects of erectile dysfunction, lethargy and orthostatic hypotension with different drug classes.

1.11 Identification and management of complications

1.11.1 Retinopathy

1.11.1.1 Eye surveillance for adults newly diagnosed with type 1 diabetes should be started from diagnosis.

1.11.1.2 Depending on the findings, structured eye surveillance should be followed by:

- routine review in 1 year, or
- earlier review, or
- referral to an ophthalmologist.

1.11.1.3 Structured eye surveillance should be at 1-year intervals.

1.11.1.4 The reasons and success of eye surveillance systems should be properly conveyed to adults with type 1 diabetes, so that attendance is not reduced by ignorance of need or fear of outcome.

1.11.1.5 Digital retinal photography should be implemented for eye surveillance programmes for adults with type 1 diabetes.

1.11.1.6 Mydriasis with tropicamide should be used when photographing the retina, after prior agreement with the person with type 1 diabetes following discussion of the advantages and disadvantages, including appropriate precautions for driving.

1.11.1.7 Visual acuity testing should be a routine part of eye surveillance programmes.

1.11.1.8 Emergency review by an ophthalmologist should occur for:

- sudden loss of vision
- rubeosis iridis
- pre-retinal or vitreous haemorrhage
- retinal detachment.

1.11.1.9 Rapid review by an ophthalmologist should occur for new vessel formation.

1.11.1.10 Referral to an ophthalmologist should occur for:

- referable maculopathy:
  - exudate or retinal thickening within one disc diameter of the centre of the fovea
  - circinate or group of exudates within the macula (the macula is defined here as a circle centred on the fovea, of a diameter the distance between the temporal border of the optic disc and the fovea)
  - any microaneurysm or haemorrhage within one disc diameter of the centre of the fovea, only if associated with a best visual acuity of 6/12 or worse
- referable pre-proliferative retinopathy:
  - any venous beading
  - any venous loop or reduplication
  - any intraretinal microvascular abnormalities (IRMA)
  - multiple deep, round or blot haemorrhages (If cotton wool spots are present, look carefully for the above features, but cotton wool spots themselves do not define pre-proliferative retinopathy)
  - any unexplained drop in visual acuity.

1.11.2 Nephropathy (see also Section 1.10.3)

1.11.2.1 All adults with type 1 diabetes with or without detected nephropathy should be asked to bring in a first-pass morning urine specimen once a year. This should be sent for estimation of albumin:creatinine ratio. Estimation of urine albumin concentration alone is a poor alternative. Serum creatinine should be measured at the same time.

1.11.2.2 If an abnormal surveillance result is obtained (in the absence of proteinuria/ urinary tract infection) the test should be repeated at each clinic visit or at least every 3–4 months, and the result taken as confirmed if a further specimen (out of two more) is also abnormal (> 2.5 mg/mmol for men, > 3.5 mg/mmol for women).

1.11.2.3 Other renal disease should be suspected:

- in the absence of progressive retinopathy
- if blood pressure is particularly high
- if proteinuria develops suddenly
- if significant haematuria is present
- in the presence of systemic ill health.

1.11.2.4 The significance of a finding of abnormal albumin excretion rate should be discussed with the person concerned.

1.11.2.5 ACE inhibitors should be started and, with the usual precautions, titrated to full dose in all adults with confirmed nephropathy (including those with microalbuminuria alone) and type 1 diabetes.

1.11.2.6 If ACE inhibitors are not tolerated, angiotensin 2 receptor antagonists should be substituted. Combination therapy is not recommended at present.

1.11.2.7 Blood pressure should be maintained below 130/80 mmHg by addition of other anti-hypertensive drugs if necessary.

1.11.2.8 Adults with type 1 diabetes and nephropathy should be advised about the advantages of not following a high protein diet.

1.11.2.9 Referral criteria for tertiary care should be agreed between local diabetes specialists and nephrologists.

1.11.3 Foot care

1.11.3.1 Structured foot surveillance should be at 1-year intervals, and should include educational assessment and education input commensurate with the assessed risk.

1.11.3.2 The reasons for and success of foot surveillance systems should be properly conveyed to adults with diabetes, so that attendance is not reduced by ignorance of need.

1.11.3.3 Inspection and examination of feet should include:

- skin condition
- shape and deformity
- shoes
- impaired sensory nerve function
- vascular supply (including peripheral pulses).

1.11.3.4 Use of a 10 g monofilament plus non-traumatic pin prick is advised for detection of impairment of sensory nerve function sufficient to significantly raise risk of foot ulceration.

1.11.3.5 On the basis of findings from foot care surveillance, foot ulceration risk should be categorised into:

- low current risk (normal sensation and palpable pulses)
- increased risk (impaired sensory nerve function or absent pulses, or other risk factor)

- high risk (impaired sensory nerve function and absent pulses or deformity or skin changes, or previous ulcer)
- ulcer present.

1.11.3.6 For people found to be at increased risk or high risk of foot complications:

- arrange specific assessment of other contributory risk factors including deformity, smoking and level of blood glucose control
- arrange/reinforce specific foot care education, and review those at high risk as part of a formal foot ulcer prevention programme
- consider the provision of special footwear, including insoles and orthoses, if there is a deformity, callosities or previous ulcer.

1.11.3.7 For people with an ulcerated foot:

- arrange referral to a specialist diabetes foot care team incorporating specifically trained foot care specialists (usually state-registered podiatrists) within 1–2 days if there is no overt infection of the ulcer or surrounding tissues, or as an emergency if such infection is present
- use antibiotics if there is any evidence of infection of the ulcer or surrounding tissues and continue these long term if infection is recurrent
- use foot dressings, taking account of cost according to local experience, ensuring arrangements are in place to monitor and change dressings frequently (often daily) accordingly to need
- remove dead tissue from diabetic foot ulcers
- consider the use of off-loading techniques (such as contact casting) for people with neuropathic foot ulcers
- do not use cultured human dermis (or equivalent), hyperbaric oxygen therapy, topical ketanserin or growth factors in routine foot ulcer management

- consider ensuring complete and effective foot education through the use of graphic visualisations of the consequences of ill-managed foot ulceration in people with recurrent ulceration or previous amputation
- review progress in ulcer healing frequently (daily to monthly) according to need
- if peripheral vascular disease is detected, refer for early assessment by a specialist vascular team.

1.11.3.8 Adults with suspected or diagnosed Charcot osteoarthropathy should be referred immediately to a multidisciplinary diabetes foot care team.

1.11.4 Neuropathy and associated complications

1.11.4.1 Men should be asked annually whether erectile dysfunction is an issue.

1.11.4.2 A PDE5 (phosphodiesterase-5) inhibitor drug, if not contraindicated, should be offered where erectile dysfunction is a problem.

1.11.4.3 Referral to a service offering other medical and surgical management of erectile dysfunction should be discussed where PDE5 inhibitors are not successful.

1.11.4.4 In adults with diabetes on insulin therapy who have erratic blood glucose control or unexplained bloating or vomiting, the diagnosis of gastroparesis should be considered.

1.11.4.5 In adults with diabetes who have altered perception of hypoglycaemia, the possibility of sympathetic nervous system damage as a contributory factor should be considered.

1.11.4.6 In adults with diabetes who have unexplained diarrhoea, particularly at night, the possibility of autonomic neuropathy affecting the gut should be considered.

1.11.4.7 Care should be taken when prescribing antihypertensive drugs not to expose people to the risks of orthostatic hypotension as a result of the combined effects of sympathetic autonomic neuropathy and blood-pressure lowering drugs.

1.11.4.8 Adults with diabetes who have bladder emptying problems should be investigated for the possibility of autonomic neuropathy affecting the bladder, unless other explanations are adequate.

1.11.4.9 The management of the symptoms of autonomic neuropathy should include standard interventions for the manifestations encountered (for example, for erectile dysfunction or abnormal sweating).

1.11.4.10 For adults with diabetes with diagnosed or suspected gastroparesis, a trial of prokinetic drugs is indicated (metoclopramide or domperidone, with cisapride[6] as third line if necessary).

Anaesthesia and autonomic neuropathy

1.11.4.11 Anaesthetists should be aware of the possibility of parasympathetic autonomic neuropathy affecting the heart in adults with diabetes who are listed for procedures under general anaesthetic and who have evidence of somatic neuropathy or other manifestations of autonomic neuropathy.

1.11.5 Management of painful neuropathy

1.11.5.1 Use of simple analgesics (paracetamol, aspirin) and local measures (bed cradles) are recommended as a first step, but if trials of these measures are ineffective, they should be discontinued and other measures should be tried.

1.11.5.2 **This recommendation has been replaced by** Neuropathic pain **(NICE clinical guideline 96).**

1.11.5.3 **This recommendation has been replaced by** Neuropathic pain **(NICE clinical guideline 96).**

1.11.5.4 **This recommendation has been replaced by** Neuropathic pain **(NICE clinical guideline 96).**

1.11.5.5 **This recommendation has been replaced by** Neuropathic pain **(NICE clinical guideline 96).**

1.11.5.6 Professionals should be alert to the psychological consequences of chronic painful neuropathy, and offer appropriate management where they are identified.

1.11.5.7 **This recommendation has been replaced by** Neuropathic pain **(NICE clinical guideline 96).**

1.11.5.8 Where neuropathic symptoms cannot be adequately controlled, it is useful, to help individuals cope, to explain the:

- reasons for the problem
- likelihood of remission in the medium term
- role of improved blood glucose control.

1.12 Management of special situations

1.12.1 Newly diagnosed adults

1.12.1.1 At the time of diagnosis (or if necessary after the management of critically decompensated metabolism) the professional team should develop with and explain to the person with type 1 diabetes a plan for their early care. To agree such a plan will generally require:

- medical assessment to:
  - ensure security of diagnosis of type of diabetes
  - ensure appropriate acute care is given when needed
  - review and detect potentially confounding disease and drugs
  - detect adverse vascular risk factors
- environmental assessment to understand:
  - social, home, work and recreational circumstances of the individual and carers

  - their preferences in nutrition and physical activity
  - other relevant factors such as substance use
- cultural and educational assessment to identify prior knowledge and to enable optimal advice and planning about:
  - treatment modalities
  - diabetes education programmes
- assessment of emotional state to determine the appropriate pace of education

The results of the assessment should be used to agree a future care plan.

Some items of the initial diabetes assessment:

- acute medical history
- social, cultural and educational history/lifestyle review
- complications history/symptoms
- long-term/recent diabetes history
- other medical history/systems
- family history of diabetes/arterial disease
- drug history/current drugs
- vascular risk factors
- smoking
- general examination
- weight/body mass index
- foot/eye/vision examination
- urine albumin excretion/urine protein/serum creatinine

- psychological well-being
- attitudes to medicine and self-care
- immediate family and social relationships and availability of informal support.

1.12.1.2 Elements of an individualised and culturally appropriate plan will include:

- sites and timescales of diabetes education including nutritional advice (see 'Approach to education', section 1.8.1, and 'Dietary management', section 1.8.3)
- initial treatment modalities (see 'Insulin regimens', Section 1.9.3, and 'Insulin delivery', section 1.9.4)
- means of self-monitoring (see 'Self-monitoring of glucose level', section 1.8.2)
- means and frequency of communication with the professional team
- follow-up consultations including surveillance at annual review (see individual late complications recommendations)
- management of arterial risk factors (see 'Control of arterial risk', section 1.10).

1.12.1.3 After the initial plan is agreed, arrangements should be put in place to implement it without inappropriate delay, and to provide for feedback and modification of the plan over the ensuing weeks.

1.12.2 Diabetic ketoacidosis (DKA)

1.12.2.1 Professionals managing DKA should be adequately trained including regular updating, and be familiar with all aspects of its management which are associated with mortality and morbidity. These topics should include:

- fluid balance
- acidosis
- cerebral oedema
- electrolyte imbalance

- disturbed interpretation of familiar diagnostic tests (white cell count, body temperature, ECG)
- respiratory distress syndrome
- cardiac abnormalities
- precipitating causes
- infection management including opportunistic infections
- gastroparesis
- use of high dependency and intensive care units
- and the recommendations below.

Management of DKA should be in line with local clinical governance.

1.12.2.2 Primary fluid replacement in DKA should be with isotonic saline, not given too rapidly except in cases of circulatory collapse.

1.12.2.3 Bicarbonate should not generally be used in the management of DKA.

1.12.2.4 Intravenous insulin should be given by infusion in cases of DKA.

1.12.2.5 In the management of DKA, once plasma glucose concentration has fallen to 10–15 mmol/litre, glucose-containing fluids should be given (not more than 2 litres in 24 hours) in combination with higher rates of insulin infusion than used in other situations (for example, 6 U/hour monitored for effect).

1.12.2.6 Potassium replacement should begin early in DKA, with frequent monitoring for the development of hypokalaemia.

1.12.2.7 Phosphate replacement should not generally be used in the management of DKA.

1.12.2.8 In patients whose conscious level is impaired, consideration should be given to insertion of a nasogastric tube, urinary catheterisation to monitor urine production, and heparinisation.

1.12.2.9 To reduce the risk of catastrophic outcomes in DKA, monitoring should be continuous and review should cover all aspects of clinical management at frequent intervals.

1.12.3 Hospital admission and intercurrent disease

1.12.3.1 From the time of admission, the person with type 1 diabetes and the team caring for him or her should receive, on a continuing basis, advice from a trained multidisciplinary team with expertise in diabetes.

1.12.3.2 Throughout the course of an inpatient admission, the personal expertise of adults with type 1 diabetes (in managing their own diabetes) should be respected and routinely integrated into ward-based blood glucose monitoring and insulin delivery, using the person with type 1 diabetes' own system. This should be incorporated into the nursing care plan.

1.12.3.3 Throughout the course of an inpatient admission, the personal knowledge and needs of adults with diabetes regarding their dietary requirements should be a major determinant of the food choices offered to them, except when illness or medical or surgical intervention significantly disturbs those requirements.

1.12.3.4 Hospitals should ensure the existence and deployment of an approved protocol for inpatient procedures and surgical operations for adults with type 1 diabetes. This should aim to ensure the maintenance of near-normoglycaemia without risk of acute decompensation, usually by the use of regular quality assured blood glucose testing driving the adjustment of intravenous insulin delivery.

1.12.3.5 Members of care teams managing adults with type 1 diabetes in institutions, such as nursing homes, residential homes and prisons, should follow the recommendations in this section.

Management during acute arterial events

1.12.3.6 Optimal insulin therapy, which can be achieved by the use of intravenous insulin and glucose, should be provided to all adults with diabetes who have threatened or actual stroke. Critical care and emergency departments should have a protocol for such management.

1.12.4 Associated disorders

1.12.4.1 In adults with type 1 diabetes who have a low body mass index or unexplained weight loss, markers of coeliac disease, should be assessed.

1.12.4.2 Healthcare professionals should be alert to the possibility of the development of other autoimmune disease in adults with type 1 diabetes (including Addison's disease, pernicious anaemia and thyroid disorders).

1.12.5 Psychological problems

1.12.5.1 Members of professional teams providing care or advice to adults with diabetes should be alert to the development or presence of clinical or sub-clinical depression and/or anxiety, in particular where someone reports or appears to be having difficulties with self-management.

1.12.5.2 Diabetes professionals should ensure that they have appropriate skills in the detection and basic management of non-severe psychological disorders in people from different cultural backgrounds. They should be familiar with appropriate counselling techniques and appropriate drug therapy, while arranging prompt referral to specialists of those people in whom psychological difficulties continue to interfere significantly with well-being or diabetes self-management.

1.12.5.3 Special management techniques or treatment for non-severe psychological illness should not commonly be used, except where diabetes-related arterial complications give rise to special precautions over drug therapy.

1.12.6 Eating disorders

1.12.6.1 Members of multidisciplinary professional teams should be alert to the possibility of bulimia nervosa, anorexia nervosa and insulin dose manipulation in adults with type 1 diabetes with:

- over-concern with body shape and weight
- low body mass index
- poor overall blood glucose control.

1.12.6.2 The risk of morbidity from the complications of poor metabolic control suggests that consideration should be given to early, and occasionally urgent, referral of adults with type 1 diabetes to local eating disorder services.

1.12.6.3 Provision for high-quality professional team support at regular intervals with regard to counselling about lifestyle issues and particularly nutritional behaviour should be made for all adults with type 1 diabetes from the time of diagnosis (see 'Approach to education', section 1.8.1; 'Dietary management', section 1.8.3; and 'Research recommendations', section 4).

1.13 Algorithms

An algorithm showing the diagnosis and management of type 1 diabetes in children and young people is presented in Appendix E (see the full guideline). An algorithm showing the key components of the care of adults with type 1 diabetes after diagnosis and at the annual and other regular reviews is presented in Appendix E.

[1] World Health Organization (1999)

[2] People for whom multiple-dose therapy has failed are considered to be those for whom it has been impossible to maintain an HbA_{1c} level no greater than 7.5% (or 6.5% in the presence of microalbuminuria or adverse features of the metabolic syndrome) without disabling hypoglycaemia occurring, despite a high level of self care of their diabetes. 'Disabling hypoglycaemia', for the purpose of this guidance, means the repeated and unpredicted

occurrence of hypoglycaemia requiring third-party assistance that results in continuing anxiety about recurrence and is associated with significant adverse effect on quality of life.

[3] Salisbury, D. M. and Department of Health, Welsh Office, Scottish Office Department of Health, DHSS (Northern Ireland): 1996. Update for pneumococcal vaccination.

[4] Dental recall: Recall interval between routine dental examinations. NICE clinical guideline 19 (2004).

[5] DCCT: Diabetes Control and Complications Trial.

[6] Cisapride is not currently licensed in the UK. Tricyclic antidepressants and carbamazepine are not currently licensed in the UK for painful neuropathy associated with type 1 diabetes. Phenytoin is currently licensed in the UK for neuropathic pain under specialist supervision. Anaesthesia and autonomic neuropathy.

2 Notes on the scope of the guidance

All NICE guidelines are developed in accordance with a scope document that defines what the guideline will and will not cover. The scope of this guideline was established at the start of the development of this guideline, following a period of consultation.

There is more information about how NICE clinical guidelines are developed on the NICE website. A booklet, 'How NICE clinical guidelines are developed: an overview for stakeholders, the public and the NHS' is available.

3 Implementation in the NHS

3.1 In general

Local health communities should review their existing practice for type 1 diabetes against this guideline. The review should consider the resources required to implement the recommendations set out in Section 1, the people and processes involved and the timeline over which full implementation is envisaged. It is in the interests of people with type 1 diabetes that the implementation timeline is as rapid as possible.

Relevant local clinical guidelines, care pathways and protocols should be reviewed in the light of this guidance and revised accordingly.

This guideline should be used in conjunction with the National Service Framework for Diabetes and the Children's National Service Framework.

3.2 Audit

Suggested audit criteria are listed in Appendix D (see the full guideline). They are intended to be suggestions to aid the implementation and monitoring of the guidelines at Trust level in the NHS. They can be used as the basis for local clinical audit, at the discretion of those in practice.

4 Research recommendations

The following research recommendations have been identified for this NICE guideline, not as the most important research recommendations, but as those that are most representative of the full range of recommendations. The Guideline Development Groups' full sets of research recommendations are detailed in the full guidelines produced by the National Collaborating Centre for Women's and Children's Health and the National Collaborating Centre for Chronic Conditions (see section 5).

4.1 Areas for future research: children and young people

- Evaluation of the effectiveness of age-specific structured education programmes for children and young people with type 1 diabetes, their families and other carers, and investigation into the most effective way of training healthcare professionals to provide such education.
- Evaluation of the effectiveness of multiple daily injection regimens, continuous subcutaneous insulin infusion (insulin pump therapy), metformin combined with insulin treatment, and invasive versus non-invasive continuous glucose monitoring systems in children and young people with type 1 diabetes, and the effectiveness of insulin glargine in young children with type 1 diabetes.
- Evaluation of the effectiveness of training in flexible, intensive insulin management to enable children and young people with type 1 diabetes to adjust insulin doses to match carbohydrate intake.
- Investigation of the effectiveness of different concentrations of rehydration fluid, the rate of rehydration, the use of albumin infusion and the dose of insulin infusion in the management of diabetic ketoacidosis.
- Evaluation of the effectiveness of behavioural and social interventions for managing anxiety and depression, eating disorders, behavioural and conduct disorders, and non-adherence to therapy in children and young people with newly diagnosed and established type 1 diabetes, especially in young people.
- Evaluation of the effects of persistent hypoglycaemia and recurrent diabetic ketoacidosis on neurocognitive function, learning, attendance at school, and educational attainment in children and young people with type 1 diabetes.

4.2 Areas for future research: adults

- Comparative studies are needed of education models from the time of diagnosis of type 1 diabetes.
- Further research is needed to evaluate the use of well-being and treatment satisfaction assessment tools to enhance the patient–professional interface and make care more directed to the agenda of adults with type 1 diabetes, while improving biomedical outcomes.
- A study is needed of multiple interventions to reduce arterial and microvascular risk in adults with type 1 diabetes identified as being at high risk of development or progression of the late complications.
- Long-term assessment is needed of recall systems allowing longer intervals between complication/risk factor detection visits according to assessed risk.
- Trials are needed of regimens and duration of traditional antibiotic therapies in adults with neuropathic foot ulceration.
- Studies are needed of the effectiveness of quality assurance systems in surveillance of complications.

5 Full guideline

The National Institute for Clinical Excellence commissioned the development of this guidance from the National Collaborating Centre for Women's and Children's Health and the National Collaborating Centre for Chronic Conditions. Each Centre established a Guideline Development Group, which reviewed the evidence and developed the recommendations. The full guidelines, 'Type 1 diabetes: diagnosis and management of type 1 diabetes in children and young people' and 'Type 1 diabetes: management of type 1 diabetes in adults in primary and secondary care', are published by the National Collaborating Centre for Women's and Children's Health and the National Collaborating Centre for Chronic Conditions.

The members of the Guideline Development Groups are listed in Appendix B. Information about the independent Guideline Review Panels is given in Appendix C.

The booklet 'The Guideline Development Process – An Overview for Stakeholders, the Public and the NHS' is available.

Information for the public

NICE has produced information for the public explaining this guideline for adults and children and young people.

We encourage NHS and voluntary sector organisations to use text from this information in their own materials.

6 Related NICE guidance

- Type 2 diabetes: The management of type 2 diabetes (update). (2008) NICE clinical guideline 66.
- Guidance on the use of patient education models in diabetes. (2003) NICE Technology Appraisal Guidance 60
- Guidance on the use of continuous subcutaneous insulin infusion for diabetes. (2003) NICE Technology Appraisal Guidance 57.
- Guidance on the use of long-acting insulin analogues for the treatment of diabetes – insulin glargine. (2002) NICE Technology Appraisal Guidance 53.

7 Review date

The process of reviewing the evidence is expected to begin 4 years after the date of issue of this guideline. Reviewing may begin earlier than 4 years if significant evidence that affects the guideline recommendations is identified sooner. The updated guideline will be available within 2 years of the start of the review process.

Appendix A: Grading schemes

The recommendations in this guideline were graded according to the quality of the evidence they were based on. The gradings are available in the full guideline.

Appendix B: The Guideline Development Groups

Guideline on the diagnosis and management of type 1 diabetes in children and young people

Guideline Development Group

Dr Stephen Greene (Group Leader)
Reader in Child and Adolescent Health, The University of Dundee, Dundee

Dr Jeremy Allgrove
Consultant Paediatric Endocrinologist, East London Centre for Paediatric and Adolescent Diabetes, London

Dr Timothy Barrett
Senior Lecturer, Diabetes Unit, Birmingham Children's Hospital, Birmingham

Dr Vincent Connolly
Consultant Physician and Clinical Director, The James Cook University Hospital, Middlesborough

Mr James Cripps
Director, Juvenile Diabetes Research Foundation, London

Mrs Jo Dalton
Specialist Practitioner, Paediatric Diabetes, Westmorland General Hospital, Morecambe Bay Hospitals NHS Trust

Mr Alan English
Consultant Clinical Psychologist, Calderdale and Huddersfield NHS Trust

Mrs Jane Houghton
Nurse Consultant, Paediatric Ambulatory Care, Royal Preston Hospital, Lancashire Teaching Hospitals NHS Trust

Dr Mustafa Kapasi
General Practitioner, Inverclyde

Miss Gill Regan
Chief Paediatric Dietitian, Royal Gwent Hospital Newport

Mrs Carol Williams
Head of Care Support, Diabetes UK, London

Ms Jane Thomas
Director, NCC–WCH

Dr Moira Mugglestone
Deputy Director, NCC-WCH

Miss Anna Burt
Research Fellow, NCC-WCH

Mr Greg Eliovson
Informatics Specialist, NCC-WCH

Mr Alex McNeil
Research Assistant, NCC-WCH

Miss Anna Bancsi
Work Programme Co-ordinator, NCC-WCH

Dr Hannah-Rose Douglas
Health Economist, London School of Hygiene and Tropical Medicine

Guideline on the diagnosis and management of type 1 diabetes in adults

Guideline Development Group (GDG) and Consensus Reference Group (CRG):

Dr John Astbury
Consultant in Health Protection, Health Protection Agency, Cumbria and Lancashire

Ms Clare Bailey
Consultant Ophthalmologist, Bristol Eye Hospital

Mr Steven Barnes
Health Services Research Fellow, National Collaborating Centre for Chronic Conditions

Mr Richard Broughton
Community Optometrist, Surrey

Dr Vincent Connelly
Consultant Physician and Clinical Director, The James Cook University Hospital, Middlesborough

Dr Melanie Davies
Consultant Physician in Diabetes and Endocrinology, University Hospitals of Leicester NHS Trust

Dr Richard Edlin
Research Associate in Health Economics, Sheffield Health Economics Group, University of Sheffield, and Health Economist, National Collaborating Centre for Chronic Conditions

Dr Gary Frost
Head of Therapy Services and Nutrition & Dietetic Research Group, Imperial College and Hammersmith Hospitals NHS Trust

Dr Roger Gadsby
GP Nuneaton, Warwickshire, and Senior Lecturer in Primary Care, University of Warwick; Medical Advisor, Warwick Diabetes Care

Ms Marilyn Gallichan
Diabetes Specialist Nurse, Royal Cornwall Hospitals Trust

Mr Rob Grant
Project Manager, National Collaborating Centre for Chronic Conditions

Ms Irene Gummerson
Pharmacist, Yorkshire

Ms Debbie Hammond
Patient and carer representative, London

Dr Simon Heller
Reader in Medicine, University of Sheffield and Honorary Consultant Physician, Sheffield Teaching Hospitals NHS Trust

Professor Philip Home
Professor of Diabetes Medicine, University of Newcastle-upon-Tyne, and Clinical Advisor, National Collaborating Centre for Chronic Conditions

Professor Des Johnston (CRG Chair)
Professor of Endocrinology and Metabolic Medicine, Imperial College and Hammersmith Hospitals NHS Trust, and CRG Chair, National Collaborating Centre for Chronic Conditions

Dr Colin Johnston
Consultant Physician & Endocrinologist, West Hertfordshire Hospitals NHS Trust

Dr George Kassianos
General Practitioner, Berkshire

Dr Eric Kilpatrick
Consultant in Chemical Pathology, Hull Royal Infirmary

Ms Suzanne Lucas
Patient and carer representative, London

Miss Emma Marcus
Clinical Specialist Diabetes Dietitian, Heart of Birmingham Teaching Primary Care Trust

Dr Alastair Mason (GDG Lead)
GDG Lead, National Collaborating Centre for Chronic Conditions

Dr Greg McAnulty
Consultant in ITU and Anaesthesia, St George's Healthcare NHS Trust

Dr Colin McIntosh
Consultant Physician in Diabetes and Endocrinology, Chelsea & Westminster Hospital NHS Trust, and Honorary Senior Lecturer, Imperial College London

Ms Sarah O'Brien
Nurse Consultant, St Helens and Knowseley Hospitals NHS Trust, Royal College of Nursing

Dr Vinod Patel
Consultant Diabetologist, George Eliot Hospital NHS Trust, and Reader in Clinical Skills, University of Warwick Medical School

Ms Karen Reid
Information Scientist, National Collaborating Centre for Chronic Conditions

Professor Ken Shaw
Consultant Physician and Director of Research & Development, Portsmouth Hospitals NHS Trust, and Association of British Clinical Diabetologists

Mr David Turner
Patient and carer representative, Berkshire

Ms Barbara Wall
Senior Lecturer and Programme Leader for Podiatry, University of East London

The National Collaborating Centre for Women and Children's Health convened a separate GDG to develop the children and adolescents' type 1 diabetes guideline. Vincent Connelly was a member of both groups, helped co-ordinate the work of the two NCCs throughout the process and chaired the joint meeting of the two GDGs.

Appendix C: The Guideline Review Panels

The Guideline Review Panels are independent panels that oversee the development of the guidelines and take responsibility for monitoring their quality. The Panels include experts on guideline methodology, health professionals and people with experience of the issues affecting patients and carers. The members of the Guideline Review Panels were as follows.

National Collaborating Centre for Women's and Children's Health

Miss Helen Spiby (Chair)
Senior Lecturer (Evidence Based Practice in Midwifery), Mother and Infant Research Unit, University of Leeds

Mr Vincent Argent
Consultant Obstetrician and Gynaecologist, Eastbourne District General Hospital

Dr Jo Cox
Clinical Research Physician, Eli Lilly and Co. Ltd

Dr Monica Lakhanpaul
Senior Lecturer in Child Health, University of Leicester and Consultant Paediatrician, Leicester City West Primary Care Trust and Leicester Royal Infirmary

Mrs Christina Oppenheimer
Consultant in Obstetrics and Gynaecology, Leicester Royal Infirmary and Honorary Senior Lecturer in Medical Education, University of Leicester

Dr Jenny Tyrell
Paediatrician, Royal United Hospital, Bath

Mrs Carol Youngs
Policy Director, British Dyslexia Association

National Collaborating Centre for Chronic Conditions

Dr Bernard Higgins (Chair)
Consultant Chest Physician, Newcastle upon Tyne

Dr Rob Higgins
Consultant in Renal and General Medicine, University Hospitals Coventry and Warwickshire NHS Trust, Coventry

Dr Peter Rutherford
Senior Lecturer in Nephrology, University of Wales College of Medicine

Dame Helena Shovelton
Chief Executive, British Lung Foundation

Mrs Fiona Wise
Chief Executive, Ealing Hospital NHS Trust

Dr John Young
Medical Director, Merck Sharp & Dohme (MSD)

Appendix D: Technical detail on the criteria for audit

The recommendations from this guideline have been incorporated into the diabetes and stroke NICE Pathways. The full guideline also contains the technical detail on the criteria for audit.

Appendix E: The algorithms

The recommendations from this guideline have been incorporated into the diabetes and stroke NICE Pathways. The full guideline also contains the algorithms.

Changes since publication

Since the publication of this guideline some of the recommendations have been updated in other NICE guidance, or by changes in guidance from other organisations.

- **July 2014:** Recommendations 1.10.1.2 to 1.10.1.5 and 1.10.2.4 to 1.10.2.7 have been updated and replaced by 'Lipid modification: cardiovascular risk assessment and the modification of blood lipids for the primary and secondary prevention of cardiovascular disease' (NICE clinical guideline 181, published July 2014)
- **October 2011:** Recommendations on managing hyperglycaemia in inpatients with threatened or actual myocardial infarction have been updated in line with 'Hyperglycaemia in acute coronary syndromes: management of hyperglycaemia in people with acute coronary syndromes' (NICE clinical guideline 130). Recommendation 1.12.3.6 – we have removed the recommendation that optimal insulin therapy should be provided to adults with diabetes who have threatened or actual myocardial infarction
- **March 2010:** Recommendations on neuropathic pain(recommendations 1.11.5.2, 1.11.5.3, 1.11.5.4, 1.11.5.5 and 1.11.5.7) have been updated and replaced by 'Neuropathic pain: the pharmacological management of neuropathic pain in adults in non-specialist settings' (NICE clinical guideline 96, published March 2010).
- **June 2009:** Recommendations on serological testing for coeliac disease have been updated in line with 'Coeliac disease: recognition and assessment of coeliac disease' (NICE clinical guideline 86, published May 2009):
  - Recommendation 1.3.5.1 – we have removed the recommendation to re-test for coeliac disease at least every 3 years after diagnosis.
  - Recommendation 1.12.4.1 – this now recommends that adults with type 1 diabetes should have serological testing for coeliac disease.
- **Recommendations on insulin pumps** NICE has published more recent guidance on insulin pumps – 'Continuous subcutaneous insulin infusion for the treatment of diabetes mellitus' (NICE technology appraisal guidance 151).

Other changes

- **May 2014:** minor maintenance
- **23 December 2011:** minor maintenance.
- The British Society for Paediatric Endocrinology and Diabetes has published an updated guideline on ketoacidosis in children and young people (referred to in recommendation 1.3.2.1 and appendix F). We have deleted appendix F and added the link to the updated guideline.
- The World Health Organization has produced new guidance on diagnosing diabetes (referred to in recommendation 1.1.1.1). We have added the link to the updated guidance.
- 'Hypostop' (referred to in recommendation 1.3.1.5) is now known as 'Glucogel'. We have updated the name of this product in recommendation 1.3.1.5.

About this guideline

NICE clinical guidelines are recommendations about the treatment and care of people with specific diseases and conditions in the NHS in England and Wales.

The guideline was developed by the National Collaborating Centre for Women's and Children's Health and the National Collaborating Centre for Chronic Conditions. The Centres worked with a group of healthcare professionals (including consultants, GPs and nurses), patients and carers, and technical staff, who reviewed the evidence and drafted the recommendations. The recommendations were finalised after public consultation.

The methods and processes for developing NICE clinical guidelines are described in The guidelines manual.

The recommendations from this guideline have been incorporated into the diabetes and stroke NICE Pathways. We have produced information for the public explaining this guideline for adults and children and young people.. Tools to help you put the guideline into practice and information about the evidence it is based on are also available.

Your responsibility

This guidance represents the view of NICE, which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer, and informed by the summary of product characteristics of any drugs they are considering.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to avoid unlawful discrimination and to have regard to promoting equality of opportunity. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties.

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