

# Type 1 diabetes in adults: diagnosis and management

NICE guideline

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## Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

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This guideline replaces TA53 and TA60.

This guideline partially replaces CG15.

This guideline is the basis of QS109 and QS6.

## Overview

This guideline covers the care and treatment for adults (aged 18 and over) with type 1 diabetes.

In December 2020 we made minor changes to the recommendations on diabetic retinopathy to align them with the [NHS diabetic eye screening programme](#).

## Who is it for?

- Healthcare professionals that care for adults with diabetes
- Commissioners and providers of diabetes services
- Adults with type 1 diabetes, and their families and carers

## Introduction

Type 1 diabetes affects over 370,000 adults in the UK. It results from destruction of the cells that normally make insulin. Loss of insulin secretion results in high blood glucose and other metabolic and haematological abnormalities, which have both short-term and long-term adverse effects on health. Over years, type 1 diabetes causes tissue damage which, if not detected and managed early, can result in disability: blindness, kidney failure and foot ulceration leading to amputation, as well as premature heart disease, stroke and death. The risk of all of these complications is greatly reduced by treatment that keeps circulating glucose levels to as near normal as possible, reducing tissue damage. Disability from complications that are not avoided can often be prevented by early detection and active management.

Type 1 diabetes is treated by insulin replacement, supported by active management of other cardiovascular risk factors, such as hypertension and high circulating lipids. Modern insulin replacement therapy aims to recreate normal fluctuations in circulating insulin concentrations. This supports a flexible lifestyle with minimal restrictions and, properly done, can improve blood glucose levels, reducing the risk of both structural complications and episodes of hypoglycaemia. Flexible insulin therapy usually involves self-injecting multiple daily doses of insulin, with doses adjusted based on taken or planned exercise, intended food intake and other factors, including current blood glucose, which the insulin user needs to test on a regular basis. This self-management needs the insulin user to have the skills and confidence to manage the regimen. One of the most important roles of healthcare professionals providing diabetes care to adults with type 1 diabetes is to ensure that systems are in place to provide informed, expert support, education and training for insulin users, as well as a range of other more conventional biomedical services and interventions.

Although type 1 diabetes in adults is not rare, it is not common enough that all healthcare professionals who deal with it are able to acquire and maintain all the necessary skills for its management. The aim of this guideline is to provide evidence-based, practical advice on supporting adults with type 1 diabetes to live full, largely unrestricted, lives and to avoid the short-term and long-term complications of both the disease and of its treatment.

## Reasons for the update

NICE last produced a guideline on type 1 diabetes in 2004. Since then, life expectancy for adults living with type 1 diabetes has increased, but it remains significantly shorter than for people without diabetes. There remain important deficiencies in care provision, most adults with type 1 diabetes have HbA1c above target levels, and rates of diabetic ketoacidosis (the acute complication

of insulin deficiency) and renal failure have increased. This update focuses on areas where new knowledge and treatment opportunities have arisen in the last decade. These include improvements in technology to support better glucose levels, that should result in improved outcomes for adults with type 1 diabetes. These changes also present more challenges in terms of the diversity and complexity of the tools that can now be provided, and this guideline describes evidence-based best practice for their deployment.

Topics from the 2004 guideline that were updated in 2015 include:

- diagnosing type 1 diabetes
- structured education programmes
- insulin preparations and regimens associated with improved glucose levels
- needle length for insulin injections
- new technologies for glucose monitoring and insulin delivery
- managing acute painful neuropathy associated with rapid blood glucose control, erectile dysfunction in men and gastroparesis
- primary prevention of cardiovascular disease.

The following topics were not included in 2004 and were added in 2015:

- new insulin formulations
- identifying, quantifying and managing impaired awareness of hypoglycaemia
- monitoring for thyroid disease
- use of blood ketone measurement in preventing and monitoring diabetic ketoacidosis
- carbohydrate counting and glycaemic index diets
- referral criteria for transplantation therapies.

This guideline describes methods for achieving optimal outcomes for adults with type 1 diabetes and to inform service design and delivery. Its intended audience includes healthcare professionals involved in delivering services to adults with type 1 diabetes, service managers and commissioners, and adults with type 1 diabetes and their families.

## Key priorities for implementation

The following recommendations have been identified as priorities for implementation. The full list of recommendations is in the [recommendations section](#).

### Education and information

- Offer all adults with type 1 diabetes a structured education programme of proven benefit, for example, the [DAFNE \(dose-adjustment for normal eating\) programme](#). Offer this programme 6 to 12 months after diagnosis. [2015]

### Blood glucose management

- Support adults with type 1 diabetes to aim for a target HbA1c level of 48 mmol/mol (6.5%) or lower, to minimise the risk of long-term vascular complications. [2015]
- Agree an individualised HbA1c target with each adult with type 1 diabetes, taking into account factors such as the person's daily activities, aspirations, likelihood of complications, comorbidities, occupation and history of hypoglycaemia. [2015]
- Support adults with type 1 diabetes to test at least 4 times a day, and up to 10 times a day if any of the following apply:
  - the desired target for blood glucose control, measured by HbA1c level (see [recommendation 1.6.6](#)), is not achieved
  - the frequency of hypoglycaemic episodes increases
  - there is a legal requirement to do so (such as before driving; see the [DVLA guide for medical professionals](#))
  - during periods of illness
  - before, during and after sport
  - when planning pregnancy, during pregnancy and while breastfeeding (see the [NICE guideline on diabetes in pregnancy](#))
  - if there is a need to know blood glucose levels more than 4 times a day for other reasons (for example, impaired awareness of hypoglycaemia, high-risk activities). [2015]

- Advise adults with type 1 diabetes to aim for:
  - a fasting plasma glucose level of 5 to 7 mmol/litre on waking and
  - a plasma glucose level of 4 to 7 mmol/litre before meals at other times of the day. [2015]

## Insulin therapy

- Offer multiple daily injection basal–bolus insulin regimens, rather than twice-daily mixed insulin regimens, as the insulin injection regimen of choice for all adults with type 1 diabetes. Provide the person with guidance on using multiple daily injection basal–bolus insulin regimens. [2015]

## Awareness and management of hypoglycaemia

- Assess awareness of hypoglycaemia in adults with type 1 diabetes at each annual review. [2015]

## Care of adults with type 1 diabetes in hospital

- Enable adults with type 1 diabetes who are hospital inpatients to self-administer subcutaneous insulin if they are willing and able and it is safe to do so. [2015]

## Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in [NICE's information on making decisions about your care](#).

[Making decisions using NICE guidelines](#) explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

## Blood glucose and plasma glucose

This guideline refers frequently to circulating glucose concentrations as 'blood glucose'. A lot of the evidence linking specific circulating glucose concentrations with particular outcomes uses 'plasma' rather than 'blood' glucose. In addition, patient-held glucose meters and monitoring systems are all calibrated to plasma glucose equivalents. However, the term 'blood glucose monitoring' is in very common use, so in this guideline we use the term 'blood glucose', except when referring to specific concentration values.

### 1.1 Diagnosis and early care plan

#### Diagnosis

1.1.1 Diagnose type 1 diabetes on clinical grounds in adults presenting with hyperglycaemia, bearing in mind that people with type 1 diabetes typically (but not always) have 1 or more of:

- ketosis
- rapid weight loss
- age of onset below 50 years
- body mass index (BMI) below 25 kg/m<sup>2</sup>
- personal and/or family history of autoimmune disease. [2015]

- 1.1.2 Do not discount a diagnosis of type 1 diabetes if an adult presents with a BMI of 25 kg/m<sup>2</sup> or above or is aged 50 years or above. [2015]
- 1.1.3 Do not measure C-peptide and/or diabetes-specific autoantibody titres routinely to confirm type 1 diabetes in adults. [2015]
- 1.1.4 Consider further investigation in adults that involves measurement of C-peptide and/or diabetes-specific autoantibody titres if:
- type 1 diabetes is suspected but the clinical presentation includes some atypical features (for example, age 50 years or above, BMI of 25 kg/m<sup>2</sup> or above, slow evolution of hyperglycaemia or long prodrome) or
  - type 1 diabetes has been diagnosed and treatment started but there is a clinical suspicion that the person may have a monogenic form of diabetes, and C-peptide and/or autoantibody testing may guide the use of genetic testing or
  - classification is uncertain, and confirming type 1 diabetes would have implications for availability of therapy (for example, continuous subcutaneous insulin infusion [CSII or 'insulin pump'] therapy). [2015]
- 1.1.5 When measuring C-peptide and/or diabetes-specific autoantibody titres, take into account that:
- autoantibody tests have their lowest false negative rate at the time of diagnosis, and that the false negative rate rises thereafter
  - C-peptide has better discriminative value the longer the test is done after diagnosis
  - with autoantibody testing, carrying out tests for 2 different diabetes-specific autoantibodies, with at least 1 being positive, reduces the false negative rate. [2015]

## Early care plan

- 1.1.6 At the time of diagnosis (or if necessary after the management of critically decompensated metabolism), the diabetes professional team should develop with and explain to the adult 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 medicines
  - detect adverse vascular risk factors
- environmental assessment to understand:
  - the social, home, work and recreational circumstances of the person 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/cardiovascular disease
- medication history/current medicines
- vascular risk factors

- smoking
- general examination
- weight/BMI
- foot/eye/vision examination
- urine albumin excretion/urine protein/serum creatinine
- psychological wellbeing
- attitudes to medicine and self-care
- immediate family and social relationships and availability of informal support. [2004]

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

- sites and timescales of diabetes education, including nutritional advice (see the [section on education and information](#) and the [section on dietary management](#))
- initial treatment modalities, including guidance on insulin injection and insulin regimens (see the [section on insulin therapy](#) and the [section on insulin delivery](#))
- means of self-monitoring and targets (see the [section on blood glucose management](#))
- symptoms, risk and treatment of hypoglycaemia
- management of special situations, such as driving
- means and frequency of communication with the diabetes professional team
- management of cardiovascular risk factors (see the [section on control of cardiovascular risk](#))
- for women of childbearing potential, implications for pregnancy and family planning advice (see the [NICE guideline on diabetes in pregnancy](#))
- frequency and content of follow-up consultations, including review of HbA1c levels and experience of hypoglycaemia, and annual review. [2004, amended 2015]

1.1.8 After the initial plan is agreed, put arrangements in place to implement it without inappropriate delay, and to provide for feedback and modification of the plan over the ensuing weeks. [2004]

## 1.2 Support and individualised care

- 1.2.1 Take account of any disabilities, including visual impairment, when planning and delivering care for adults with type 1 diabetes. [2015]
- 1.2.2 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. [2004]
- 1.2.3 Provide adults with type 1 diabetes with:
- open-access services on a walk-in and telephone-request basis during working hours
  - a helpline staffed by people with specific diabetes expertise on a 24-hour basis
  - contact information for these services. [2004]
- 1.2.4 Regard each adult with type 1 diabetes as an individual, rather than as a member of any cultural, economic or health-affected group (see also [recommendations 1.4.5 and 1.4.13](#) about the cultural preferences of individual adults with type 1 diabetes). [2004, amended 2015]
- 1.2.5 Set up an individual care plan jointly agreed with the adult with type 1 diabetes, review it annually and modify it taking into account changes in the person's wishes, circumstances and medical findings, and record the details. The plan should include aspects of:
- diabetes education, including nutritional advice (see the [section on education and information](#) and the [section on dietary management](#))
  - insulin therapy, including dose adjustment (see the [section on insulin therapy](#))
  - self-monitoring (see the [section on blood glucose management](#))
  - avoiding hypoglycaemia and maintaining awareness of hypoglycaemia
  - for women of childbearing potential, family planning, contraception and pregnancy planning (see the [NICE guideline on diabetes in pregnancy](#))

- cardiovascular risk factor monitoring and management (see the [section on control of cardiovascular risk](#))
  - complications monitoring and management (see the [section on managing complications](#))
  - means and frequency of communicating with the diabetes professional team
  - frequency and content of follow-up consultations, including review of HbA1c levels and experience of hypoglycaemia, and next annual review. [2004, amended 2015]
- 1.2.6 Use population, practice-based and clinic diabetes registers (as specified by the [government national service framework for diabetes](#)) to assist programmed recall for annual review and assessment of complications and cardiovascular risk. [2004]
- 1.2.7 The multidisciplinary team approach should be available to inpatients with type 1 diabetes, regardless of the reason for admission (see the [section on care of adults with type 1 diabetes in hospital](#)). [2004]
- 1.2.8 At the time of diagnosis and periodically thereafter, provide adults with type 1 diabetes with up-to-date information about diabetes support groups (local and national), how to contact them and the benefits of membership. [2004]

## 1.3 Education and information

Recommendations in this section update and replace the NICE technology appraisal guidance on the use of patient-education models for diabetes for adults with type 1 diabetes.

- 1.3.1 Offer all adults with type 1 diabetes a structured education programme of proven benefit, for example, the [DAFNE \(dose-adjustment for normal eating\) programme](#). Offer this programme 6 to 12 months after diagnosis. [2015]
- 1.3.2 If a structured education programme has not been undertaken by an adult with type 1 diabetes by 12 months after diagnosis, offer it at any time that is clinically appropriate and suitable for the person, regardless of duration of type 1 diabetes. [2015]
- 1.3.3 Provide an alternative of equal standard for any adult with type 1 diabetes unable or unwilling to participate in group education. [2015]

- 1.3.4 Ensure that any structured education programme for adults with type 1 diabetes includes the following components:
- It is evidence-based, and suits the needs of the person.
  - It has specific aims and learning objectives, and supports the person and their family members and carers in developing attitudes, beliefs, knowledge and skills to self-manage diabetes.
  - It has a structured curriculum that is theory-driven, evidence-based and resource-effective, has supporting materials, and is written down.
  - It is delivered by trained educators who have an understanding of educational theory appropriate to the age and needs of the person, and who are trained and competent to deliver the principles and content of the programme.
  - It is quality assured, and reviewed by trained, competent, independent assessors who measure it against criteria that ensure consistency.
  - The outcomes are audited regularly. [2015]
- 1.3.5 Explain to adults with type 1 diabetes that structured education is an integral part of diabetes care. [2015]
- 1.3.6 Provide information about type 1 diabetes and its management to adults with type 1 diabetes at all opportunities from diagnosis onwards. Follow the principles in the [NICE guideline on patient experience in adult NHS services](#). [2015]
- 1.3.7 Consider the Blood Glucose Awareness Training (BGAT) programme for adults with type 1 diabetes who are having recurrent episodes of hypoglycaemia (see also the [section on awareness and management of hypoglycaemia](#)). [2015]
- 1.3.8 Carry out more formal review of self-care and needs annually in all adults with type 1 diabetes. Vary the agenda addressed each year according to the priorities agreed between the healthcare professional and the adult with type 1 diabetes. [2004, amended 2015]

## 1.4 Dietary management

### Carbohydrate counting

- 1.4.1 Offer carbohydrate-counting training to adults with type 1 diabetes as part of structured education programmes for self-management (see the [section on education and information](#)). [2015]
- 1.4.2 Consider carbohydrate-counting courses for adults with type 1 diabetes who are waiting for a more detailed structured education programme or are unable to take part in a stand-alone structured education programme. [2015]

### Glycaemic index diets

- 1.4.3 Do not advise adults with type 1 diabetes to follow a low glycaemic index diet for blood glucose control. [2015]

### Dietary advice

- 1.4.4 Offer dietary advice to adults with type 1 diabetes about issues other than blood glucose control, such as weight control and cardiovascular risk management, as indicated clinically. [2015]
- 1.4.5 Provide nutritional information sensitive to personal needs and culture from the time of diagnosis of type 1 diabetes. [2004]
- 1.4.6 Provide nutritional information individually and as part of a diabetes education programme (see the [section on education and information](#)). Include advice from professionals with specific and approved training and continuing accredited education in delivering nutritional advice to people with health conditions. Offer opportunities to receive nutritional advice at intervals agreed between adults with type 1 diabetes and their advising professionals. [2004]
- 1.4.7 Discuss the hyperglycaemic effects of different foods an adult with type 1 diabetes wishes to eat in the context of the insulin preparations chosen to match those food choices. [2004]
- 1.4.8 Make programmes 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. [2004, amended 2015]
- 1.4.9 Agree the choice of content, timing and amount of snacks between meals or at bedtime available to the adult with type 1 diabetes, based on informed discussion about the extent and duration of the effects of eating different food types and the insulin preparations available to match them. Modify those choices based on discussion of the results of self-monitoring tests. [2004]
- 1.4.10 Make information available on:
- effects of different alcohol-containing drinks on blood glucose excursions and calorie intake
  - use of high-calorie and high-sugar 'treats'. [2004, amended 2015]
- 1.4.11 Make information available about the benefits of healthy eating in reducing cardiovascular risk as part of dietary education in the period after diagnosis, and according to need and interest at intervals thereafter. Include information about fruit and vegetables, types and amounts of fat, and ways of making the appropriate nutritional changes. [2004, amended 2015]
- 1.4.12 Modify nutritional recommendations to adults with type 1 diabetes to take account of associated features of diabetes, including:
- excess weight and obesity
  - underweight
  - eating disorders
  - hypertension
  - renal failure. [2004]
- 1.4.13 Be aware of appropriate nutritional advice on common topics of concern and interest to adults living with type 1 diabetes, and be prepared to seek advice from colleagues with more specialised knowledge. Suggested common topics include:

- 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
- comorbidities, including nephropathy and renal failure, coeliac disease, cystic fibrosis or eating disorders
- use of peer support groups. [2004, amended 2015]

## 1.5 Physical activity

1.5.1 Advise adults with type 1 diabetes that physical activity can reduce their enhanced cardiovascular risk in the medium and longer term. [2004]

1.5.2 Give adults with type 1 diabetes who choose to integrate increased physical activity into a more healthy lifestyle 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. [2004]

## 1.6 Blood glucose management

### HbA1c measurement and targets

#### Measurement

- 1.6.1 Measure HbA1c levels every 3 to 6 months in adults with type 1 diabetes. [2015]
- 1.6.2 Consider measuring HbA1c levels more often in adults with type 1 diabetes if the person's blood glucose control is suspected to be changing rapidly; for example, if the HbA1c level has risen unexpectedly above a previously sustained target. [2015]
- 1.6.3 Use methods to measure HbA1c that have been calibrated according to International Federation of Clinical Chemistry (IFCC) standardisation. [2015]
- 1.6.4 Inform adults with type 1 diabetes of their HbA1c results after each measurement and ensure that their most recent result is available at the time of consultation. Follow the principles in the [NICE guideline on patient experience in adult NHS services](#) about communication. [2015]
- 1.6.5 If HbA1c monitoring is invalid because of disturbed erythrocyte turnover or abnormal haemoglobin type, estimate trends in blood glucose control using one of the following:
- fructosamine estimation
  - quality-controlled blood glucose profiles
  - total glycated haemoglobin estimation (if abnormal haemoglobins). [2015]

## Targets

- 1.6.6 Support adults with type 1 diabetes to aim for a target HbA1c level of 48 mmol/mol (6.5%) or lower, to minimise the risk of long-term vascular complications. [2015]
- 1.6.7 Agree an individualised HbA1c target with each adult with type 1 diabetes, taking into account factors such as the person's daily activities, aspirations, likelihood of complications, comorbidities, occupation and history of hypoglycaemia. [2015]
- 1.6.8 Ensure that aiming for an HbA1c target is not accompanied by problematic hypoglycaemia in adults with type 1 diabetes. [2015]
- 1.6.9 Diabetes services should document the proportion of adults with type 1 diabetes in a service who achieve an HbA1c level of 53 mmol/mol (7%) or lower. [2015]

## Self-monitoring of blood glucose

### Frequency of self-monitoring of blood glucose

- 1.6.10 Advise routine self-monitoring of blood glucose levels for all adults with type 1 diabetes, and recommend testing at least 4 times a day, including before each meal and before bed. [2015]
- 1.6.11 Support adults with type 1 diabetes to test at least 4 times a day, and up to 10 times a day if any of the following apply:
- the desired target for blood glucose control, measured by HbA1c level (see recommendation 1.6.6), is not achieved
  - the frequency of hypoglycaemic episodes increases
  - there is a legal requirement to do so (such as before driving; see the [DVLA guide for medical professionals](#))
  - during periods of illness
  - before, during and after sport

- when planning pregnancy, during pregnancy and while breastfeeding (see the [NICE guideline on diabetes in pregnancy](#))
- if there is a need to know blood glucose levels more than 4 times a day for other reasons (for example, impaired awareness of hypoglycaemia, high-risk activities). [2015]

1.6.12 Enable additional blood glucose testing (more than 10 times a day) for adults with type 1 diabetes if this is necessary because of the person's lifestyle (for example, driving for a long period of time, undertaking high-risk activity or occupation, travel) or if the person has impaired awareness of hypoglycaemia. [2015]

## Blood glucose targets

1.6.13 Advise adults with type 1 diabetes to aim for:

- a fasting plasma glucose level of 5 to 7 mmol/litre on waking and
- a plasma glucose level of 4 to 7 mmol/litre before meals at other times of the day. [2015]

1.6.14 Advise adults with type 1 diabetes who choose to test after meals to aim for a plasma glucose level of 5 to 9 mmol/litre at least 90 minutes after eating. (This timing may be different in pregnancy – for guidance on plasma glucose targets in pregnancy, see the [NICE guideline on diabetes in pregnancy](#).) [2015]

1.6.15 Agree bedtime target plasma glucose levels with each adult with type 1 diabetes that take into account timing of the last meal and its related insulin dose, and are consistent with the recommended fasting level on waking (see recommendation 1.6.13). [2015]

## Empowering people to self-monitor blood glucose

1.6.16 Teach self-monitoring skills at the time of diagnosis and initiation of insulin therapy. [2004, amended 2015]

1.6.17 When choosing blood glucose meters:

- take the needs of the adult with type 1 diabetes into account

- ensure that meters meet current ISO standards. [2015]

1.6.18 Educate adults with type 1 diabetes about how to measure their blood glucose level, interpret the results and know what action to take. Review these skills at least annually. [2015]

1.6.19 Support adults with type 1 diabetes to make the best use of data from self-monitoring of blood glucose through structured education (see [recommendations 1.3.1 and 1.3.2](#)). [2015]

## Sites for self-monitoring of blood glucose

1.6.20 Monitoring blood glucose using sites other than the fingertips cannot be recommended as a routine alternative to conventional self-monitoring of blood glucose. [2004, amended 2015]

## Continuous glucose monitoring

1.6.21 Do not offer real-time continuous glucose monitoring routinely to adults with type 1 diabetes. [2015]

1.6.22 Consider real-time continuous glucose monitoring for adults with type 1 diabetes who are willing to commit to using it at least 70% of the time and to calibrate it as needed, and who have any of the following despite optimised use of insulin therapy and conventional blood glucose monitoring:

- More than 1 episode a year of severe hypoglycaemia with no obviously preventable precipitating cause.
- Complete loss of awareness of hypoglycaemia.
- Frequent (more than 2 episodes a week) asymptomatic hypoglycaemia that is causing problems with daily activities.
- Extreme fear of hypoglycaemia.

- Hyperglycaemia (HbA1c level of 75 mmol/mol [9%] or higher) that persists despite testing at least 10 times a day (see recommendations 1.6.11 and 1.6.12). Continue real-time continuous glucose monitoring only if HbA1c can be sustained at or below 53 mmol/mol (7%) and/or there has been a fall in HbA1c of 27 mmol/mol (2.5%) or more. [2015]
- 1.6.23 For adults with type 1 diabetes who are having real-time continuous glucose monitoring, use the principles of flexible insulin therapy with either a multiple daily injection insulin regimen or continuous subcutaneous insulin infusion (CSII or insulin pump) therapy. [2015]
- 1.6.24 Real-time continuous glucose monitoring should be provided by a centre with expertise in its use, as part of strategies to optimise a person's HbA1c levels and reduce the frequency of hypoglycaemic episodes. [2015]

## 1.7 Insulin therapy

### Insulin regimens

- 1.7.1 Offer multiple daily injection basal–bolus insulin regimens, rather than twice-daily mixed insulin regimens, as the insulin injection regimen of choice for all adults with type 1 diabetes. Provide the person with guidance on using multiple daily injection basal–bolus insulin regimens. [2015]
- 1.7.2 Do not offer adults newly diagnosed with type 1 diabetes non-basal–bolus insulin regimens (that is, twice-daily mixed, basal only or bolus only). [2015]

### Long-acting insulin

Recommendations in this section update and replace the NICE technology appraisal guidance on the use of long-acting insulin analogues for the treatment of diabetes – insulin glargine, in relation to adults with type 1 diabetes.

- 1.7.3 Offer twice-daily insulin detemir as basal insulin therapy for adults with type 1 diabetes. [2015]
- 1.7.4 Consider, as an alternative basal insulin therapy for adults with type 1 diabetes:

- an existing insulin regimen being used by the person that is achieving their agreed targets
- once-daily insulin glargine or insulin detemir if twice-daily basal insulin injection is not acceptable to the person, or once-daily insulin glargine if insulin detemir is not tolerated. [2015]

1.7.5 Consider other basal insulin regimens for adults with type 1 diabetes only if the regimens in recommendations 1.7.3 and 1.7.4 do not deliver agreed targets. When choosing an alternative insulin regimen, take account of the person's preferences and acquisition cost. [2015]

## Continuous subcutaneous insulin infusion (CSII or insulin pump) therapy

1.7.6 For guidance on the use of continuous subcutaneous insulin infusion (CSII or insulin pump) therapy for adults with type 1 diabetes, see the [NICE technology appraisal guidance on continuous subcutaneous insulin infusion for the treatment of diabetes mellitus](#). [2015]

## Rapid-acting insulin

- 1.7.7 Offer rapid-acting insulin analogues injected before meals, rather than rapid-acting soluble human or animal insulins, for mealtime insulin replacement for adults with type 1 diabetes. [2015]
- 1.7.8 Do not advise routine use of rapid-acting insulin analogues after meals for adults with type 1 diabetes. [2015]
- 1.7.9 If an adult with type 1 diabetes has a strong preference for an alternative mealtime insulin, respect their wishes and offer the preferred insulin. [2015]

## Mixed insulin

- 1.7.10 Consider a twice-daily human mixed insulin regimen for adults with type 1 diabetes if a multiple daily injection basal-bolus insulin regimen is not possible and a twice-daily mixed insulin regimen is chosen. [2015]
- 1.7.11 Consider a trial of a twice-daily analogue mixed insulin regimen if an adult using

a twice-daily human mixed insulin regimen has hypoglycaemia that affects their quality of life. [2015]

## Optimising insulin therapy

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

- 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. [2004, amended 2015]

1.7.13 Give clear guidelines and protocols ('sick-day rules') to all adults with type 1 diabetes to help them to adjust insulin doses appropriately during periods of illness. [2004]

## Adjuncts

1.7.14 Consider adding metformin to insulin therapy if an adult with type 1 diabetes and a BMI of 25 kg/m<sup>2</sup> (23 kg/m<sup>2</sup> for people from South Asian and related minority ethnic groups) or above wants to improve their blood glucose control while minimising their effective insulin dose. [2015]

In August 2015, this was an off-label use of metformin. See [NICE's information on prescribing medicines](#).

## 1.8 Insulin delivery

1.8.1 Adults with type 1 diabetes who inject insulin should have access to the insulin injection delivery device they find allows them optimal wellbeing, often using

one or more types of insulin injection pen. [2004]

- 1.8.2 Provide adults with type 1 diabetes who have special visual or psychological needs with injection devices or needle-free systems that they can use independently for accurate dosing. [2004]
- 1.8.3 Offer needles of different lengths to adults with type 1 diabetes who are having problems such as pain, local skin reactions and injection site leakages. [2015]
- 1.8.4 After taking clinical factors into account, choose needles with the lowest acquisition cost to use with pre-filled and reusable insulin pen injectors. [2015]
- 1.8.5 Advise adults with type 1 diabetes to rotate insulin injection sites and avoid repeated injections at the same point within sites. [2015]
- 1.8.6 Provide adults with type 1 diabetes with suitable containers for collecting used needles and other sharps. Arrangements should be available for the suitable disposal of these containers. See also the [section on safe use and disposal of sharps in the NICE guideline on infection control](#). [2004, amended 2015]
- 1.8.7 Check injection site condition at least annually and if new problems with blood glucose control occur. [2004, amended 2015]

## 1.9 Referral for islet or pancreas transplantation

- 1.9.1 Consider referring adults with type 1 diabetes who have recurrent severe hypoglycaemia that has not responded to other treatments (see the [section on awareness and management of hypoglycaemia](#)) to a centre that assesses people for islet and/or pancreas transplantation. [2015]
- 1.9.2 Consider islet or pancreas transplantation for adults with type 1 diabetes with suboptimal diabetes control who have had a renal transplant and are currently on immunosuppressive therapy. [2015]

## 1.10 Awareness and management of hypoglycaemia

### Identifying and quantifying impaired awareness of hypoglycaemia

- 1.10.1 Assess awareness of hypoglycaemia in adults with type 1 diabetes at each annual review. [2015]
- 1.10.2 Use the Gold score or Clarke score to quantify awareness of hypoglycaemia in adults with type 1 diabetes, checking that the questionnaire items have been answered correctly. [2015]
- 1.10.3 Explain to adults with type 1 diabetes that impaired awareness of the symptoms of plasma glucose levels below 3 mmol/litre is associated with a significantly increased risk of severe hypoglycaemia. [2015]

### Strategies for managing impaired awareness of hypoglycaemia

- 1.10.4 Ensure that adults with type 1 diabetes with impaired awareness of hypoglycaemia have had structured education in flexible insulin therapy using basal-bolus regimens and are following its principles correctly. [2015]
- 1.10.5 Offer additional education focusing on avoiding and treating hypoglycaemia to adults with type 1 diabetes who continue to have impaired awareness of hypoglycaemia after structured education in flexible insulin therapy. [2015]
- 1.10.6 Avoid relaxing individualised blood glucose targets as a treatment for adults with type 1 diabetes with impaired awareness of hypoglycaemia. [2015]
- 1.10.7 If target blood glucose levels preferred by adults with type 1 diabetes who have impaired awareness of hypoglycaemia are lower than recommended, reinforce the recommended targets (see [recommendations 1.6.13 to 1.6.15](#)). [2015]
- 1.10.8 Review insulin regimens and doses and prioritise strategies to avoid hypoglycaemia in adults with type 1 diabetes with impaired awareness of hypoglycaemia, including:
  - reinforcing the principles of structured education
  - offering continuous subcutaneous insulin infusion (CSII or insulin pump) therapy

- offering real-time continuous glucose monitoring. [2015]

1.10.9 If impaired awareness of hypoglycaemia is associated with recurrent severe hypoglycaemia in an adult with type 1 diabetes despite these interventions, consider referring the person to a specialist centre. [2015]

## Preventing and managing hypoglycaemia

1.10.10 Explain to adults with type 1 diabetes that a fast-acting form of glucose is needed for the management of hypoglycaemic symptoms or signs in people who are able to swallow. [2004, amended 2015]

1.10.11 Adults with type 1 diabetes with a decreased level of consciousness as a result of hypoglycaemia and so are unable to take oral treatment safely should be:

- given intramuscular glucagon by a family member or friend who has been shown how to use it (intravenous glucose may be used by healthcare professionals skilled in obtaining intravenous access)
- monitored for response at 10 minutes, and then given intravenous glucose if their 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. [2004, amended 2015]

1.10.12 Explain to adults with type 1 diabetes 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. Make advice available to all adults with type 1 diabetes to assist in obtaining the best such balance from any insulin regimen. (See the [section on education and information](#) and the [section on dietary management](#).) [2004]

1.10.13 If hypoglycaemia becomes unusually problematic or of increased frequency, review the following possible contributory causes:

- inappropriate insulin regimens (incorrect dose distributions and insulin types)

- meal and activity patterns, including alcohol
- injection technique and skills, including insulin resuspension if necessary
- injection site problems
- possible organic causes including gastroparesis
- changes in insulin sensitivity (including drugs affecting the renin–angiotensin system and renal failure)
- psychological problems
- previous physical activity
- lack of appropriate knowledge and skills for self-management. [2004]

1.10.14 Manage nocturnal hypoglycaemia (symptomatic or detected on monitoring) by:

- reviewing knowledge and self-management skills
- reviewing current insulin regimen, evening eating habits and previous physical activity
- choosing an insulin type and regimen that is less likely to induce low glucose levels at night. [2004, amended 2015]

1.10.15 If early cognitive decline occurs in adults on long-term insulin therapy, supplement normal investigations by the consideration or investigation of possible brain damage resulting from overt or covert hypoglycaemia, and the need to ameliorate this. [2004]

## 1.11 Ketone monitoring and management of diabetic ketoacidosis (DKA)

### Ketone self-monitoring for prevention of DKA

1.11.1 Consider ketone monitoring (blood or urine) as part of 'sick-day rules' for adults with type 1 diabetes, to facilitate self-management of an episode of hyperglycaemia. [2015]

## Ketone monitoring in hospital

1.11.2 In adults with type 1 diabetes presenting to emergency services, consider capillary blood ketone testing if:

- DKA is suspected or
- the person has uncontrolled diabetes with a period of illness, and urine ketone testing is positive. [2015]

1.11.3 Consider capillary blood ketone testing for inpatient management of DKA in adults with type 1 diabetes that is incorporated into a formal protocol. [2015]

## Management of DKA

1.11.4 Professionals managing DKA in adults 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, electrocardiogram [ECG])
- respiratory distress syndrome
- cardiac abnormalities
- precipitating causes
- infection management, including opportunistic infections
- gastroparesis
- use of high dependency and intensive care units

- recommendations 1.11.5 to 1.11.12 in this guideline.

Management of DKA in adults should be in line with local clinical governance. [2004]

- 1.11.5 For primary fluid replacement in adults with DKA, use isotonic saline, not given too rapidly except in cases of circulatory collapse. [2004]
- 1.11.6 Do not generally use bicarbonate in the management of DKA in adults. [2004, amended 2015]
- 1.11.7 Give intravenous insulin by infusion to adults with DKA. [2004]
- 1.11.8 In the management of DKA in adults, once the plasma glucose concentration has fallen to 10 to 15 mmol/litre, give glucose-containing fluids (not more than 2 litres in 24 hours) in order to allow continued infusion of insulin at a sufficient rate to clear ketones (for example, 6 units/hour monitored for effect). [2004, amended 2015]
- 1.11.9 Begin potassium replacement early in DKA in adults, with frequent monitoring for the development of hypokalaemia. [2004]
- 1.11.10 Do not generally use phosphate replacement in the management of DKA in adults. [2004, amended 2015]
- 1.11.11 In adults with DKA whose conscious level is impaired, consideration should be given to inserting a nasogastric tube, monitoring urine production using a urinary catheter and giving heparin. [2004]
- 1.11.12 To reduce the risk of catastrophic outcomes in adults with DKA, ensure that monitoring is continuous and that review covers all aspects of clinical management at frequent intervals. [2004, amended 2015]

## 1.12 Associated illness

- 1.12.1 In adults with type 1 diabetes who have a low BMI or unexplained weight loss, assess markers of coeliac disease. For guidance on testing for coeliac disease, see the [NICE guideline on coeliac disease](#). [2004, amended 2015]
- 1.12.2 Be alert to the possibility of the development of other autoimmune disease in

adults with type 1 diabetes (including Addison's disease and pernicious anaemia). For advice on monitoring for thyroid disease, see the [recommendation on thyroid disease monitoring](#). [2004, amended 2015]

## 1.13 Control of cardiovascular risk

### Aspirin

1.13.1 Do not offer aspirin for the primary prevention of cardiovascular disease to adults with type 1 diabetes. [2015]

### Identifying cardiovascular risk

1.13.2 Assess cardiovascular risk factors annually, including:

- albuminuria
- smoking
- blood glucose control
- blood pressure
- full lipid profile (including high-density lipoprotein [HDL] and low-density lipoprotein [LDL] cholesterol and triglycerides)
- age
- family history of cardiovascular disease
- abdominal adiposity. [2004, amended 2015]

1.13.3 For guidance on tools for assessing risk of cardiovascular disease in adults with type 1 diabetes, see [recommendation 1.1.9 in the NICE guideline on lipid modification](#). [2015]

### Interventions to reduce risk and manage cardiovascular disease

1.13.4 For guidance on the primary prevention of cardiovascular disease in adults with type 1 diabetes, see the [NICE guideline on lipid modification](#). [2015]

- 1.13.5 Give adults with type 1 diabetes who smoke advice on smoking cessation and use of smoking cessation services, including NICE guidance-recommended therapies. Reinforce these messages annually for people who currently do not plan to stop smoking, and at all clinical contacts if there is a prospect of the person stopping. [2004]
- 1.13.6 Advise young adult non-smokers never to start smoking. [2004]
- 1.13.7 Provide intensive management for adults who have had myocardial infarction or stroke, 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 the [section on care of adults with type 1 diabetes in hospital](#).) For guidance on secondary prevention of myocardial infarction, see the [NICE guideline on acute coronary syndromes](#). [2004, amended 2015]

## Blood pressure management

- 1.13.8 Intervention levels for recommending blood pressure management should be 135/85 mmHg unless the adult with type 1 diabetes has albuminuria or 2 or more features of metabolic syndrome, in which case it should be 130/80 mmHg. See also [recommendations 1.15.9 to 1.15.11](#). [2004]
- 1.13.9 To allow informed choice by the person with hypertension, discuss the following with them:
- reasons for choice of intervention level
  - substantial potential gains from small improvements in blood pressure control
  - possible negative consequences of therapy.
- See also [recommendations 1.15.9 and 1.15.10](#). [2004, amended 2015]
- 1.13.10 Start a trial of a renin–angiotensin system blocking drug as first-line therapy for hypertension in adults with type 1 diabetes. [2004, amended 2015]
- 1.13.11 Provide information to adults with type 1 diabetes on the potential for lifestyle changes to improve blood pressure control and associated outcomes, and offer

assistance in achieving their aims in this area. [2004]

1.13.12 Do not allow concerns over potential side effects 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:

- do not avoid selective beta-adrenergic blockers where indicated in adults on insulin
- low-dose thiazides may be combined with beta-blockers
- when calcium channel antagonists are prescribed, use only long-acting preparations
- use direct questioning to detect the potential side effects of erectile dysfunction, lethargy and orthostatic hypotension with different drug classes. [2004, amended 2015]

1.13.13 For guidance on blood pressure management in adults with type 1 diabetes and evidence of renal involvement, see [recommendations 1.6.2 to 1.6.4 in the NICE guideline on chronic kidney disease](#). [2015]

## 1.14 Care of adults with type 1 diabetes in hospital

### Blood glucose control

1.14.1 Aim for a target plasma glucose level of 5 to 8 mmol/litre for adults with type 1 diabetes during surgery or acute illness. [2015]

1.14.2 Establish a local protocol for controlling blood glucose levels in adults with type 1 diabetes during surgery or acute illness to achieve the target level. [2015]

1.14.3 Use intravenous in preference to subcutaneous insulin regimens for adults with type 1 diabetes if:

- the person is unable to eat or is predicted to miss more than 1 meal or
- an acute situation is expected to result in unpredictable blood glucose levels – for example, major surgery, high-dose steroid treatment, inotrope treatment or sepsis or
- insulin absorption is expected to be unpredictable, for example, because of circulatory compromise. [2015]

- 1.14.4 Consider continuing the person's existing basal insulin regimen (including basal rate if they are using continuous subcutaneous insulin infusion [CSII or insulin pump] therapy) together with protocol-driven insulin delivery for controlling blood glucose levels in adults with type 1 diabetes during surgery or acute illness. [2015]
- 1.14.5 Use subcutaneous insulin regimens (including rapid-acting insulin before meals) if an adult with type 1 diabetes and acute illness is eating. [2015]
- 1.14.6 Enable adults with type 1 diabetes who are hospital inpatients to self-administer subcutaneous insulin if they are willing and able and it is safe to do so. [2015]

## Delivery of care

- 1.14.7 From the time of admission, the adult 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. [2004]
- 1.14.8 Throughout the course of an inpatient admission, respect the personal expertise of adults with type 1 diabetes (in managing their own diabetes) and routinely integrate this into ward-based blood glucose monitoring and insulin delivery. [2004, amended 2015]
- 1.14.9 Throughout the course of an inpatient admission, the personal knowledge and needs of adults with type 1 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. [2004]
- 1.14.10 Members of care teams caring for adults with type 1 diabetes in institutions, such as nursing homes, residential homes and prisons, should follow the recommendations in this section. [2004]
- 1.14.11 Provide optimal insulin therapy, which can be achieved by the use of intravenous insulin and glucose, to all adults with type 1 diabetes with threatened or actual stroke. Critical care and emergency departments should have a protocol for such management. [2004, amended 2011]

## 1.15 Managing complications

### Eye disease

- 1.15.1 When adults are diagnosed with type 1 diabetes, GPs should immediately refer them to the local eye screening service. [2004, amended 2020]
- 1.15.2 Encourage adults to attend eye screening, and explain that it will help them to keep their eyes healthy and help to prevent problems with their vision. Explain that the screening service is effective at identifying problems so that they can be treated early. [2004]
- 1.15.3 Arrange emergency review by an ophthalmologist for:
- sudden loss of vision
  - rubeosis iridis
  - pre-retinal or vitreous haemorrhage
  - retinal detachment. [2004, amended 2015]
- 1.15.4 Refer to an ophthalmologist in accordance with the National Screening Committee criteria and timelines for any large sudden unexplained drop in visual acuity. [2004, amended 2020]

### Diabetic kidney disease

- 1.15.5 For guidance on managing kidney disease in adults with type 1 diabetes, see the [NICE guideline on chronic kidney disease](#). [2015]
- 1.15.6 Ask all adults with type 1 diabetes with or without detected nephropathy to bring in the first urine sample of the day ('early morning urine') once a year. Send this 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. [2004]
- 1.15.7 Suspect other renal disease:
- 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. [2004]
- 1.15.8 Discuss the significance of a finding of albuminuria with the person concerned. [2004, amended 2015]
- 1.15.9 Start angiotensin-converting enzyme (ACE) inhibitors and, with the usual precautions, titrate to full dose in all adults with confirmed nephropathy (including those with moderately increased albuminuria ['microalbuminuria'] alone) and type 1 diabetes. [2004, amended 2015]
- 1.15.10 If ACE inhibitors are not tolerated, substitute angiotensin 2 receptor antagonists. Combination therapy is not recommended. [2004, amended 2015]
- 1.15.11 Maintain blood pressure below 130/80 mmHg by addition of other anti-hypertensive drugs if necessary. [2004]
- 1.15.12 Advise adults with type 1 diabetes and nephropathy about the advantages of not following a high-protein diet. [2004]
- 1.15.13 Referral criteria for tertiary care should be agreed between local diabetes specialists and nephrologists. [2004]

## Chronic painful diabetic neuropathy

- 1.15.14 For guidance on managing chronic painful diabetic neuropathy in adults with type 1 diabetes, see the [NICE guideline on neuropathic pain in adults: pharmacological management in non-specialist settings](#). [2015]

## Autonomic neuropathy

- 1.15.15 In adults with type 1 diabetes who have unexplained diarrhoea, particularly at night, the possibility of autonomic neuropathy affecting the gut should be considered. [2004]

- 1.15.16 Take care when prescribing antihypertensive medicines 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 medicines. [2004]
- 1.15.17 In adults with type 1 diabetes who have bladder emptying problems, investigate the possibility of autonomic neuropathy affecting the bladder, unless other explanations are adequate. [2004]
- 1.15.18 When managing the symptoms of autonomic neuropathy, include standard interventions for the manifestations encountered (for example, for abnormal sweating and postural hypotension). [2004, amended 2015]
- 1.15.19 Anaesthetists should be aware of the possibility of parasympathetic autonomic neuropathy affecting the heart in adults with type 1 diabetes who are listed for procedures under general anaesthetic and who have evidence of somatic neuropathy or other manifestations of autonomic neuropathy. [2004]

## Gastroparesis

- 1.15.20 Advise a small-particle-size diet (mashed or pureed food) for symptomatic relief for adults with type 1 diabetes who have vomiting caused by gastroparesis. Be aware that diagnosis of gastroparesis needing specific therapy can only be made in the absence of hyperglycaemia at the time of testing, because hyperglycaemia induces a physiological delay in gastric emptying. [2015]
- 1.15.21 Consider continuous subcutaneous insulin infusion (CSII or insulin pump) therapy for adults with type 1 diabetes who have gastroparesis. [2015]
- 1.15.22 For adults with type 1 diabetes who have vomiting caused by gastroparesis, explain that:
- there is no strong evidence that any available antiemetic therapy is effective
  - some people have had benefit with domperidone (see the [Medicines and Healthcare products Regulatory Agency \[MHRA\] guidance on the risk of serious cardiac side effects](#)), erythromycin or metoclopramide (see the [MHRA guidance on the risk of neurological adverse effects](#))

- the strongest evidence for effectiveness is for domperidone, but prescribers must take into account its safety profile, in particular its cardiac risk and potential interactions with other medicines. [2015]

In August 2015, this was an off-label use of erythromycin and many higher doses or treatment durations of domperidone. See [NICE's information on prescribing medicines](#).

1.15.23 For treating vomiting caused by gastroparesis in adults with type 1 diabetes:

- consider alternating use of erythromycin and metoclopramide (see the [MHRA guidance on the risk of neurological adverse effects](#))
- consider domperidone only in exceptional circumstances (that is, when it is the only effective treatment) and in accordance with [MHRA guidance on the risk of serious cardiac side effects](#). [2015]

In August 2015, this was an off-label use of erythromycin and many higher doses or treatment durations of domperidone. See [NICE's information on prescribing medicines](#).

1.15.24 Refer adults with type 1 diabetes who have gastroparesis for specialist advice if the interventions in recommendations 1.15.25, 1.15.26 and 1.15.28 are not beneficial or not appropriate. [2015]

## Acute painful neuropathy of rapid improvement of blood glucose control

1.15.25 Reassure adults with type 1 diabetes that acute painful neuropathy resulting from rapid improvement of blood glucose control is a self-limiting condition that improves symptomatically over time. [2015]

1.15.26 Explain to adults with type 1 diabetes that the specific treatments for acute painful neuropathy resulting from rapid improvement of blood glucose control:

- have the aim of making the symptoms tolerable until the condition resolves
- may not relieve pain immediately and may need to be taken regularly for several weeks to be effective. [2015]

- 1.15.27 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, discontinue them and try other measures. [2004]
- 1.15.28 Do not relax diabetes control to address acute painful neuropathy resulting from rapid improvement of blood glucose control in adults with type 1 diabetes. [2015]
- 1.15.29 If simple analgesia does not provide sufficient pain relief for adults with type 1 diabetes who have acute painful neuropathy resulting from rapid improvement of blood glucose control, offer treatment as described in the [NICE guideline on neuropathic pain in adults: pharmacological management in non-specialist settings](#). Simple analgesia may be continued until the effects of additional treatments have been established. [2015]
- 1.15.30 When offering medicines for managing acute painful neuropathy resulting from rapid improvement of blood glucose control to adults with type 1 diabetes, be aware of the risk of dependency associated with opioids. [2015]

## Diabetic foot problems

- 1.15.31 For guidance on preventing and managing foot problems in adults with type 1 diabetes, see the [NICE guideline on diabetic foot problems](#). [2015]

## Erectile dysfunction

- 1.15.32 Offer men with type 1 diabetes the opportunity to discuss erectile dysfunction as part of their regular review. [2015]
- 1.15.33 Offer a phosphodiesterase-5 inhibitor to men with type 1 diabetes with isolated erectile dysfunction unless contraindicated. Choose the phosphodiesterase-5 inhibitor with the lowest acquisition cost. [2015]
- 1.15.34 Consider referring men with type 1 diabetes to a service offering further assessment and other medical, surgical or psychological management of erectile dysfunction if phosphodiesterase-5 inhibitor treatment is unsuccessful or contraindicated. [2015]

## Thyroid disease monitoring

1.15.35 Measure blood thyroid-stimulating hormone (TSH) levels in adults with type 1 diabetes at annual review. [2015]

## Psychological problems

1.15.36 Members of diabetes professional teams providing care or advice to adults with type 1 diabetes should be alert to the development or presence of clinical or subclinical depression and/or anxiety, in particular if someone reports or appears to be having difficulties with self-management. [2004]

1.15.37 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
- be familiar with appropriate counselling techniques and drug therapy, while arranging prompt referral to specialists of those people in whom psychological difficulties continue to interfere significantly with wellbeing or diabetes self-management.

See also the [NICE guidelines on common mental health problems, generalised anxiety disorder and panic disorder and depression in adults with a chronic physical health problem](#). [2004, amended 2015]

## Eating disorders

1.15.38 Members of diabetes 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 BMI
- hypoglycaemia
- suboptimal overall blood glucose control.

See also the [NICE guideline on eating disorders](#). [2004, amended 2015]

- 1.15.39 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. [2004]
- 1.15.40 Make provision for high-quality professional team support at regular intervals with regard to counselling about lifestyle issues and particularly dietary behaviour for all adults with type 1 diabetes from the time of diagnosis (see the [section on education and information](#) and the [section on dietary management](#)). [2004]

## Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future. The Guideline Development Group's full set of research recommendations is detailed in the [full guideline](#).

### 1 Improved methods and interventions for achieving HbA1c targets in adults with type 1 diabetes

What methods and interventions are effective in increasing the number of adults with type 1 diabetes who achieve the recommended HbA1c targets without risking severe hypoglycaemia or weight gain?

#### Why this is important

The evidence that sustained near-normoglycaemia substantially reduces the risk of long-term complications in adults with type 1 diabetes is unequivocal. Current methods for achieving such blood glucose control require skills in glucose monitoring and insulin dose adjustment, injection technique and site management, and the ability to use such self-management skills on a day-to-day basis life-long. Fear of hypoglycaemia and of weight gain are major barriers to success, as is fitting diabetes self-management into busy lifestyles. Everyone struggles to meet optimised targets and some are more successful in achieving them than others. Research into new interventions ranging from more effective education and support, through improved technologies in terms of insulin replacement and glucose monitoring, and including use of cell-based therapies, is urgently needed. It is also important to ensure that adults with type 1 diabetes are able to engage with such methodologies.

### 2 Continuous glucose monitoring for adults with type 1 diabetes

In adults with type 1 diabetes who have chronically poor control of blood glucose levels, what is the clinical and cost effectiveness of continuous glucose monitoring technologies?

#### Why this is important

Current continuous glucose monitoring systems were found not to be cost-effective in the de novo

analysis carried out for this guideline, even in people who had impaired awareness of hypoglycaemia. In adults with type 1 diabetes who have high HbA1c values, there still may be some value in using continuous glucose monitoring systems, and further research is needed to determine whether newer technologies would prove to be cost-effective, particularly in this group.

## 3 Structured education programmes for adults with type 1 diabetes

In adults with type 1 diabetes, what methods can be used to increase the uptake of structured education programmes and to improve their clinical outcomes (particularly achieving and sustaining blood glucose control targets)?

### Why this is important

Structured education programmes in flexible insulin therapy have been shown to improve diabetes control (lower HbA1c and less hypoglycaemia), but achieving and sustaining optimal diabetes control for avoidance of complications remains challenging. Some people do not achieve ideal targets for blood glucose control, others achieve but are not able to maintain them, and still others are not offered or do not access structured education at all. There is therefore a need to develop and test (1) more effective ways of engaging adults with type 1 diabetes in education; (2) improvements in the delivery of education to increase the number of people achieving targets for diabetic control and (3) enhanced support for adults with type 1 diabetes to sustain good diabetic control over time. If the uptake and delivery of clinically and cost-effective education and support for adults with type 1 diabetes can be improved, it should be possible to achieve a reduction in the short-term and long-term complications of the condition.

## 4 Risk stratification tool for HbA1c targets for adults with type 1 diabetes

Can a risk stratification tool be used to aid the setting of individualised HbA1c targets for adults with type 1 diabetes?

### Why this is important

Strict blood glucose control early in the history of type 1 diabetes has been shown to reduce the development and progression of long-term complications, but it is not possible to determine who is at particular risk of glucose-driven poor outcomes. Furthermore, there is a dearth of evidence of the risk:benefit ratio of strict blood glucose control in people who already have diabetes

complications. Since achieving and maintaining near-normal blood glucose concentrations is complicated, a risk stratification tool to calculate the modifiable individual risk of complications will allow blood glucose targets to be tailored for each person and appropriate support to be provided.

## 5 Technologies for preventing and treating impaired awareness of hypoglycaemia in adults with type 1 diabetes

For adults with type 1 diabetes, what are the optimum technologies (such as insulin pump therapy and/or continuous glucose monitoring, partially or fully automated insulin delivery, and behavioural, psychological and educational interventions) and how are they best used, in terms of clinical and cost effectiveness, for preventing and treating impaired awareness of hypoglycaemia?

### Why this is important

Impaired awareness of hypoglycaemia renders adults with type 1 diabetes susceptible to sudden unexpected deteriorations of conscious level and irrational behaviour, and increases their risk of severe hypoglycaemia 6-fold. Impaired awareness of hypoglycaemia and severe hypoglycaemia creates barriers to many aspects of daily living, and can cause enormous stress for family and friends. Severe hypoglycaemia can also cause fear of hypoglycaemia great enough to prevent a person achieving the glucose targets that are associated with minimal risk of complications. Impaired awareness of hypoglycaemia results from overexposure to hypoglycaemia in daily life, and awareness can be much improved by avoidance of hypoglycaemia. Developing technologies in glucose monitoring and insulin delivery have not been rigorously tested in adults with type 1 diabetes and impaired awareness of hypoglycaemia. Research is needed formally to document the extent to which existing technologies can help the adult with type 1 diabetes and impaired awareness of hypoglycaemia to avoid hypoglycaemic episodes and regain awareness for occasional episodes. Research is also needed to develop new technologies. Research is also needed into how to engage adults with type 1 diabetes and impaired awareness of hypoglycaemia with treatment strategies designed to improve awareness.

## Finding more information and committee details

You can see everything NICE says on this topic in the [NICE Pathway on type 1 diabetes in adults](#).

To find NICE guidance on related topics, including guidance in development, see the [NICE webpage on diabetes](#).

For full details of the evidence and the guideline committee's discussions, see the [evidence](#). You can also find information about [how the guideline was developed](#), including details of the committee.

NICE has produced [tools and resources to help you put this guideline into practice](#). For general help and advice on putting our guidelines into practice, see [resources to help you put NICE guidance into practice](#).

## Update information

**December 2020:** We have amended recommendations 1.15.1 and 1.15.4 to bring them in line with the diabetic eye screening programme. The evidence for these recommendations has not been reviewed, and they are marked [2004, amended 2020].

**November 2015:** We added a note to recommendation 1.7.14, to state that metformin does not have a UK marketing authorisation for the recommended indication. We added a link to the NICE guideline on coeliac disease to recommendation 1.12.1.

**September 2015:** We added 'that is' to recommendation 1.7.2, to clarify that these regimens should not be offered.

**August 2015:** We updated and replaced NICE guideline CG15 (published July 2004) for adults and NICE technology appraisal guidance 53 and 60.

Recommendations are marked as [2015], [2004] or [2004, amended 2015]:

- [2015] indicates that the evidence has been reviewed
- [2004] indicates that the evidence has not been reviewed since 2004
- [2004, amended 2015] or [2004, amended 2016] indicates that the evidence has not been reviewed since 2004, but either changes have been made to the recommendation wording that change the meaning or NICE has made editorial changes to the original wording to clarify the action to be taken (see below).

We have also made some changes without an evidence review:

- Recommendation 1.1.7 had extra information added, to make the recommendation more comprehensive.
- Recommendation 1.2.5 was amended for clarity, and updated to include some crucial parts of the care plan that were missing from the original recommendation.
- Recommendations 1.4.10, 1.4.11 and 1.4.13 were updated to remove mention of a low glycaemic index diet, as there is no evidence of benefit for this.

- Recommendation 1.6.16 was amended to make it clear that self-monitoring skills should be taught as soon as type 1 diabetes is diagnosed.
- Recommendation 1.6.20 has been amended to remove references to small volumes of blood (which is now normal for all meters) and devices for alternative site monitoring (which are not recommended anyway).
- Recommendation 1.7.12 was amended to remove a reference to resuspension of insulin, as this is out of date.
- Recommendation 1.10.10 has been updated to reflect changes in practice for managing hypoglycaemia.
- Recommendation 1.10.11 has been amended for clarity, and to highlight that glucagon can be given by untrained users in an emergency.
- Recommendation 1.10.14 has been amended to remove out of date and inconsistent information about different types of insulin.
- Recommendation 1.12.2 has been updated to remove mention of thyroid disorders, which are now covered in a separate recommendation.
- Recommendation 1.3.10 has been updated to reflect changes in hypertension management (covered in the [NICE guideline on hypertension](#)).
- Recommendation 1.14.8 has been updated to reflect changes in hospital practice around monitoring systems.
- Recommendations 1.15.2, 1.15.4 and 1.15.9 were amended to bring them in line with the national diabetes eye screening programme.
- Recommendations 1.13.2, 1.13.9, 1.15.3 and 1.15.4 have been amended to use the [same terminology as the NICE guideline on chronic kidney disease](#).
- Recommendation 1.15.23 has been updated to mention postural hypertension, because this is an important sign of autonomic neuropathy.

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## Accreditation

