1 **NATIONAL INSTITUTE FOR HEALTH AND CARE**
2 **EXCELLENCE**

3 # Guideline

4 # Type 1 diabetes in adults: diagnosis and
5 # management

6 ## Draft for consultation, April 2021

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

This guideline will update NICE guideline NG17 (published August 2015).

Who is it for?

- Healthcare professionals
- Commissioners and providers
- Adults with type 1 diabetes and their families and carers

What does it include?

- the draft recommendations
- recommendations for research
- rationale and impact sections that explain why the committee made the 2021 recommendations and how they might affect practice
- the guideline context.

Information about how the guideline was developed is on the guideline's webpage on the NICE website. This includes the evidence reviews, the scope, details of the committee and any declarations of interest.

New and updated recommendations

We have reviewed the evidence on insulin therapy. You are invited to comment on the new and updated recommendations. These are marked as **[2021]**.

You are also invited to comment on recommendations that we propose to delete from the 2015 guideline.

We have not reviewed the evidence for the recommendations shaded in grey, and cannot accept comments on them. In some cases, we have made minor wording changes for clarification.

See update information for a full explanation of what is being updated.

Full details of the evidence and the committee's discussion on the 2021 recommendations are in the evidence reviews. Evidence for the 2004 and 2015 recommendations is in the full version of the 2015 guideline.

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Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in 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

'Blood glucose' is the more commonly used term. However, a lot of the evidence this guideline is based on uses 'plasma' rather than 'blood' glucose, and patient-held glucose meters and monitoring systems are calibrated to plasma glucose equivalents. Because of this, in this guideline we use the term 'blood glucose', except when referring to specific concentration values.

1.1 Diagnosis and early care plan

Diagnosis

NICE is currently updating recommendations on diagnosis of type 1 diabetes.

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

- ketosis
- rapid weight loss
- age of onset under 50
- BMI below 25 kg/m^2

- personal and/or family history of autoimmune disease. **[2015]**

1.1.2 Do not discount a diagnosis of type 1 diabetes if an adult has a BMI of 25 kg/m^2 or above or is aged 50 or over. **[2015]**

1.1.3 Do not routinely measure C-peptide or diabetes-specific autoantibody titres to confirm type 1 diabetes in adults. **[2015]**

1.1.4 Consider further investigation (including measuring C-peptide and/or diabetes-specific autoantibody titres) if the adult:

- has suspected type 1 diabetes, but with some atypical features (for example, age 50 or over, BMI of 25 kg/m^2 or above, slow evolution of hyperglycaemia or long prodrome) **or**
- has been diagnosed with type 1 diabetes and has started treatment, but there is clinical suspicion of monogenic 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, insulin pump therapy). **[2015]**

1.1.5 When measuring C-peptide 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 after this
- 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 diagnosis (or, if necessary, after managing critically decompensated metabolism), the diabetes professional team should work with adults with type 1 diabetes to develop a plan for their early care. This will generally require:

- medical assessment to:
  - ensure the diagnosis is accurate (see recommendations 1.1.1 to 1.1.5)
  - ensure appropriate acute care is given when needed
  - review medicines and detect potentially associated disease
  - detect adverse vascular risk factors
- environmental assessment to understand:
  - the social, home, work and recreational circumstances of the person and their carers
  - their lifestyle (including diet and physical activity)
  - other relevant factors, such as substance use
- cultural and educational assessment to:
  - find out what they know about diabetes
  - help with tailoring advice, and with planning treatments and diabetes education programmes
- assessment of their emotional wellbeing to decide how to pace diabetes education.

1.1.7 Use the results of the initial diabetes assessment to agree a future care plan. This assessment should include:

- acute medical history
- social, cultural and educational history, and lifestyle review
- complications history and symptoms
- diabetes history (recent and long term)
- other medical history
- family history of diabetes and cardiovascular disease

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

1.1.8 Include the following in an individualised and culturally appropriate diabetes plan:

- when and where they will have their diabetes education, including their dietary advice (see the sections on education and information and dietary management)
- initial treatment, including guidance on insulin injection and insulin regimens (see the sections on insulin therapy and insulin delivery)
- self-monitoring and targets (see the section on blood glucose management)
- symptoms, and the risk of hypoglycaemia and how it is treated
- management of special situations, such as driving
- communicating with the diabetes professional team (how often and how to contact them)
- management of cardiovascular risk factors (see the section on control of cardiovascular risk)
- implications for pregnancy and family planning advice (see the NICE guideline on diabetes in pregnancy)

1 2 3
- how often they will have follow-up appointments, and what these will cover (including review of HbA1c levels, experience of hypoglycaemia, and annual reviews). **[2004, amended 2015]**

4 5 6
1.1.9 After the initial plan is agreed, implement it without inappropriate delay. Based on discussion with the adult with type 1 diabetes, modify the plan as needed over the following weeks. **[2004]**

7
1.2 Support and individualised care

8 9
1.2.1 Take account of any disabilities, including visual impairment, when planning and delivering care for adults with type 1 diabetes. **[2015]**

10 11 12
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.**[2004]**

13
1.2.3 Provide adults with type 1 diabetes with:

14 15 16 17
- access to services by different methods (including phone and email) during working hours
- information about out-of-hours services staffed by people with diabetes expertise. **[2004]**

18 19 20 21 22
1.2.4 View each adult with type 1 diabetes as an individual, rather than as a member of any cultural, economic or health-affected group (also see recommendations 1.4.5 and 1.4.14 about cultural preferences in the section on dietary advice). **[2004, amended 2015]**

23 24 25 26
1.2.5 Jointly agree an individual care plan with the adult with type 1 diabetes. Review this plan annually and amend it as needed, taking into account changes in the person's wishes, circumstances and medical findings.

27
1.2.6 Individual care plans should include:

- diabetes education, including dietary advice (see the sections on education and information and dietary management)
- insulin therapy, including dosage adjustment (see the sections on insulin therapy and insulin delivery)
- self-monitoring (see the section on blood glucose management)
- avoiding hypoglycaemia and maintaining hypoglycaemia awareness
- 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)
- communicating with the diabetes professional team (how often and how to contact them)
- how often they will have follow-up appointments, and what these will cover (including review of HbA1c levels, experience of hypoglycaemia, and annual reviews). **[2004, amended 2015]**

1.2.7 Use population, practice-based and clinic diabetes registers (as specified by the national service framework for diabetes) to assist programmed recall for annual reviews and assessments of complications and cardiovascular risk. **[2004]**

1.2.8 At diagnosis and periodically after this, give adults with type 1 diabetes up-to-date information about diabetes support groups (local and national), how to contact them and their benefits. **[2004]**

1.3 Education and information

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. **[2015]**

1.3.2 Offer the structured education programme 6 to 12 months after diagnosis. For adults who have not had a structured education programme by 12 months, offer it at any time that is clinically appropriate and suitable for the person, regardless of how long they have had type 1 diabetes. **[2015]**

1.3.3 For adults with type 1 diabetes who are unable or unwilling to take part in group education, provide an alternative of equal standard. **[2015]**

1.3.4 Ensure that any structured education programme for adults with type 1 diabetes:

- is evidence based, and suits the needs of the person
- 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
- has a structured curriculum that is theory driven and resource effective and has supporting materials
- is delivered by trained educators who:
  - have an understanding of educational theory appropriate to the age and needs of the person and
  - are trained and competent to deliver the principles and content of the programme
- is quality assured, and reviewed by trained, competent, independent assessors who measure it against criteria that ensure consistency
- has outcomes that 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 hypoglycaemia awareness and management). **[2015]**

1.3.8 Carry out an annual review of self-care and needs for all adults with type 1 diabetes. Decide what to cover each year by agreeing priorities with 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 who are unable to take part in a standalone 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 managing weight and cardiovascular risk), as needed. **[2015]**

1.4.5 From diagnosis, provide nutritional information that is sensitive to the personal needs and culture of each adult with type 1 diabetes. **[2004]**

1.4.6 Provide nutritional information individually and as part of a structured education programme (see the section on education and information). Include advice from professionals who are trained and accredited to provide dietary advice to people with health conditions. **[2004]**

1.4.7 Offer opportunities to receive dietary advice at intervals agreed between adults with type 1 diabetes and their healthcare professionals. **[2004]**

1.4.8 Discuss the hyperglycaemic effects of the different foods the adult with type 1 diabetes wants to eat in the context of the insulin regimens chosen to match those food choices. **[2004]**

1.4.9 Provide education programmes for adults with type 1 diabetes to help them with:

- healthy eating and a balanced diet
- changing their insulin dosage to reduce glucose excursions when varying their diet. **[2004, amended 2015]**

1.4.10 Discuss snacks with the adult with type 1 diabetes.

- Cover the choice of snack, the quantity, and when to eat them.
- Explain the effects of eating different food types, and how long these effects last.
- Explain which insulin regimens are available to match different food types.
- Discuss changes in choice of snack if needed, based on the results of self-monitoring tests. **[2004]**

1.4.11 Provide information on:

- the effects of different alcohol-containing drinks on blood glucose excursions and calorie intake
- high-calorie and high-sugar ‘treats’. **[2004, amended 2015]**

1.4.12 As part of dietary education after diagnosis (and as needed after this), provide information on how healthy eating can reduce cardiovascular risk. Include information about fruit and vegetables, types and amounts of fat, and how to make the appropriate dietary changes. **[2004, amended 2015]**

1.4.13 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]**

1.4.14 Healthcare professionals giving dietary advice to adults with type 1 diabetes should be able to advise about common topics of concern and interest, and should seek advice from specialists when needed. 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 intake, insulin and physical activity
- salt intake in hypertension

- comorbidities, including nephropathy and renal failure, coeliac disease, cystic fibrosis or eating disorders
- 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 long term. **[2004]**

1.5.2 For adults with type 1 diabetes who choose to increase their level of physical activity as part of a healthier lifestyle, provide information about:

- appropriate intensity and frequency of physical activity
- self-monitoring their changed insulin and or nutritional needs
- the effect of physical activity on blood glucose levels (which are likely to fall) when insulin levels are adequate
- the effect of physical activity on blood glucose levels when hyperglycaemic and hypoinsulinaemic (there is a risk of worsening hyperglycaemia and ketonaemia)
- appropriate adjustments of insulin dosage and or nutritional intake for periods during and immediately after physical activity, and the 24 hours after this
- interactions of physical activity 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 their blood glucose control is suspected to be changing rapidly; for example, if their HbA1c level has risen unexpectedly above a previously sustained target. **[2015]**

1.6.3 Measure HbA1c using methods calibrated according to International Federation of Clinical Chemistry (IFCC) standardisation. **[2015]**

1.6.4 Tell adults with type 1 diabetes their HbA1c results after each measurement and have their most recent result available at consultations. Follow the principles on communication in the NICE guideline on patient experience in adult NHS services. **[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. Take into account factors such as their 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 who reach 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 adults with type 1 diabetes to routinely self-monitor their blood glucose levels, and to test 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 their target for blood glucose control, measured by HbA1c level (see recommendation 1.6.6), is not reached
- if they are having more frequent hypoglycaemic episodes
- if 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 they need to know their blood glucose levels more than 4 times a day for other reasons (for example, impaired hypoglycaemia awareness, or they are undertaking 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, they drive for long periods of time, they undertake high-risk activities or have a high-risk occupation, or they are travelling) **or**
- impaired hypoglycaemia awareness. **[2015]**

1 **Blood glucose targets**

2 1.6.13 Advise adults with type 1 diabetes to aim for:

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

6 1.6.14 Advise adults with type 1 diabetes who choose to test after meals
7 to aim for a plasma glucose level of 5 to 9 mmol/litre at least
8 90 minutes after eating. (This timing may be different in pregnancy
9 – for guidance on plasma glucose targets in pregnancy, see the
10 NICE guideline on diabetes in pregnancy.) **[2015]**

11 1.6.15 Agree bedtime target plasma glucose levels with each adult with
12 type 1 diabetes. Take into account the timing of their last meal of
13 the day and the related insulin dose, and ensure the target is
14 consistent with the recommended fasting level on waking (see
15 recommendation 1.6.13). **[2015]**

16 **Empowering people to self-monitor blood glucose**

17 1.6.16 Teach self-monitoring skills at the time of diagnosis and the start of
18 insulin therapy. **[2004, amended 2015]**

19 1.6.17 When choosing blood glucose meters:

20 - take the needs of the adult with type 1 diabetes into account
21 - ensure that meters meet current ISO standards. **[2015]**

22 1.6.18 Teach adults with type 1 diabetes how to measure their blood
23 glucose level, interpret the results and take appropriate action.
24 Review these skills at least annually. **[2015]**

25 1.6.19 Support adults with type 1 diabetes through structured education
26 (see recommendations 1.3.1 and 1.3.2) to make the best use of
27 data from self-monitoring of blood glucose. **[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

Recommendations on continuous glucose monitoring are due to be updated, alongside a review on integrated sensor-augmented pump therapy systems for managing blood glucose levels in type 1 diabetes (NICE diagnostics guidance [DG21]).

1.6.21 Do not routinely offer real-time continuous glucose monitoring 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 insulin therapy and conventional blood glucose monitoring:

- More than 1 episode a year of severe hypoglycaemia with no obvious preventable cause.
- Complete loss of hypoglycaemia awareness.
- 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 using real-time continuous glucose monitoring, use the principles of flexible insulin therapy, with either a multiple daily injection regimen or an insulin pump. **[2015]**

1.6.24 Real-time continuous glucose monitoring should be provided by a centre with expertise in its use, as part of a strategy 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 as the insulin injection regimen of choice for all adults with type 1 diabetes. Provide guidance on using this regimen. **[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

1.7.3 Offer twice-daily insulin detemir as basal insulin therapy for adults with type 1 diabetes. **[2021]**

1.7.4 Consider one of the following as an alternative basal insulin therapy to twice-daily insulin detemir for adults with type 1 diabetes:

- an insulin regimen that is already being used by the person if it is meeting their agreed treatment goals (such as meeting their HbA1c targets or time in target glucose range and minimising hypoglycaemia)
- once-daily insulin glargine (100 units/ml) if insulin detemir is not tolerated or the person has a strong preference for once-daily basal injections

- degludec (100 units/ml) if there is a particular concern about nocturnal hypoglycaemia
- once-daily insulin such as degludec (100 units/ml) for people who need help from a carer or healthcare professional to administer injections. **[2021]**

1.7.5 When starting an insulin for which a biosimilar is available, use the product with the lowest acquisition cost. The MHRA has produced guidance on minimising the risk of medication error with insulins, including advice for healthcare professionals when starting treatment with a biosimilar. **[2021]**

1.7.6 When people are already using an insulin for which a lower cost biosimilar is available, discuss the possibility of switching to the biosimilar. Make a shared decision with the person after discussing their preferences. **[2021]**

1.7.7 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 meet their agreed treatment goals. When choosing an alternative insulin regimen, take account of the person's preferences, comorbidities, risk of hypoglycaemia and the acquisition cost. **[2021]**

For a short explanation of why the committee made these recommendations see the rationale and impact section on long-acting insulin.

Full details of the evidence and the committee's discussion are in evidence review A: long-acting insulins in type 1 diabetes.

Insulin pumps

1.7.8 For guidance on the use of insulin pumps 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

1.7.9 Offer rapid-acting insulin analogues that are injected before meals, rather than rapid-acting soluble human or animal insulins, for mealtime insulin replacement for adults with type 1 diabetes. **[2015]**

1.7.10 Do not advise routine use of rapid-acting insulin analogues after meals for adults with type 1 diabetes. **[2015]**

1.7.11 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

1.7.12 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 used. **[2015]**

1.7.13 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

1.7.14 For adults with erratic and unpredictable blood glucose control (hyperglycaemia and hypoglycaemia at no consistent times), consider the following rather than changing a previously optimised insulin regimen:

- injection technique
- injection sites
- self-monitoring skills
- knowledge and self-management skills

- lifestyle
- psychological and psychosocial difficulties
- possible organic causes, such as gastroparesis. **[2004, amended 2015]**

1.7.15 Give clear guidelines and protocols ('sick-day rules') to all adults with type 1 diabetes, to help them adjust insulin doses appropriately when they are ill. **[2004]**

Adjuncts

1.7.16 Consider adding metformin to insulin therapy for adults with type 1 diabetes if:

- they have a BMI of 25 kg/m^2 or above (23 kg/m^2 or above for people from South Asian and related family backgrounds) **and**
- they want to improve their blood glucose control while minimising their effective insulin dose.

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

1.8 Insulin delivery

1.8.1 For adults with type 1 diabetes who inject insulin, provide their preferred insulin injection delivery device (this often means using one or more types of insulin injection pen). **[2004]**

1.8.2 For adults with type 1 diabetes and special visual or psychological needs, provide 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
- a way to safely get rid of these containers.

See also section 1.1.4 of the NICE guideline on healthcare-associated infections: prevention and control in primary and community care. **[2004, amended 2015]**

1.8.7 Check injection site condition at least annually, and whenever new problems with blood glucose control occur. **[2004, amended 2015]**

1.9 Referral for islet or pancreas transplantation

1.9.1 For adults with type 1 diabetes who have recurrent severe hypoglycaemia that has not responded to other treatments (see the section on hypoglycaemia awareness and management), consider referral 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, if they have had a renal transplant and are currently on immunosuppressive therapy. **[2015]**

1.10 Hypoglycaemia awareness and management

Identifying and quantifying impaired hypoglycaemia awareness

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

1.10.2 Use the Gold score or Clarke score to quantify hypoglycaemia awareness 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]**

Managing impaired hypoglycaemia awareness

1.10.4 Ensure that adults with type 1 diabetes and impaired hypoglycaemia awareness 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 still have impaired hypoglycaemia awareness after structured education in flexible insulin therapy. **[2015]**

1.10.6 Avoid relaxing individualised blood glucose targets to address impaired hypoglycaemia awareness for adults with type 1 diabetes. **[2015]**

1.10.7 For adults with type 1 diabetes and impaired hypoglycaemia awareness who are using lower target blood glucose levels than recommended in this guideline, encourage them to use the recommended targets (see recommendations 1.6.13 to 1.6.15). **[2015]**

1.10.8 Review insulin regimens and doses, and prioritise ways to avoid hypoglycaemia in adults with type 1 diabetes with impaired hypoglycaemia awareness, including:

- reinforcing the principles of structured education

- offering an insulin pump
- offering real-time continuous glucose monitoring. **[2015]**

1.10.9 If, despite these interventions, an adult with type 1 diabetes has impaired hypoglycaemia awareness that is associated with recurrent severe hypoglycaemia, consider referring them 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 managing hypoglycaemic symptoms or signs in people who can swallow. **[2004, amended 2015]**

1.10.11 Adults with type 1 diabetes who have a decreased level of consciousness because of hypoglycaemia and so cannot safely take oral treatment 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 getting intravenous access)
- checked 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 put under continued observation by someone who has been warned about the risk of relapse. **[2004, amended 2015]**

1.10.12 Explain to adults with type 1 diabetes that:

- it is very common to experience some hypoglycaemic episodes with any insulin regimen
- they should use a regimen that avoids or reduces the frequency of hypoglycaemic episodes, while maintaining the most optimal blood glucose control possible. **[2004]**

1.10.13 Make hypoglycaemia advice available to all adults with type 1 diabetes, to help them find the best possible balance with any insulin regimen. (See the sections on insulin therapy and insulin delivery.) **[2004]**

1.10.14 If hypoglycaemia becomes unusually problematic or increases in frequency, review the following possible 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]**

1.10.15 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 cause low glucose levels at night. **[2004, amended 2015]**

1.10.16 If early cognitive decline occurs in adults on long-term insulin therapy, then in addition to normal investigations consider possible

brain damage from overt or covert hypoglycaemia, and the need to manage this. **[2004]**

1.11 Ketone monitoring and managing diabetic ketoacidosis

Ketone self-monitoring to prevent diabetic ketoacidosis

1.11.1 Consider ketone monitoring (blood or urine) as part of ‘sick-day rules’ for adults with type 1 diabetes, to help with self-management 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:

- diabetic ketoacidosis (DKA) is suspected **or**
- the person has uncontrolled diabetes during an illness, and urine ketone testing is positive. **[2015]**

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

Management of DKA

1.11.4 Professionals managing DKA in adults should have adequate and up-to-date training, and be familiar with all aspects of DKA management that are associated with mortality and morbidity. These topics should include:

- fluid balance
- acidosis
- cerebral oedema
- electrolyte imbalance
- that DKA can affect the results of standard 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
- 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 Use isotonic saline for primary fluid replacement in adults with DKA, not given too rapidly except in cases of circulatory collapse. **[2004]**

1.11.6 Do not generally use bicarbonate for managing DKA in adults. **[2004, amended 2015]**

1.11.7 Give intravenous insulin by infusion to adults with DKA. **[2004]**

1.11.8 When the plasma glucose concentration has fallen to 10 to 15 mmol/litre in adults with DKA, give glucose-containing fluids (not more than 2 litres in 24 hours) so that the insulin infusion can be continued 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 hypokalaemia. **[2004]**

1.11.10 Do not generally use phosphate replacement when managing DKA in adults. **[2004, amended 2015]**

1.11.11 In adults with DKA who have reduced consciousness, think about:

- inserting a nasogastric tube **and**
- monitoring urine output using a urinary catheter **and**

- giving venous thromboembolism (VTE) prophylaxis. **[2004, amended 2021]**

1.11.12 To reduce the risk of catastrophic outcomes in adults with DKA, use continuous monitoring and frequent reviews that cover all aspects of clinical management. **[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 for 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 other autoimmune diseases in adults with type 1 diabetes (including Addison's disease and pernicious anaemia). For advice on monitoring for thyroid disease, see recommendation 1.15.36. **[2004, amended 2015]**

1.13 Control of cardiovascular risk

Aspirin

1.13.1 Do not offer aspirin for the primary prevention of cardiovascular disease in 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 HDL and 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 the recommendations on full formal risk assessment 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 stopping smoking and stop smoking services, including NICE guidance-recommended therapies (see the NICE webpage on smoking and tobacco). 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 adults who don't smoke never to start smoking. **[2004, amended 2021]**

1.13.7 Provide intensive management for adults who have had myocardial infarction or stroke, according to relevant non-diabetes guidelines. For angina or other ischaemic heart disease, beta-blockers should be considered (for insulin use in these circumstances, see the section on caring for 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 Recommend blood pressure management at 135/85 mmHg for adults with type 1 diabetes. If they have albuminuria or 2 or more features of metabolic syndrome, recommend blood pressure

management at 130/80 mmHg. See also the recommendations on diabetic kidney disease. **[2004]**

1.13.9 Discuss the following with adults with type 1 diabetes who have hypertension to help them make an informed choice:

- reasons for the choice of intervention level
- the substantial potential gains from small improvements in blood pressure control
- any possible negative consequences of therapy. **[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 how lifestyle changes can improve their blood pressure control and associated outcomes, and offer help to achieve 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 side effects become symptomatic or otherwise clinically significant. In particular:

- do not avoid selective beta-blockers for adults on insulin if these are indicated
- low-dose thiazides may be combined with beta-blockers
- when prescribing calcium channel antagonists, only use long-acting preparations
- ask adults directly about 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 in adults. **[2015]**

1.14 Caring for 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 reach the target level. **[2015]**

1.14.3 Use intravenous rather than subcutaneous insulin regimens for adults with type 1 diabetes if:

- they are unable to eat or are 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 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 for them to do so. **[2015]**

Delivering care in hospital and other institutions

These recommendations are for care teams caring for adults with type 1 diabetes in hospital and in institutions such as nursing homes, residential homes and prisons.

1.14.7 From admission, provide ongoing advice to adults with type 1 diabetes and the team caring for them from a trained multidisciplinary team with expertise in diabetes. **[2004]**

1.14.8 Throughout inpatient admission, respect the personal expertise of adults with type 1 diabetes in managing their own diabetes and incorporate this into routine ward-based blood glucose monitoring and insulin delivery. **[2004, amended 2015]**

1.14.9 Throughout inpatient admission, support adults with type 1 diabetes to make their own food choices based on their personal knowledge of their dietary needs, except when illness or medical or surgical intervention significantly disturbs those requirements. **[2004]**

1.14.10 Provide optimal insulin therapy, which can be achieved using 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 or practice nurses 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 in adults. **[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 (estimating urine albumin concentration alone is a poor alternative) and measure serum creatinine at the same time. **[2004]**

1.15.7 Suspect other renal disease if:

- progressive retinopathy is absent
- blood pressure is particularly high
- proteinuria develops suddenly
- significant haematuria is present
- the person is systemically unwell. **[2004]**

1.15.8 If albuminuria is found, discuss with the person what this means. **[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 type 1 diabetes who have confirmed nephropathy, including those with moderately increased albuminuria ('microalbuminuria') alone. **[2004, amended 2015]**

1.15.10 If ACE inhibitors are not tolerated, substitute angiotensin 2 receptor antagonists. Do not offer combination therapy. **[2004, amended 2015]**

1.15.11 Maintain the person's blood pressure below 130/80 mmHg by adding other anti-hypertensive drugs if necessary. **[2004]**

1.15.12 Advise adults with type 1 diabetes and nephropathy about the advantages of avoiding 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 Suspect the possibility of autonomic neuropathy affecting the gut if adults with type 1 diabetes have unexplained diarrhoea, particularly at night. **[2004]**

1.15.16 When prescribing antihypertensive medicines, take care not to increase the risk of orthostatic hypotension from the combined

effects of sympathetic autonomic neuropathy and blood pressure lowering medicines. **[2004]**

1.15.17 For adults with type 1 diabetes who have bladder emptying problems, investigate the possibility of autonomic neuropathy affecting the bladder, unless another explanation is found. **[2004]**

1.15.18 Follow standard clinical practice when managing the symptoms of autonomic neuropathy, such as 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**
- have evidence of somatic neuropathy or other manifestations of autonomic neuropathy. **[2004]**

Gastroparesis

1.15.20 Advise adults with type 1 diabetes who have vomiting caused by gastroparesis to follow a small-particle-size diet (mashed or pureed food) to relieve their symptoms.

1.15.21 Be aware that gastroparesis needing specific therapy can only be diagnosed in the absence of hyperglycaemia at the time of testing, because hyperglycaemia delays gastric emptying. **[2015]**

1.15.22 Consider insulin pump therapy for adults with type 1 diabetes who have gastroparesis. **[2015]**

1.15.23 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 MHRA guidance on domperidone: risks of serious cardiac side effects), erythromycin or metoclopramide (see the MHRA guidance on metoclopramide: risks 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.

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. **[2015]**

1.15.24 To treat vomiting caused by gastroparesis in adults with type 1 diabetes:

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

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. **[2015]**

1.15.25 Refer adults with type 1 diabetes who have gastroparesis for specialist advice if the interventions in this section have not helped or are not appropriate. **[2015]**

Acute painful neuropathy from rapid improvement of blood glucose control

1.15.26 Reassure adults with type 1 diabetes that acute painful neuropathy resulting from rapid improvement of blood glucose control is a self-limiting condition and symptoms improve over time. **[2015]**

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

- aim to make 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]**

1.15.28 Use simple analgesics (paracetamol, aspirin) and local measures (bed cradles) as a first step to treat acute painful neuropathy, and if these do not help, try other measures. **[2004, amended 2021]**

1.15.29 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]**

1.15.30 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]**

1.15.31 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

1.15.32 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

1.15.33 Offer men with type 1 diabetes the opportunity to discuss erectile dysfunction as part of their regular review. **[2015]**

1.15.34 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]**

1.15.35 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

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

Psychological problems

1.15.37 Members of diabetes professional teams providing care or advice to adults with type 1 diabetes should be alert to possible clinical or subclinical depression and/or anxiety, particularly if someone reports or appears to be having difficulties with self-management. **[2004]**

1.15.38 Diabetes professionals should:

- ensure they have appropriate skills to identify and provide 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 for people whose psychological difficulties continue to interfere significantly with their wellbeing or diabetes self-management.

See also the NICE guidelines on:

- common mental health problems
- generalised anxiety disorder and panic disorder in adults
- depression in adults with a chronic physical health problem. **[2004, amended 2015]**

Eating disorders

1.15.39 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]**

1.15.40 Think about making an early (or if, needed, urgent) referral to local eating disorder services for adults with type 1 diabetes with an eating disorder. **[2004]**

1.15.41 From diagnosis, the diabetes professional team should provide regular high-quality support and counselling about lifestyle and diet for all adults with type 1 diabetes (see the sections on education and information and dietary management). **[2004]**

2 Recommendations for research

The guideline committee has made the following recommendations for research.

Key recommendations for research

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 people are more able to meet 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 hypoglycaemia awareness. 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 to avoid complications remains challenging. Some people do not reach ideal targets for blood glucose control, others reach 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 meeting 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 short-term and long-term complications.

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 hypoglycaemia awareness 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 hypoglycaemia awareness?

Why this is important

Impaired hypoglycaemia awareness 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 hypoglycaemia awareness 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 meeting the glucose targets that are associated with minimal risk of complications. Impaired hypoglycaemia awareness results from overexposure to hypoglycaemia in daily life, and awareness can be much improved by avoiding hypoglycaemia. Developing technologies in glucose monitoring and insulin delivery have not

1 been rigorously tested in adults with type 1 diabetes and impaired
2 hypoglycaemia awareness. Research is needed formally to document the
3 extent to which existing technologies can help adults with type 1 diabetes and
4 impaired hypoglycaemia awareness to avoid hypoglycaemic episodes and
5 regain awareness for occasional episodes. Research is also needed to
6 develop new technologies. Research is also needed into how to engage
7 adults with type 1 diabetes and impaired hypoglycaemia awareness with
8 treatment strategies designed to improve awareness.

9

Rationale and impact

These sections briefly explain why the committee made the 2021 recommendations and how they might affect practice.

Long-acting insulin

Recommendations 1.7.3 to 1.7.7

Why the committee made the recommendations

Evidence showed that there were fewer severe and nocturnal hypoglycaemic events with insulin detemir twice daily compared with neutral protamine Hagedorn (NPH). Insulin detemir twice daily was also found to be the most cost-effective treatment strategy in the economic analysis. Based on this evidence and their clinical expertise, the committee recommended twice-daily insulin detemir as a basal insulin therapy for adults with type 1 diabetes.

The committee agreed there were situations in which an insulin other than twice-daily insulin detemir might be preferred, and set out specific clinical scenarios where alternative long-acting insulins could be used. This includes if the person is already using an insulin regimen that is working well for them and helping them meet their treatment goals.

Some people may not able to tolerate insulin detemir or for some a once-daily regimen may be necessary (either because the person has a strong preference for once-daily injections or there are circumstances that make twice daily not practical). Glargine (100 units/ml) was found to be the most cost effective once-daily insulin (particularly when the costs of glargine biosimilars were considered) so it was recommended as the appropriate alternative in these cases.

People on insulin therapies can still have hypoglycaemic episodes. This can be a cause of concern, particularly if they have nocturnal hypoglycaemic events. Evidence showed a lower proportion of nocturnal hypoglycaemic events with degludec (100 units/ml), when compared with other once-daily insulins. Degludec (100 units/ml) is an ultra-long-acting insulin which means it

has a longer duration of action compared with long-acting insulins. The committee agreed that once-daily degludec could therefore be considered as an alternative basal insulin therapy if there is a particular concern about nocturnal hypoglycaemia.

The committee agreed that once-daily regimens may also be needed by people who need support from a carer or healthcare professional to administer injections, for example because they are frail or have a physical or mental health condition or learning disability. Flexible insulins, such as degludec (100 units/ml), that have a long duration of action may be particularly useful as they give more flexibility in when the dose can be given.

Biosimilars have the potential to offer the NHS considerable cost savings. To gain approval for use, biosimilar medicines have to be shown to be safe and as effective as the original reference medicine, and have the same quality. Based on this understanding, the committee noted it was appropriate when starting a new prescription of an insulin where a biosimilar is available to use the one with the lowest cost. Additionally, people may be using an insulin for which a lower cost biosimilar is available. In such cases, the committee recommended discussing with people the possibility of switching to the biosimilar. They also agreed that switching to the biosimilar should be carefully planned, taking into consideration the dose switching protocols, monitoring and the person’s concerns about switching from their existing regimen, and a shared decision reached. Healthcare professionals should also refer to the summary of product characteristics for further information when considering switching to biosimilars.

The committee retained the recommendation from the 2015 version of the guideline on considering the use of other basal insulin regimens not covered by other recommendations. Based on their clinical understanding, they added comorbidities (such as renal function) and risk of hypoglycaemia to the factors to take into account when considering alternative regimens.

1 **How the recommendations might affect practice**

2 Use of long-acting insulins varies across the country, with some centres
3 offering twice-daily insulin detemir to people who are newly diagnosed, while
4 other centres start with once-daily regimens. A major shift in practice is
5 unlikely but the recommendations do set out scenarios where other insulins
6 such as ultra-long-acting insulins and biosimilars may be useful and cost
7 effective.

8 Return to recommendations

9 Context

10 Type 1 diabetes affects over 370,000 adults in the UK. It results from
11 destruction of the cells that normally make insulin. Loss of insulin secretion
12 results in high blood glucose and other metabolic and haematological
13 abnormalities, which have both short-term and long-term adverse effects on
14 health.

15 Over years, type 1 diabetes causes tissue damage which, if not detected and
16 managed early, can result in disability: blindness, kidney failure and foot
17 ulceration leading to amputation, as well as premature heart disease, stroke
18 and death. The risk of all of these complications is greatly reduced by
19 treatment that keeps circulating glucose levels to as near normal as possible,
20 reducing tissue damage. Disability from complications that are not avoided
21 can often be prevented by early detection and active management.

22 Type 1 diabetes is treated by insulin replacement and supported by active
23 management of other cardiovascular risk factors, such as hypertension and
24 high circulating lipids. Modern insulin replacement therapy aims to recreate
25 normal fluctuations in circulating insulin concentrations. This supports a
26 flexible lifestyle with minimal restrictions and, properly done, can improve
27 blood glucose levels, reducing the risk of both structural complications and
28 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.

Finding more information and committee details

To find NICE guidance on related topics, including guidance in development, see the NICE webpage on diabetes.

For details of the guideline committee see the committee member list.

Update information

This guideline is an update of NICE guideline NG17 (published August 2015) and will replace it. We have reviewed the evidence on long-acting insulin therapy for adults with type 1 diabetes. Recommendations are marked **[2021]** if the evidence has been reviewed.

Recommendations that have been deleted, or changed without an evidence review

We propose to delete some recommendations from the 2015 guideline. Table 1 sets out these recommendations and includes details of replacement recommendations. If there is no replacement recommendation, an explanation for the proposed deletion is given.

For recommendations shaded in grey and ending **[2004, amended 2021] or [2015, amended 2021]**, we have made changes that could affect the intent without reviewing the evidence. Yellow shading is used to highlight these changes, and reasons for the changes are given in table 2.

For recommendations shaded in grey and ending **[2004]**, **[2015]**, or **[2004, amended 2015]** we have not reviewed the evidence. In some cases minor changes have been made – for example, to update links, or bring the language and style up to date – without changing the intent of the recommendation. Minor changes are listed in table 3.

1 **Table 1 Recommendations that have been deleted**

Recommendation in 2015 guideline	Comment
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]** [1.2.7]	This recommendation was deleted because it is covered by recommendation 1.14.7.

2

3 **Table 2 Amended recommendation wording (change to intent) without**
4 **an evidence review**

Recommendation in 2015 guideline	Recommendation in current guideline	Reason for change
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]** [1.11.11]	In adults with DKA who have reduced consciousness, think about: • inserting a nasogastric tube and • monitoring urine output using a urinary catheter and • giving venous thromboembolism (VTE) prophylaxis. [2004] [1.11.11]	Heparin replaced by VTE prophylaxis because there is more than one type of prophylaxis that could be used.
Advise young adults who don't smoke never to start smoking. **[2004, amended 2021]** [1.13.6]	Advise adults who don't smoke never to start smoking. **[2004, amended 2021]** [1.13.6]	'Young' removed from recommendation so that it applies to all adults.
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]** [1.15.27]	Use simple analgesics (paracetamol, aspirin) and local measures (bed cradles) as a first step to treat acute painful neuropathy, and if these do not help, try other measures. **[2004, amended 2021]** [1.15.28]	'and discontinue them' removed because this contradicts recommendation 1.15.30 which says to keep using them while trying other measures.

5

6 **Table 3 Minor changes to recommendation wording (no change to**
7 **intent)**

Recommendation numbers in current guideline	Comment
All recommendations except those labelled **[2021]**	Recommendations have been edited into the direct style (in line with current NICE style for recommendations in guidelines) where possible. The language has been updated for simplicity and clarity and some recommendations have been split to make them shorter and more succinct. Some wording has also been updated to be more person centred. Yellow highlighting has not been applied to these changes.
–	‘Nutritional advice’ changed to ‘dietary advice’ throughout.
–	‘Physical activity’ used throughout (changed from ‘exercise’ in a few places to be consistent).
–	‘Awareness of hypoglycaemia’ changed to ‘hypoglycaemia awareness’ throughout.
–	‘Insulin preparations’ changed to ‘insulin regimens’ throughout.
–	‘Continuous subcutaneous insulin infusion (CSII or insulin pump) therapy’ replaced with ‘insulin pump’ throughout.

Recommendation numbers in current guideline	Comment
1.1.6	Sub-bullet 1 of bullet 1 changed from ‘ensure security of diagnosis of type of diabetes’ to ‘ensure the diagnosis is accurate’ for plainer English.
1.1.6	Sub-bullet 3 under bullet 1 has been changed from ‘review and detect potentially confounding disease and medicines’ to ‘review medicines and detect potentially associated disease’ to make the actions clearer and clarify that it involves looking for associated disease such as other autoimmune conditions.
1.1.6	Sub-bullet 2 of bullet 2 changed from ‘their preferences in nutrition and physical activity’ to ‘their lifestyle (including diet and physical activity)’ for style and clarity.
1.1.6	Bullet 4: ‘emotional state’ changed to ‘emotional wellbeing’ for current NICE style.
1.1.7	‘Other medical history/systems’ in bullet 5 changed to ‘other medical history’ because it was not clear what systems referred to.
1.1.9	Recommendation updated to say ‘Based on discussion with the adult with type 1 diabetes, modify the plan as needed over the following weeks’ to reflect shared decision making.
1.2.3	Walk-in and phone request replaced by ‘different methods (including phone and email’ to bring the recommendation up to date. ’24-hour helplines’ replaced by ‘information about out-of-hours services’ to update the recommendation, and bullet 3 about contact information removed as it is no longer needed.
1.3.4	Bullet 3: ‘and is written down’ removed in relation to the structured curriculum because it doesn’t account for online learning. ‘Evidence-based’ removed from this bullet because it repeats the first bullet point.
1.4.9	Bullet 1 changed from ‘optimal choices about the variety of foods they wish to consume’ to ‘healthy eating and a balanced diet’ for simplicity.

Recommendation numbers in current guideline	Comment
1.4.10	Opening of recommendation changed to ‘discuss’ to reflect shared decision making, and language simplified throughout the recommendation, with the actions clarified.
1.4.14	‘Be aware of appropriate nutritional advice’ changed to: ‘Healthcare professionals giving dietary advice to adults with type 1 diabetes should be able to advise’ to make the action clearer.
1.10.12	‘It is inevitable’ replaced with ‘It is very common’ in relation to experiencing some hypoglycaemic episodes, which the committee thought was more appropriate as ‘inevitable’ suggests a lack of control.
1.11.4	In bullet 5, ‘disturbed interpretation of familiar diagnostic tests’ replaced with ‘that DKA can affect the results of standard diagnostic tests’ for clarity and simplicity.
1.11.1	‘Consideration should be given’ replaced by ‘think about’ because ‘consider’ is only used at NICE to indicate weaker evidence.
1.14.9	‘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’ replaced by ‘support adults with type 1 diabetes to make their own food choices’ to use active language and reflect personal autonomy of adults with type 1 diabetes.
1.15.10	‘Combination therapy is not recommended’ replaced by ‘do not offer combination therapy’ to use active language.
1.15.12	‘the advantages of not following a high-protein diet’ replaced by ‘the advantages of avoiding a high-protein diet’ to make the action clearer.
1.15.15	‘the possibility of autonomic neuropathy affecting the gut should be considered’ replaced by ‘suspect the possibility of autonomic neuropathy affecting the gut’ to use active language and avoid the use of ‘consider’ which is only used in NICE recommendations to indicate weaker evidence.
1.15.18	‘include standard interventions’ has been replaced by ‘follow standard clinical practice’ to improve clarity.

Recommendation numbers in current guideline	Comment
1.15.40	‘who are at risk of morbidity from the complications of poor metabolic control’ replaced by ‘with an eating disorder’ for simplicity and clarity. ‘Consideration should be given to’ replaced by ‘Think about’ to use active language and avoid use of ‘consider’ which is only used in NICE recommendations to indicate weaker evidence.

December 2020

Recommendations on diabetic retinopathy have been amended 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

A footnote has been added to recommendation 1.7.14, to state that metformin does not have a UK marketing authorisation for the recommended indication. A link to the NICE guideline on coeliac disease has been added to recommendation 1.12.1.

August 2015

The guidance updated NICE guideline CG15 (published July 2004). It also updated and replaced NICE technology appraisal guidance 53 and NICE technology appraisal guidance 60.

Some changes were made 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 in adults).
- 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 in adults.
- Recommendation 1.15.23 has been updated to mention postural hypertension, because this is an important sign of autonomic neuropathy.

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