

# Diabetes (type 1 and type 2) in children and young people: 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.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

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 partially replaces CG15.

This guideline is the basis of QS125.

## Overview

This guideline covers the diagnosis and management of type 1 and type 2 diabetes in children and young people aged under 18. The guideline recommends how to support children and young people and their families and carers to maintain tight control of blood glucose to reduce the long-term risks associated with diabetes.

## Who is it for?

- Healthcare professionals, including those working in dental services
- Commissioners and providers
- Children and young people with type 1 or type 2 diabetes, and their families and carers

# 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

1.1.1 Be aware that signs of type 1 diabetes in children and young people include:

- hyperglycaemia (random plasma glucose more than 11 mmol/litre)
- polyuria
- polydipsia
- weight loss
- excessive tiredness. **[2004, amended 2015]**

1.1.2 Refer children and young people with suspected type 1 diabetes immediately (on the same day) to a multidisciplinary paediatric diabetes team with the competencies needed to confirm diagnosis and provide immediate care. **[2004,**

**amended 2015]**

- 1.1.3 Confirm type 1 diabetes in children and young people using the plasma glucose criteria in the World Health Organization's 2006 report on the diagnosis and classification of diabetes mellitus. **[2004, amended 2015]**
- 1.1.4 When diagnosing diabetes in a child or young person, assume type 1 diabetes unless there are strong indications of type 2 diabetes, monogenic or mitochondrial diabetes. **[2015]**
- 1.1.5 Think about the possibility of type 2 diabetes in children and young people with suspected diabetes who:
- have a strong family history of type 2 diabetes
  - are obese
  - are from a Black or Asian family background
  - do not need insulin, or need less than 0.5 units/kg body weight/day after the partial remission phase
  - show evidence of insulin resistance (for example, acanthosis nigricans).
- [2004, amended 2015]**
- 1.1.6 Think about the possibility of other types of diabetes (not type 1 or 2), such as other insulin-resistance syndromes, or monogenic or mitochondrial diabetes, in children and young people with suspected diabetes who have any of the following:
- diabetes in the first year of life
  - rarely or never develop ketones in the blood (ketonaemia) during episodes of hyperglycaemia
  - associated features, such as optic atrophy, retinitis pigmentosa, deafness, or another systemic illness or syndrome. **[2004, amended 2015]**
- 1.1.7 Do not measure C-peptide or diabetes-specific autoantibody titres at initial presentation to distinguish type 1 diabetes from type 2 diabetes. **[2015]**

- 1.1.8 Consider measuring C-peptide after initial presentation if needed to distinguish between type 1 diabetes and other types of diabetes. Be aware that C-peptide concentrations have better discriminative value the longer the interval between initial presentation and the test. [2015]
- 1.1.9 Perform genetic testing if atypical disease behaviour, clinical characteristics or family history suggest monogenic diabetes. [2015]

## 1.2 Type 1 diabetes

### Education and information

- 1.2.1 Offer children and young people with type 1 diabetes and their families or carers a continuing programme of education from diagnosis. Include the following core topics:
- insulin therapy (including its aims and how it works), insulin delivery (including rotating injection sites within the same body region) and dosage adjustment [2015]
  - blood glucose monitoring, including blood glucose and HbA1c targets [2015]
  - how diet, physical activity and intercurrent illness affect blood glucose levels [2015]
  - managing intercurrent illness ('sick-day rules', including monitoring of blood ketones [ $\beta$ -hydroxybutyrate]) [2015]
  - detecting and managing hypoglycaemia, hyperglycaemia and ketosis [2015]
  - the importance of good oral hygiene and regular oral health reviews for preventing periodontitis. [2022]
- 1.2.2 Tailor the education programme to each child or young person with type 1 diabetes and their families or carers, taking account of issues such as:
- personal preferences

- emotional wellbeing
- age and maturity
- cultural considerations
- existing knowledge
- current and future social circumstances
- life goals. **[2015]**

- 1.2.3 Encourage young people with type 1 diabetes to attend clinic 4 times a year, and explain that regular contact with the diabetes team will help them maintain optimal blood glucose levels. **[2004, amended 2015]**
- 1.2.4 Explain to children and young people with type 1 diabetes and their families or carers that, like people without diabetes, they should have:
- regular dental examinations (see the NICE guideline on dental checks: intervals between oral health reviews)
  - an eye examination by an optician at least every 2 years. **[2015, amended 2020]**
- 1.2.5 Encourage children and young people with type 1 diabetes and their families or carers to discuss any concerns and raise any questions they have with their diabetes team. **[2015]**
- 1.2.6 Give children and young people with type 1 diabetes and their families or carers information about diabetes support groups and organisations, and the potential benefits of membership. Give this information after diagnosis and regularly afterwards. **[2004, amended 2015]**
- 1.2.7 Encourage children and young people with type 1 diabetes to wear or carry something that tells people they have type 1 diabetes (for example, a bracelet). **[2004]**
- 1.2.8 Explain to children and young people with type 1 diabetes and their families or

carers how to find out about government disability benefits. [2004, amended 2015]

- 1.2.9 Take particular care when communicating with children and young people with type 1 diabetes if they or their families or carers have physical or sensory disabilities, or difficulties speaking or reading English. [2004]
- 1.2.10 Diabetes teams should offer comprehensive advice to children and young people with type 1 diabetes who want to play sports that have particular risks for people with diabetes. Support groups and organisations (including sports organisations) may be able to provide more information. [2004, amended 2015]
- 1.2.11 Offer education for children and young people with type 1 diabetes and their families or carers on the practical issues around long-distance travel, such as when best to eat and inject insulin when travelling across time zones. [2004]

## **Smoking and substance misuse**

- 1.2.12 Encourage children and young people with type 1 diabetes not to start smoking. Explain the general health problems smoking causes, in particular the risks of vascular complications. [2004, amended 2015]
- 1.2.13 For more guidance on preventing smoking, see also the NICE guideline on tobacco: preventing uptake, promoting quitting and treating dependence. [2004, amended 2015]
- 1.2.14 Offer smoking cessation programmes to children and young people with type 1 diabetes who smoke. See also the NICE guideline on tobacco: preventing uptake, promoting quitting and treating dependence. [2004, amended 2015]
- 1.2.15 Explain to children and young people with type 1 diabetes and their families or carers about the general dangers of substance misuse and the possible effects on blood glucose levels. [2004]

## Immunisation

- 1.2.16 Explain to children and young people with type 1 diabetes and their families or carers that the UK Health Security Agency Green Book recommends they have:
- annual immunisation against influenza, starting when they are 6 months old
  - immunisation against pneumococcal infection if they are taking insulin or oral hypoglycaemic medicines. **[2004, amended 2015]**

## Insulin therapy

- 1.2.17 Discuss the choice of insulin regimen with the child or young person and their family:
- explain the advantages and disadvantages of the different options
  - discuss their personal circumstances and preferences
  - help them to make an informed decision between the options that are available to them. **[2015]**
- 1.2.18 Offer children and young people with type 1 diabetes a multiple daily injection basal-bolus insulin regimen from diagnosis. **[2015]**
- 1.2.19 If multiple daily insulin injections are not appropriate for a particular child or young person, consider an insulin pump, as recommended in the NICE technology appraisal guidance on continuous subcutaneous insulin infusion for the treatment of diabetes mellitus. **[2015]**
- 1.2.20 Encourage children and young people with type 1 diabetes who are having multiple daily insulin injections to adjust the insulin dose if appropriate after each blood glucose measurement. **[2004, amended 2015]**
- 1.2.21 Tell children and young people with type 1 diabetes who are having multiple daily insulin injections to inject rapid-acting insulin analogues before eating. Explain that this reduces blood glucose levels after meals and will help them optimise their blood glucose levels. **[2004, amended 2015]**

- 1.2.22 When children and young people start on an insulin pump, train them and their families and carers how to use it. A specialist team should provide ongoing support. **[2004, amended 2015]**
- 1.2.23 Specialist teams should agree a common core of advice to give insulin pump users. **[2004, amended 2015]**
- 1.2.24 For children and young people with type 1 diabetes who are using twice-daily injection regimens, encourage them to adjust the insulin dose according to the general trend in their pre-meal, bedtime and occasional night-time blood glucose. **[2004, amended 2015]**
- 1.2.25 Explain to children and young people with newly diagnosed type 1 diabetes and their families or carers that:
- they may have a partial remission phase (a 'honeymoon period') when they start using insulin
  - during this time, they may only need a low dosage of insulin (0.5 units/kg body weight/day) to maintain an HbA1c level of less than 48 mmol/mol (6.5%). **[2004, amended 2015]**
- 1.2.26 Offer children and young people with type 1 diabetes a choice of insulin delivery systems. **[2004]**
- 1.2.27 Provide children and young people with type 1 diabetes insulin injection needles that are the right length for their body fat. **[2004, amended 2015]**
- 1.2.28 Provide children and young people with type 1 diabetes and their families or carers:
- suitable containers for collecting used needles and other sharps
  - a way to safely get rid of these containers.
- See also the section on safe use and disposal of sharps in the NICE guideline on healthcare-associated infections. **[2015]**
- 1.2.29 Offer children and young people with type 1 diabetes a review of injection sites at

each clinic visit. [2004, amended 2015]

- 1.2.30 Provide children and young people with type 1 diabetes rapid-acting insulin analogues to use during intercurrent illness or episodes of hyperglycaemia. [2015]
- 1.2.31 If a child or young person with type 1 diabetes does not have optimal blood glucose levels (see recommendation 1.2.55 and recommendation 1.2.76):
- offer additional support, such as more contact with their diabetes team **and**
  - if necessary, offer an alternative insulin regimen (multiple daily injections, an insulin pump, or once-, twice- or three-times daily mixed insulin injections). [2015]

## Oral medicines

- 1.2.32 Only use metformin in combination with insulin within research studies because it is uncertain whether this combination improves blood glucose management. [2004]
- 1.2.33 Do not offer children and young people with type 1 diabetes acarbose or sulfonylureas (glibenclamide, gliclazide, glipizide, tolbutamide) in combination with insulin, because they may increase the risk of hypoglycaemia without improving blood glucose management. [2004, amended 2015]

## Dietary management

- 1.2.34 Support children and young people with type 1 diabetes and their families or carers to develop a good working knowledge of nutrition and how it affects their diabetes. [2015]
- 1.2.35 Discuss healthy eating regularly with children and young people with type 1 diabetes and their families or carers.
- Explain that this means eating foods with a low glycaemic index, fruit and

vegetables, and appropriate types and amounts of fats.

- Explain that healthy eating can reduce their risk of cardiovascular disease.
- Support them to adjust their food choices accordingly. **[2015]**

- 1.2.36 Take into account social and cultural considerations when providing advice on diet to children and young people with type 1 diabetes. **[2015]**
- 1.2.37 Explain that children and young people with type 1 diabetes have the same basic nutritional requirements as other children and young people. Their food should provide enough energy and nutrients for their growth and development. **[2004, amended 2015]**
- 1.2.38 For children and young people who are using a multiple daily insulin injection regimen or an insulin pump, offer level 3 carbohydrate counting education from diagnosis to them and their families or carers. Repeat this offer regularly. **[2015]**
- 1.2.39 When children and young people with type 1 diabetes change their insulin regimen, offer them and their families or carers dietary advice tailored to the new treatment. **[2015]**
- 1.2.40 Offer children and young people with type 1 diabetes and their families or carers education about the practical problems associated with fasting and feasting. **[2004, amended 2015]**
- 1.2.41 Encourage children and young people with type 1 diabetes and their families or carers to discuss the nutritional composition and timing of snacks with their diabetes team. **[2015]**
- 1.2.42 Encourage children and young people with type 1 diabetes to eat at least 5 portions of fruit and vegetables each day. **[2015]**
- 1.2.43 Explain to children and young people with type 1 diabetes and their families or carers that a low glycaemic index diet may help to improve blood glucose management and reduce the risk of hyperglycaemic episodes. **[2015]**
- 1.2.44 Offer children and young people with type 1 diabetes and their families or carers

advice and education to help them follow a low glycaemic index diet. [2015]

- 1.2.45 Offer children and young people with type 1 diabetes dietetic support to help optimise body weight and blood glucose levels. [2004]
- 1.2.46 At each clinic visit for children and young people with type 1 diabetes, measure their height and weight and plot on an appropriate growth chart. Check for normal growth or significant changes in weight because these may reflect changes in blood glucose levels. [2004, amended 2015]
- 1.2.47 Provide arrangements for weighing children and young people with type 1 diabetes that respect their privacy. [2004]

## Exercise

- 1.2.48 Encourage children and young people with type 1 diabetes to exercise on a regular basis, and explain that this reduces their long-term risk of developing cardiovascular disease. [2004, amended 2015]
- 1.2.49 Explain to children and young people with type 1 diabetes and their families or carers that they can take part in all forms of exercise, provided that appropriate attention is given to changes in insulin and dietary management. [2004]
- 1.2.50 Explain to children and young people with type 1 diabetes and their families or carers about:
- the effects of exercise on blood glucose levels and
  - how to avoid hypo- or hyperglycaemia during or after physical activity.
- [2004, amended 2015]
- 1.2.51 Encourage children and young people with type 1 diabetes and their families or carers to monitor blood glucose levels before and after exercise so that they can:
- identify when changes in insulin or food intake are needed
  - learn how their blood glucose responds to different levels of exercise

- watch out for exercise-induced hypoglycaemia
  - see how hypoglycaemia can occur several hours after prolonged exercise.  
**[2004, amended 2015]**
- 1.2.52 Explain to children and young people with type 1 diabetes and their families or carers that:
- they should have extra carbohydrates as needed to avoid hypoglycaemia **and**
  - they should have carbohydrate-based foods available during and after exercise. **[2004]**
- 1.2.53 Explain to children and young people with type 1 diabetes and their families or carers that they should have extra carbohydrates if their plasma glucose levels are less than 7 mmol/litre before they exercise. **[2004, amended 2015]**
- 1.2.54 Explain to children and young people with type 1 diabetes and their families or carers that they may need to alter their insulin dose or carbohydrate intake if they change their daily exercise patterns. **[2004]**

## Blood glucose and HbA1c targets and monitoring

### Blood glucose targets

- 1.2.55 Explain to children and young people with type 1 diabetes and their families or carers that the optimal target ranges for short-term plasma glucose management are:
- fasting plasma glucose level of 4 mmol/litre to 7 mmol/litre on waking
  - a plasma glucose level of 4 mmol/litre to 7 mmol/litre before meals at other times of the day
  - a plasma glucose level of 5 mmol/litre to 9 mmol/litre after meals
  - a plasma glucose level of at least 5 mmol/litre when driving (see the Driver and Vehicle Licensing Agency [DVLA] guidance for people with diabetes for

further details about driving). [2015]

- 1.2.56 Explain to children and young people with type 1 diabetes and their families or carers that maintaining blood glucose levels at the lower end of the target ranges will help them achieve the lowest possible HbA1c. **[2015]**
- 1.2.57 If children and young people with type 1 diabetes experience problematic hypoglycaemia or undue emotional distress while attempting to achieve blood glucose and HbA1c targets, discuss changing the targets with them and their families and carers. **[2015]**
- 1.2.58 Be aware that blood glucose and HbA1c targets can cause conflict between children and young people with type 1 diabetes and their families or carers, and they may need to agree a compromise. **[2015]**

## **Interpreting blood glucose levels**

- 1.2.59 Explain to children and young people with type 1 diabetes and their families or carers that blood glucose levels should be interpreted in the 'whole child' context, which includes the social, emotional and physical environment. **[2004]**

## **Continuous glucose monitoring**

- 1.2.60 Offer real-time continuous glucose monitoring (rtCGM) to all children and young people with type 1 diabetes, alongside education to support children and young people, and their families and carers, to use it (see recommendation 1.2.67). **[2022]**
- 1.2.61 Offer intermittently scanned continuous glucose monitoring (isCGM, commonly referred to as 'flash') to children and young people with type 1 diabetes aged 4 years and over who are unable to use rtCGM or who express a clear preference for isCGM. **[2022]**

In March 2022, isCGM was licensed for children aged 4 years and over.

- 1.2.62 Offer children and young people with type 1 diabetes a choice of rtCGM device, based on their individual preferences, needs, characteristics, and the functionality of the devices available. See box 1 for examples of factors to consider as part of this discussion. [2022]
- 1.2.63 When choosing a continuous glucose monitoring (CGM) device:
- use shared decision making to identify the child or young person's needs and preferences and offer them an appropriate device
  - if multiple devices meet their needs and preferences, offer the device with the lowest cost. [2022]

**Box 1 Factors to consider when choosing a continuous glucose monitoring device**

- Accuracy of the device.
- Whether the device provides predictive alerts or alarms and if these need to be shared with anyone else, for example a parent or carer.
- Whether using the device requires access to particular technologies (such as a smartphone and up-to-date phone software).
- How easy the device is to use and take readings from, including for people with limited dexterity (taking into account the age and abilities of the child or young person and whether the device needs to be used by others).
- Fear, frequency, awareness and severity of hypoglycaemia.
- Psychosocial factors.
- The child or young person's insulin regimen or type of insulin pump, if relevant (taking into account whether a particular device integrates with their pump as part of a hybrid closed loop or insulin suspend function).
- Whether, how often and how the device needs to be calibrated, and how easy it is for the person to do this themselves.
- How data can be collected, compatibility of the device with other technology, and whether data can be shared with the person's healthcare provider to help inform treatment.
- How unpredictable the child or young person's activity and blood glucose levels are and whether erratic blood glucose is affecting their quality of life.
- Whether the choice of device will impact on the child or young person's ability to attend school or education, or to do their job.
- Whether the child or young person takes part in sports or exercise when glucose levels will need additional management.
- Whether the child or young person has situations when symptoms of hypoglycaemia cannot be communicated or can be confused, for example during exercise.

- Clinical factors that may make devices easier or harder to use.
- Frequency of sensor replacement.
- Sensitivities to the device, for example local skin reactions.
- Body image concerns.

- 1.2.64 CGM should be provided by a team with expertise in its use, as part of supporting children and young people to self-manage their diabetes. [2022]
- 1.2.65 Advise children and young people with type 1 diabetes who are using CGM (and their families or carers) that they will still need to take capillary blood glucose measurements (although they can do this less often). Explain that this is because:
- they will need to use capillary blood glucose measurements to check the accuracy of their CGM device
  - they will need capillary blood glucose monitoring as a back-up (for example, when their blood glucose levels are changing quickly or if the device stops working).
- Provide them with enough test strips to take capillary blood glucose measurements as needed. [2022]
- 1.2.66 If a person cannot use or does not want rtCGM or isCGM, offer capillary blood glucose monitoring. [2022]
- 1.2.67 Include CGM in the continuing programme of education provided to all children and young people with type 1 diabetes and their families or carers (see the section on education and information). [2022]
- 1.2.68 Monitor and review the child or young person's use of CGM as part of reviewing their diabetes care plan, and explain to them the importance of continuously wearing the device. [2022]
- 1.2.69 If the child or young person is not using their CGM device at least 70% of the

time:

- ask if they are having problems with their device
- look at ways to address any problems or concerns to improve their use of the device, including further education and emotional and psychological support. [2022]

1.2.70 Commissioners, providers and healthcare professionals should address inequalities in CGM access and uptake by:

- monitoring who is using CGM
- identifying groups who are eligible but who have a lower uptake
- making plans to engage with these groups to encourage them to consider CGM. [2022]

For a short explanation of why the committee made the 2022 recommendations and how they might affect practice, see the [rationale and impact section on continuous glucose monitoring](#).

Full details of the evidence and the committee's discussion are in [evidence review B: continuous glucose monitoring in children and young people with type 1 diabetes](#).

## **Monitoring capillary blood glucose for children and young people not using continuous glucose monitoring**

1.2.71 Advise children and young people with type 1 diabetes who are using capillary blood glucose monitoring (and their families or carers) to routinely perform at least 5 capillary blood glucose tests per day. [2015, amended 2022]

1.2.72 Advise children and young people with type 1 diabetes who are using capillary blood glucose monitoring (and their families or carers) that more frequent testing is often needed (for example, with physical activity and during intercurrent illness). Ensure they have enough test strips for this. [2015, amended 2022]

- 1.2.73 Offer children and young people with type 1 diabetes who are using capillary blood glucose monitoring (and their families or carers) a choice of equipment for monitoring, so they can optimise their blood glucose management in response to changes in their insulin, diet and exercise. **[2004, amended 2022]**

## HbA1c targets and monitoring

- 1.2.74 Measure HbA1c using methods that have been calibrated according to International Federation of Clinical Chemistry standardisation. **[2015]**
- 1.2.75 Explain the benefits of safely achieving and maintaining the lowest attainable HbA1c to children and young people with type 1 diabetes and their families or carers. **[2015]**
- 1.2.76 Explain to children and young people with type 1 diabetes and their families or carers that an HbA1c target level of 48 mmol/mol (6.5%) or lower will minimise their risk of long-term complications. **[2015]**
- 1.2.77 Explain to children and young people with type 1 diabetes who have an HbA1c level above 48 mmol/mol (6.5%) that any reduction in HbA1c level reduces their risk of long-term complications. **[2015]**
- 1.2.78 Agree an individualised lowest achievable HbA1c target with each child or young person with type 1 diabetes and their families or carers. Take into account factors such as their daily activities, individual life goals, complications, comorbidities and the risk of hypoglycaemia. **[2015]**
- 1.2.79 Support children and young people with type 1 diabetes and their families or carers to safely achieve and maintain their individual agreed HbA1c target level. **[2015]**
- 1.2.80 Measure HbA1c level 4 times a year in children and young people with type 1 diabetes. Think about more frequent testing if they are having difficulty with blood glucose management. **[2004, amended 2015]**
- 1.2.81 Diabetes services should document the proportion of children and young people

with type 1 diabetes who achieve an HbA1c level of 53 mmol/mol (7%) or lower.  
[2015]

## Hyperglycaemia, blood ketone monitoring and intercurrent illness

1.2.82 Provide children and young people with type 1 diabetes and their families or carers with individualised oral and written advice ('sick-day rules') about managing type 1 diabetes during intercurrent illness or episodes of hyperglycaemia, including:

- monitoring blood glucose
- monitoring and interpreting blood ketones (beta-hydroxybutyrate)
- adjusting their insulin regimen
- food and fluid intake
- when and where to get further advice or help.

Revisit the advice at least annually. [2015]

1.2.83 Offer children and young people with type 1 diabetes blood ketone testing strips and a meter. Advise them and their families or carers to test for ketonaemia if they are ill or have hyperglycaemia. [2015]

1.2.84 Explain to children and young people with type 1 diabetes and their families or carers that they should not use blood ketone testing strips after the use-by date.  
[2015]

## Hypoglycaemia

1.2.85 Explain to children and young people with type 1 diabetes and their families or carers how they can avoid and manage hypoglycaemia. [2004]

- 1.2.86 Offer education for children and young people with type 1 diabetes and their families, carers, and teachers about recognising and managing hypoglycaemia. **[2004]**
- 1.2.87 Explain to children and young people with type 1 diabetes and their families or carers that they should always have access to an immediate source of fast-acting glucose and blood glucose monitoring equipment, so that they can check for hypoglycaemia and manage it safely. **[2004, amended 2015]**
- 1.2.88 Train and equip families, carers, and (if appropriate) school nurses and other carers to give intramuscular glucagon for severe hypoglycaemia in an emergency. **[2004, amended 2015]**
- 1.2.89 Immediately treat mild-to-moderate hypoglycaemia in children and young people with type 1 diabetes as follows:
- Give oral fast-acting glucose (for example, 10 g to 20 g; liquid carbohydrate may be easier to swallow than solid).
  - Be aware that fast-acting glucose may need to be given in frequent small amounts because hypoglycaemia can cause vomiting.
  - Recheck blood glucose levels within 15 minutes (fast-acting glucose should raise blood glucose levels within 5 to 15 minutes), and give more fast-acting glucose if they still have hypoglycaemia.
  - As symptoms improve or blood glucose levels return to normal, give oral complex long-acting carbohydrate to maintain blood glucose levels, unless the child or young person is:
    - about to have a snack or meal
    - having a continuous subcutaneous insulin infusion. **[2004, amended 2015]**
- 1.2.90 For children and young people with type 1 diabetes who are in hospital, treat severe hypoglycaemia with 10% intravenous glucose if rapid intravenous access is possible. Give a maximum dose of 500 mg/kg body weight (equivalent to a maximum of 5 ml/kg). **[2004, amended 2015]**

- 1.2.91 For children and young people with type 1 diabetes who are not in hospital, or if rapid intravenous access is not possible, treat severe hypoglycaemia as follows:
- Use intramuscular glucagon or a concentrated oral glucose solution (for example, Glucogel). Do not use oral glucose solution if they have reduced consciousness because this could be dangerous.
  - If using intramuscular glucagon:
    - give 1 mg glucagon to children and young people who are over 8 years old, or who weigh 25 kg or more
    - give 500 micrograms of glucagon to children who are under 8 years old, or who weigh less than 25 kg.
  - Seek medical assistance if blood glucose levels do not respond or symptoms continue for more than 10 minutes.
  - As symptoms improve or blood glucose levels return to normal, and once the child or young person is sufficiently awake, give oral complex long-acting carbohydrate to maintain normal blood glucose levels.
  - Recheck blood glucose repeatedly in children and young people who have persistently reduced consciousness after a severe hypoglycaemic episode to determine whether further glucose is needed. **[2004, amended 2015]**
- 1.2.92 Explain to young people with type 1 diabetes how alcohol affects blood glucose levels, and in particular the increased risk of hypoglycaemia (including hypoglycaemia while sleeping). **[2004, amended 2015]**
- 1.2.93 Explain to young people with type 1 diabetes who drink alcohol that they should:
- eat food containing carbohydrates before and after drinking
  - monitor their blood glucose levels regularly and aim to keep the levels within the recommended range by eating food containing carbohydrates. **[2004]**
- 1.2.94 Explain to children and young people with type 1 diabetes and their families or carers that when alcohol causes or contributes to hypoglycaemia, glucagon may be ineffective and they may need intravenous glucose. **[2004]**

- 1.2.95 Diabetes teams should consider referring children and young people with type 1 diabetes for assessment of cognitive function if they have frequent hypoglycaemia or recurrent seizures, particularly if these occur at a young age. **[2004]**

## Difficulties with maintaining optimal blood glucose levels

- 1.2.96 Think about the possibility of non-adherence to therapy in children and young people with type 1 diabetes who have difficulty with blood glucose management, especially in adolescence. **[2004, amended 2015]**
- 1.2.97 Be aware that young people with type 1 diabetes can have difficulty with blood glucose management during adolescence, and this may in part be due to non-adherence to therapy. **[2004]**
- 1.2.98 Raise the issue of non-adherence to therapy with children and young people with type 1 diabetes and their families or carers in a sensitive manner. **[2004]**
- 1.2.99 Be aware of the possible negative psychological impact of setting targets that may be difficult for a child or young person with type 1 diabetes to achieve and maintain. **[2015]**

## Surgery

- 1.2.100 Only offer surgery in centres that have dedicated paediatric facilities for children and young people with diabetes. **[2004]**
- 1.2.101 All centres caring for children and young people with type 1 diabetes should have written protocols on safe surgery for children and young people. The protocols should be agreed between surgical and anaesthetic staff and the diabetes team. **[2004]**
- 1.2.102 Surgical, anaesthetic and diabetes teams should discuss care for children and young people with type 1 diabetes before they are admitted to hospital for elective surgery, and as soon as possible after they are admitted for emergency

surgery. [2004, amended 2015]

## Psychological and social issues

- 1.2.103 Be aware that children and young people with type 1 diabetes have a greater risk of emotional and behavioural difficulties. [2004, amended 2015]
- 1.2.104 Offer children and young people with type 1 diabetes and their families or carers emotional support after diagnosis, and tailor this to their emotional, social, cultural and age-dependent needs. [2004]
- 1.2.105 Assess the emotional and psychological wellbeing of young people with type 1 diabetes who have frequent episodes of diabetic ketoacidosis (DKA). [2004, amended 2015]
- 1.2.106 Be aware that a lack of adequate psychosocial support for children and young people with type 1 diabetes has a negative effect on various outcomes (including blood glucose management) and can also reduce their self-esteem. [2004, amended 2015]
- 1.2.107 Offer children and young people with type 1 diabetes and their families or carers timely and ongoing access to mental health professionals with an understanding of diabetes. This is because they may experience psychological problems (such as anxiety, depression, behavioural and conduct disorders, and family conflict) or psychosocial difficulties that can impact on the management of diabetes and wellbeing. [2004, amended 2015]
- 1.2.108 See the NICE guidelines on depression in children and young people and antisocial behaviour and conduct disorders in children and young people for guidance on managing these conditions. [2015]
- 1.2.109 Diabetes teams should have access to mental health professionals to support them in psychological assessment and providing psychosocial support. [2004]
- 1.2.110 Offer children and young people with type 1 diabetes who have behavioural or conduct disorders, and their families or carers, access to mental health

professionals. [2004]

- 1.2.111 Offer specific family-based behavioural interventions, such as behavioural family systems therapy, if there are difficulties with diabetes-related family conflict. [2015]
- 1.2.112 Consider a programme of behavioural intervention therapy or behavioural techniques for children and young people with type 1 diabetes if there are concerns about their psychological wellbeing. Choose a type of therapy based on what the child or young person needs help with:
- health-related quality of life – for example, counselling or cognitive behavioural therapy (CBT), including CBT focused on quality of life
  - adherence to diabetes treatment – for example, motivational interviewing or multisystemic therapy
  - blood glucose management if they have high HbA1c levels (above 69 mmol/mol [8.5%]) – for example, multisystemic therapy. [2015]
- 1.2.113 Offer screening for anxiety and depression to children and young people with type 1 diabetes who have persistent difficulty with blood glucose management. [2004]
- 1.2.114 Be aware that children and young people with type 1 diabetes may develop anxiety or depression, particularly when they have difficulty with self-management when they have had diabetes for a long time. [2004]
- 1.2.115 Refer children and young people with type 1 diabetes and suspected anxiety or depression promptly to child mental health professionals. [2004]
- 1.2.116 Be aware that children and young people with type 1 diabetes (in particular, young women) have an increased risk of eating disorders. For more guidance on assessing and managing eating disorders, see the NICE guideline on eating disorders. [2004, amended 2015]
- 1.2.117 Be aware that children and young people with type 1 diabetes and an eating disorder may have associated difficulties with:

- blood glucose management (both hyperglycaemia and hypoglycaemia)
- symptoms of gastroparesis. **[2004, amended 2015]**

1.2.118 For children and young people with type 1 diabetes and an eating disorder, offer joint management involving their diabetes team and child mental health professionals. **[2004, amended 2015]**

## Monitoring for complications and associated conditions of type 1 diabetes

- 1.2.119 Offer children and young people with type 1 diabetes monitoring for:
- thyroid disease, at diagnosis and then annually until transfer to adult services
  - moderately increased albuminuria (albumin to creatinine ratio [ACR] 3 mg/mmol to 30 mg/mmol) to detect diabetic kidney disease, annually from 12 years
  - hypertension, annually from 12 years. **[2015]**
- 1.2.120 Refer children and young people with type 1 diabetes for diabetic retinopathy screening from 12 years, in line with NHS England's diabetic eye screening programme. **[2015]**
- 1.2.121 For guidance on monitoring for coeliac disease in children and young people with type 1 diabetes, see the NICE guideline on coeliac disease. **[2015]**
- 1.2.122 For guidance on managing foot problems in children and young people with type 1 diabetes, see the NICE guideline on diabetic foot problems. **[2015]**
- 1.2.123 Be aware of the following rare complications and associated conditions when children and young people with type 1 diabetes attend clinic visits:
- juvenile cataracts
  - necrobiosis lipoidica

- Addison's disease. [2004, amended 2015]

1.2.124 Explain to children and young people with type 1 diabetes and their families or carers the importance of annual monitoring from 12 years for diabetic kidney disease. [2015]

## Diabetic retinopathy

1.2.125 For children and young people with type 1 diabetes who are having eye screening, explain to them and their families or carers that:

- monitoring for diabetic retinopathy begins at 12 years (see recommendation 1.2.120) because diabetic retinopathy that needs treatment is extremely rare in children and young people under 12
- annual monitoring from age 12 is important because if significant diabetic retinopathy is found, early treatment will improve the outcome (for more information, see [NHS England's diabetic eye screening programme](#))
- it will help them keep their eyes healthy and help prevent problems with their vision
- the screening service is effective at identifying problems so that they can be treated early. [2015, amended 2020]

For guidance on managing and monitoring diabetic retinopathy in children and young people under the care of hospital eye services, see [NICE's guideline on diabetic retinopathy](#).

## Diabetic kidney disease

1.2.126 Explain to children and young people with type 1 diabetes and their families or carers that:

- monitoring for moderately increased albuminuria (ACR 3 mg/mmol to 30 mg/mmol) to detect diabetic kidney disease begins at 12 years because diabetic kidney disease in children and young people under 12 is extremely rare

- using the first urine sample of the day ('early morning urine') to screen for moderately increased albuminuria is important, as this reduces the risk of false positive results
- if moderately increased albuminuria is detected, improving blood glucose management will reduce the risk of this progressing to significant diabetic kidney disease
- annual monitoring from 12 years is important because if they have diabetic kidney disease, early treatment will improve the outcome. **[2015]**

- 1.2.127 Use the first urine sample of the day ('early morning urine') to measure the ACR. If the first urine sample of the day is not available, use a random sample, but be aware that this is associated with an increased risk of false positive results. **[2015]**
- 1.2.128 If the initial ACR is above 3 mg/mmol but below 30 mg/mmol, confirm the result by repeating the test on 2 further occasions using the first urine samples of the day ('early morning urine') before starting further investigation and therapy. **[2015]**
- 1.2.129 Investigate further if the initial ACR is 30 mg/mmol or more (proteinuria). **[2015]**

## Periodontitis

- 1.2.130 Advise children and young people with type 1 diabetes and their families and carers at their regular diabetes reviews that:
- they are at higher risk of periodontitis
  - if they get periodontitis, managing it can improve their blood glucose control and can reduce their risk of hyperglycaemia. **[2022]**
- 1.2.131 Advise children and young people with type 1 diabetes to have regular oral health reviews (their oral healthcare or dental team will tell them how often, in line with the NICE guideline on dental checks: intervals between oral health reviews). **[2022]**

1.2.132 For guidance for oral healthcare and dental teams on how to provide oral health advice, see the NICE guideline on oral health promotion. [2022]

For a short explanation of why the committee made these recommendations, see the rationale and impact section on periodontitis.

Full details of the evidence and the committee's discussion are in evidence review C: periodontitis.

## 1.3 Type 2 diabetes

### Education and information

1.3.1 When giving children and young people, or their families or carers, information about type 2 diabetes:

- tailor the timing, content and delivery of information to their needs and preferences, paying particular attention to people with additional needs such as autistic people or those with learning disabilities, people who have physical or sensory disabilities and people who have difficulties speaking or reading English
- ensure that the information given supports shared decision making between the child or young person and the multidisciplinary diabetes team.

Follow the recommendation in NICE's guideline on shared decision making and babies, children and young people's experience of healthcare. [2023]

1.3.2 Offer children and young people with type 2 diabetes and their families or carers a continuing programme of education from diagnosis. Include the following core topics:

- the importance of managing glucose levels, including achieving and maintaining glucose and HbA1c targets
- how and when to take capillary blood glucose measurements (self-

monitoring)

- how diet, increasing physical activity and reducing body weight can reduce the symptoms of type 2 diabetes and lead to remission
- how diet, physical activity, body weight and intercurrent illness affects blood glucose levels
- how metformin can help, and its possible adverse effects
- the complications of type 2 diabetes and how to prevent them.

See also the recommendations for children and young people in NICE's guideline on overweight and obesity management (sections on general principles, identifying and assessing overweight and obesity, behavioural overweight and obesity management interventions, and physical activity and diet), and recommendations 1.3.68 to 1.3.70 on psychological and social issues in this guideline. **[2015, amended 2023]**

1.3.3 Tailor the education programme to each child or young person with type 2 diabetes and their families or carers, taking account of issues such as:

- personal preferences
- emotional wellbeing
- age and maturity
- cultural considerations
- existing knowledge
- current and future social circumstances
- life goals. **[2015]**

1.3.4 Give children and young people with type 2 diabetes who are taking insulin, and their families or carers, information and education about:

- insulin therapy (including its aims and how it works)

- insulin delivery (including rotating injection sites within the same body region)
- dosage adjustment
- the recognition and management of hypoglycaemia
- the importance of monitoring their glucose levels. **[2023]**

1.3.5 Give children and young people with type 2 diabetes who are offered continuous glucose monitoring (CGM), and their families and carers, information about how to use their chosen device, as part of their continuing programme of education. **[2023]**

1.3.6 Explain to children and young people with type 2 diabetes and their families or carers that, like people without diabetes, they should have:

- regular dental examinations (see the NICE guideline on dental checks: intervals between oral health reviews)
- an eye examination by an optician every 2 years. **[2004, amended 2015]**

1.3.7 Encourage children and young people with type 2 diabetes and their families or carers to discuss any concerns and raise any questions they have with their diabetes team. **[2015]**

1.3.8 Give children and young people with type 2 diabetes and their families or carers information about diabetes support groups and organisations, and the potential benefits of membership. Give this information after diagnosis and regularly afterwards. **[2004, amended 2015]**

1.3.9 Explain to children and young people with type 2 diabetes and their families or carers how to find out about possible government disability benefits. **[2004, amended 2015]**

For a short explanation of why the committee made the 2023 recommendations, see the rationale and impact section on education and information for children and young people with type 2 diabetes.

Full details of the evidence and the committee's discussion are in evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes.

## Smoking and substance misuse

- 1.3.10 Encourage children and young people with type 2 diabetes not to start smoking. Explain the general health problems smoking causes, in particular the risks of vascular complications. **[2004, amended 2015]**
- 1.3.11 For more guidance on preventing smoking, see also the NICE guideline on tobacco: preventing uptake, promoting quitting and treating dependence. **[2004, amended 2015]**
- 1.3.12 Offer smoking cessation programmes to children and young people with type 2 diabetes who smoke. See also the NICE guideline on tobacco: preventing uptake, promoting quitting and treating dependence. **[2004, amended 2015]**
- 1.3.13 Explain to children and young people with type 2 diabetes and their families or carers about the general dangers of substance misuse and the possible effects on blood glucose levels. **[2004, amended 2015]**

## Immunisation

- 1.3.14 Explain to children and young people with type 2 diabetes and their families or carers that the UK Health Security Agency Green Book recommends they have:
  - annual immunisation against influenza
  - immunisation against pneumococcal infection if they are taking insulin or oral hypoglycaemic medicines. **[2004, amended 2015]**

## Dietary management

- 1.3.15 At each contact with a child or young person with type 2 diabetes who is overweight or obese, advise them and their families or carers about the benefits of exercise and weight loss, and provide support towards achieving this. See also the NICE guideline on overweight and obesity management. [2015]
- 1.3.16 Offer children and young people with type 2 diabetes dietetic support to help optimise body weight and blood glucose levels. [2004, amended 2015]
- 1.3.17 At each contact with a child or young person with type 2 diabetes, explain to them and their families or carers how healthy eating can help to:
- reduce hyperglycaemia
  - reduce cardiovascular risk
  - promote weight loss (see recommendation 1.3.15). [2015]
- 1.3.18 Provide dietary advice to children and young people with type 2 diabetes and their families or carers in a sensitive manner. Take into account the difficulties that many people have with losing weight, and how healthy eating can also help with blood glucose levels and avoiding complications. [2015]
- 1.3.19 Take into account social and cultural considerations when providing dietary advice to children and young people with type 2 diabetes. [2015]
- 1.3.20 Encourage children and young people with type 2 diabetes to eat at least 5 portions of fruit and vegetables each day. [2015]
- 1.3.21 At each clinic visit for children and young people with type 2 diabetes:
- measure height and weight and plot on an appropriate growth chart
  - calculate body mass index.

Check for normal growth or significant changes in weight because these may reflect changes in blood glucose levels. [2004, amended 2015]

1.3.22 Provide arrangements for weighing children and young people with type 2 diabetes that respect their privacy. [2004, amended 2015]

## At diagnosis

1.3.23 Refer children and young people with suspected type 2 diabetes to a multidisciplinary paediatric diabetes team for specialist review to:

- confirm diagnosis **and**
- provide immediate and continuing care. [2023]

1.3.24 Offer children and young people with type 2 diabetes:

- advice and support on dietary management (see recommendations 1.3.15 to 1.3.22)
- a metformin monotherapy formulation in line with their own preferences
- equipment for capillary blood glucose monitoring.

See also recommendation 1.3.84 on screening for diabetic retinopathy.

In May 2023, the use of formulations other than standard-release metformin was off-label. See NICE's information on prescribing medicines. (2015, updated 2023)

1.3.25 In addition, offer children and young people with type 2 diabetes:

- insulin if their HbA1c level is 69 mmol/mol (8.5%) or more
- basal-bolus insulin if they have ketosis but not diabetic ketoacidosis (DKA).

If the child or young person with type 2 diabetes exhibits signs and symptoms of DKA, see section 1.4 on DKA. [2023]

For a short explanation of why the committee made the 2023 recommendations, see the [rationale and impact section](#) on what to do at diagnosis for children and young people with type 2 diabetes.

Full details of the evidence and the committee's discussion are in [evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

## Monitoring blood glucose levels and reviewing treatment

- 1.3.26 Four weeks after diagnosing type 2 diabetes and starting metformin in a child or young person, review data from glucose monitoring and, if needed, change treatment (see [recommendations on adding liraglutide, dulaglutide, or empagliflozin for people on metformin only](#) or [for people on metformin and insulin](#)). **[2023]**
- 1.3.27 Review treatment for children and young people with type 2 diabetes, as needed, at least every 3 months. Assess glucose trends using available data from glucose monitoring and HbA1c measurements. **[2023]**
- 1.3.28 If HbA1c monitoring cannot be used because of disturbed erythrocyte turnover or abnormal haemoglobin type, estimate trends in blood glucose levels using one of the following:
  - glucose profiles
  - total glycated haemoglobin estimation (if abnormal haemoglobins)
  - fructosamine estimation. **[2023]**
- 1.3.29 Adjust the frequency of capillary blood glucose monitoring based on the person's treatment and whether they are using CGM. Ensure they have enough test strips for capillary blood glucose monitoring. **[2023]**

For a short explanation of why the committee made the 2023 recommendations, see the [rationale and impact section on monitoring blood glucose levels and reviewing treatment for children and young people with type 2 diabetes](#).

Full details of the evidence and the committee's discussion are in [evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

## HbA1c targets and monitoring

- 1.3.30 Measure HbA1c using methods that have been calibrated according to the International Federation of Clinical Chemistry standardisation. **[2015]**
- 1.3.31 Explain to children and young people with type 2 diabetes and their families or carers that an HbA1c target level of 48 mmol/mol (6.5%) or lower will minimise their risk of long-term complications. **[2015]**
- 1.3.32 Explain to children and young people with type 2 diabetes who have an HbA1c level above 48 mmol/mol (6.5%) that any reduction in HbA1c level reduces their risk of long-term complications. **[2015]**
- 1.3.33 Explain the benefits of safely achieving and maintaining the lowest attainable HbA1c to children and young people with type 2 diabetes and their families or carers. **[2015]**
- 1.3.34 Agree an individualised lowest achievable HbA1c target with each child or young person with type 2 diabetes and their families or carers. Take into account factors such as their daily activities, individual life goals, complications and comorbidities. **[2015]**
- 1.3.35 Measure HbA1c levels every 3 months in children and young people with type 2 diabetes. **[2015]**
- 1.3.36 Support children and young people with type 2 diabetes and their families or carers to safely achieve and maintain their individual agreed HbA1c target level. **[2015]**

1.3.37 Diabetes services should document the proportion of children and young people with type 2 diabetes who achieve an HbA1c level of 53 mmol/mol (7%) or lower. **[2015]**

## Continuous glucose monitoring

1.3.38 Offer real-time continuous glucose monitoring (rtCGM) to children and young people with type 2 diabetes if any of the following apply. They:

- have a need, condition or disability (including a mental health need, learning disability or cognitive impairment) that means they cannot engage in monitoring their glucose levels by capillary blood glucose monitoring
- would otherwise be advised to self-monitor at least 8 times a day
- have recurrent or severe hypoglycaemia. **[2023]**

1.3.39 Consider rtCGM for children and young people with type 2 diabetes who are on insulin therapy. **[2023]**

1.3.40 Consider intermittently scanned continuous glucose monitoring (isCGM, commonly referred to as 'flash') for children and young people with type 2 diabetes aged 4 years and over who are on insulin therapy if:

- rtCGM is contraindicated for them or
- they express a clear preference for isCGM.

In May 2023, use of isCGM for children aged 3 years and under was off-licence. **[2023]**

1.3.41 When offering CGM to children and young people with type 2 diabetes, choose the appropriate device with them, based on their individual preferences, needs, characteristics, and the functionality of the devices available. See box 1 for factors to consider as part of this discussion. **[2023]**

1.3.42 When choosing a CGM device, if multiple devices meet the person's needs and preferences, offer the device with the lowest cost. **[2023]**

- 1.3.43 CGM should be provided by a team with expertise in its use to support children and young people to self-manage their type 2 diabetes. **[2023]**
- 1.3.44 Advise children and young people with type 2 diabetes who are using CGM, and their families or carers, that they will still need to take capillary blood glucose measurements, but they can do this less often. Explain that this is because they will need the capillary blood glucose measurements:
- to check the accuracy of their CGM device
  - as a back-up (for example, if the device stops working). **[2023]**
- 1.3.45 Monitor and review the child or young person's use of CGM when reviewing their diabetes care plan and explain to them the importance of continuously wearing the device. **[2023]**
- 1.3.46 If the child or young person is not using their CGM device at least 70% of the time:
- ask if they are having problems with their device
  - look at ways to address any problems or concerns to improve their use of the device, including further education and emotional and psychological support. **[2023]**
- 1.3.47 Commissioners, providers and healthcare professionals should address inequalities in CGM access and uptake by:
- monitoring who is using CGM
  - identifying groups who are eligible but have a lower uptake
  - making plans to engage with these groups to encourage them to consider CGM. **[2023]**

For a short explanation of why the committee made the 2023 recommendations, see the [rationale and impact section on continuous glucose monitoring for children and young people with type 2 diabetes](#).

Full details of the evidence and the committee's discussion are in [evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

## When to reduce insulin for people who have been on it from diagnosis

1.3.48 For children and young people with type 2 diabetes who have been on insulin therapy from diagnosis, gradually reduce with the aim of stopping insulin therapy if they have achieved:

- an HbA1c level of 48 mmol/mol (6.5%) or less **or**
- a plasma glucose level of 4 mmol/litre to 7 mmol/litre, on 4 or more days a week, when fasting or before meals **or**
- a plasma glucose level of 5 mmol/litre to 9 mmol/litre, on 4 or more days a week, 2 hours after meals.

See also [recommendations on insulin therapy for children and young people with type 2 diabetes in this guideline. \[2023\]](#)

For a short explanation of why the committee made the 2023 recommendation, see the [rationale and impact section on when to reduce insulin for children and young people with type 2 diabetes who have been on insulin since diagnosis](#).

Full details of the evidence and the committee's discussion are in [evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

## Adding liraglutide, dulaglutide, or empagliflozin

### People on metformin only

1.3.49 Offer liraglutide or dulaglutide, depending on the person's preference, in addition to metformin, to children and young people aged 10 or over with type 2 diabetes if they have:

- an HbA1c level of more than 48 mmol/mol (6.5%) or
- a plasma glucose level of more than 7 mmol/litre, on 4 or more days a week, when fasting or before meals or
- a plasma glucose level of more than 9 mmol/litre, on 4 or more days a week, 2 hours after meals.

In May 2023, this was an off-label use of dulaglutide. See NICE's information on prescribing medicines. **[2023]**

1.3.50 Consider empagliflozin, in addition to metformin, for children and young people aged 10 or over with type 2 diabetes who:

- meet any of the criteria listed in recommendation 1.3.49
- are not able to tolerate liraglutide or dulaglutide or have a clear preference for empagliflozin. **[2023, amended 2024]**

### When to add insulin for people on metformin with or without one of liraglutide, dulaglutide or empagliflozin

1.3.51 Offer insulin to children and young people with type 2 diabetes in whom an HbA1c level of 48 mmol/mol (6.5%) or less cannot be achieved using metformin with one medicine among liraglutide, dulaglutide or empagliflozin. **[2023]**

### People on metformin and insulin

1.3.52 Offer liraglutide or dulaglutide in addition to current treatment, rather than

increasing insulin, for a child or young person aged 10 or over with type 2 diabetes if:

- they are already on insulin therapy **and**
- their HbA1c or glucose levels do not meet the conditions in recommendation 1.3.48 to safely reduce and stop insulin.

See also recommendation 1.3.15 on dietary management.

In May 2023, this was an off-label use of dulaglutide. See NICE's information on prescribing medicines. [2023]

1.3.53 Consider empagliflozin in addition to current treatment, rather than increasing insulin, for a child or young person aged 10 or over with type 2 diabetes if:

- they are already on insulin therapy **and**
- their HbA1c or glucose levels do not meet the conditions in recommendation 1.3.48 to safely reduce and stop insulin **and**
- they are not able to tolerate liraglutide or dulaglutide or have a clear preference for empagliflozin. **[2023, amended 2024]**

See also recommendation 1.3.15 on dietary management.

### **When to increase insulin for people on metformin and insulin with or without one of liraglutide, dulaglutide or empagliflozin**

1.3.54 Only increase insulin for a child or young person aged 10 or over with type 2 diabetes who is on metformin and insulin if their HbA1c or glucose levels are not in the target ranges listed in recommendation 1.3.48 and:

- they are already also taking liraglutide, dulaglutide or empagliflozin **or**
- liraglutide, dulaglutide and empagliflozin are not tolerated or contraindicated. **[2023]**

## Dose of liraglutide, dulaglutide or empagliflozin

1.3.55 For children and young people aged 10 or over with type 2 diabetes who are on liraglutide, dulaglutide or empagliflozin, maintain the lowest dose that enables them to achieve the target ranges specified in recommendation 1.3.48. [2023]

See relevant Medicines and Healthcare products Regulatory Agency (MHRA) advice on the use of SGLT2 inhibitors and specific BNF advice on the use of empagliflozin.

For a short explanation of why the committee made the 2023 recommendations, see the rationale and impact section on adding liraglutide, dulaglutide or empagliflozin to current treatment for children and young people with type 2 diabetes.

Full details of the evidence and the committee's discussion are in evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes.

## Insulin therapy

1.3.56 When insulin therapy is appropriate (as per the recommendations about prescribing insulin at diagnosis or when to subsequently add insulin in this guideline), discuss the choice of insulin regimen with the child or young person and their family:

- explain the advantages and disadvantages of the different options and whether only basal or a combination of basal and meal-time insulin is required
- discuss their personal circumstances and preferences
- help them make an informed decision between the options that are available to them. [2023]

1.3.57 Provide children and young people with type 2 diabetes insulin injection needles that are the right length for their body fat. [2023]

- 1.3.58 Provide children and young people with type 2 diabetes and their families or carers with:
- suitable containers for collecting used needles and other sharps
  - a way to safely get rid of these containers.
- See also the section on safe use and disposal of sharps in the NICE guideline on healthcare-associated infections. [2023]
- 1.3.59 Offer children and young people with type 2 diabetes a review of injection sites at each clinic visit. [2023]
- 1.3.60 If a child or young person with type 2 diabetes does not have optimal blood glucose levels (see recommendations 1.3.31 on HbA1c target and 1.3.48 for HbA1c and plasma glucose targets), offer additional support, such as more contact with their diabetes team. [2023]

For a short explanation of why the committee made the 2023 recommendations, see the rationale and impact section on insulin therapy for children and young people with type 2 diabetes.

Full details of the evidence and the committee's discussion are in evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes.

## Changing treatments and updating healthcare plans

- 1.3.61 Ensure that the paediatric diabetes team updates the child or young person's school healthcare plan as soon as treatment changes in a way that affects the school's involvement, and annually. [2023]
- For recommendations about involving children and young people, and their family and carers, in making decisions about treatment, see:
- recommendation 1.5.4 (2015) on service provision in this guideline

- sections 1.2 to 1.4 in NICE's guideline on shared decision making.

For a short explanation of why the committee made the 2023 recommendation, see the rationale and impact section on changing treatment and updating school healthcare plans for children and young people with type 2 diabetes.

Full details of the evidence and the committee's discussion are in evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes.

## Surgery

- 1.3.62 Only offer surgery in centres that have dedicated paediatric facilities for children and young people with diabetes. **[2004, amended 2015]**
- 1.3.63 All centres caring for children and young people with type 2 diabetes should have written protocols on safe surgery for children and young people. The protocols should be agreed between surgical and anaesthetic staff and the diabetes team. **[2004, amended 2015]**

## Psychological and social issues

- 1.3.64 Be aware that children and young people with type 2 diabetes have a greater risk of emotional and behavioural difficulties. **[2004, amended 2015]**
- 1.3.65 Offer children and young people with type 2 diabetes and their families or carers emotional support after diagnosis, and tailor this to their emotional, social, cultural and age-dependent needs. **[2004, amended 2015]**
- 1.3.66 Be aware that children and young people with type 2 diabetes have an increased risk of psychological conditions (for example, anxiety, depression, and behavioural and conduct disorders) and complex social factors (for example, family conflict), and these can affect their wellbeing and diabetes management. **[2015]**

- 1.3.67 Be aware that a lack of adequate psychosocial support for children and young people with type 2 diabetes has a negative effect on various outcomes (including blood glucose management) and can also reduce their self-esteem. [2004, amended 2015]
- 1.3.68 Offer children and young people with type 2 diabetes and their families or carers timely and ongoing access to mental health professionals with an understanding of diabetes. This is because they may experience psychological problems (such as anxiety, depression, behavioural and conduct disorders, and family conflict) or psychosocial difficulties that can impact on the management of diabetes and wellbeing. [2004, amended 2015]
- 1.3.69 See the NICE guidelines on depression in children and young people and antisocial behaviour and conduct disorders in children and young people for guidance on managing these conditions. [2015]
- 1.3.70 Diabetes teams should have access to mental health professionals to support them in psychological assessment and providing psychosocial support. [2004, amended 2015]
- 1.3.71 Offer assessment for anxiety and depression to children and young people with type 2 diabetes who have persistent difficulty with blood glucose management. [2004, amended 2015]
- 1.3.72 Refer children and young people with type 2 diabetes and suspected anxiety or depression promptly to child mental health professionals. [2004, amended 2015]
- 1.3.73 Ensure that children and young people with type 2 diabetes and their families or carers have timely and ongoing access to mental health services when needed. [2015]

## Monitoring for complications and associated conditions of type 2 diabetes

- 1.3.74 Offer children and young people with type 2 diabetes annual monitoring for:

- hypertension, starting at diagnosis
- dyslipidaemia, starting at diagnosis
- moderately increased albuminuria (albumin to creatinine ratio [ACR] 3 mg/mmol to 30 mg/mmol) to detect diabetic kidney disease, starting at diagnosis. **[2015]**

- 1.3.75 Explain to children and young people with type 2 diabetes and their families or carers the importance of annual monitoring for hypertension, dyslipidaemia and diabetic kidney disease. **[2015]**
- 1.3.76 Refer children and young people with type 2 diabetes for diabetic retinopathy screening from 12 years, in line with NHS England's diabetic eye screening programme. **[2015]**
- 1.3.77 For guidance on managing foot problems in children and young people with type 2 diabetes, see the NICE guideline on diabetic foot problems. **[2015]**

## Hypertension

- 1.3.78 Explain to children and young people with type 2 diabetes and their families or carers that monitoring (see recommendation 1.3.74) is important because if they have hypertension, early treatment will reduce their risk of complications. **[2015]**
- 1.3.79 Use a cuff large enough for the child or young person with type 2 diabetes when measuring blood pressure. **[2015]**
- 1.3.80 If repeated resting measurements are greater than the 95th percentile for age and sex, confirm hypertension using 24-hour ambulatory blood pressure monitoring before starting antihypertensive therapy. **[2015]**

## Dyslipidaemia

- 1.3.81 Explain to children and young people with type 2 diabetes and their families or

carers that monitoring (see recommendation 1.3.74) is important because if they have dyslipidaemia, early treatment will reduce their risk of complications. [2015]

- 1.3.82 When monitoring for dyslipidaemia in children and young people with type 2 diabetes, measure total cholesterol, high-density lipoprotein (HDL) cholesterol, non-HDL cholesterol and triglyceride concentrations. [2015]
- 1.3.83 Confirm dyslipidaemia using a repeat sample (fasting or non-fasting) before deciding on further management. [2015]

## Diabetic retinopathy

- 1.3.84 For children and young people with type 2 diabetes who are having eye screening, explain to them and their families or carers that:
- background retinopathy is often found through screening (see recommendation 1.3.76), and improved blood glucose management will reduce the risk of this progressing to significant diabetic retinopathy
  - it will help them keep their eyes healthy and prevent problems with their vision
  - the screening service is effective at identifying problems so that they can be treated early
  - at least annual monitoring from 12 years is important because, if significant diabetic retinopathy is found, early treatment will improve the outcome.
- [2015, amended 2020]**
- 1.3.85 Consider referring children and young people with type 2 diabetes who are younger than 12 years to an ophthalmologist for retinal examination if they have difficulty with blood glucose management. [2015]

For guidance on managing and monitoring diabetic retinopathy in children and young people under the care of hospital eye services, see [NICE's guideline on diabetic retinopathy](#).

## Diabetic kidney disease

- 1.3.86 Explain to children and young people with type 2 diabetes and their families or carers that:
- using the first urine sample of the day ('early morning urine') to screen for moderately increased albuminuria (ACR 3 mg/mmol to 30 mg/mmol) is important as this reduces the risk of false positive results
  - if moderately increased albuminuria is detected, improving blood glucose management will reduce the risk of this progressing to significant diabetic kidney disease
  - annual monitoring (see recommendation 1.3.74) is important because, if they have diabetic kidney disease, early treatment will improve the outcome.
- [2015]
- 1.3.87 Use the first urine sample of the day ('early morning urine') to measure the ACR. If the first urine sample of the day is not available, use a random sample, but be aware that this is associated with an increased risk of false positive results.
- [2015]
- 1.3.88 If the initial ACR is above 3 mg/mmol but below 30 mg/mmol, confirm the result by repeating the test on 2 further occasions using the first urine samples of the day ('early morning urine') before starting further investigation and therapy.
- [2015]
- 1.3.89 Investigate further if the initial ACR is 30 mg/mmol or more (proteinuria). [2015]

## Periodontitis

- 1.3.90 Advise children and young people with type 2 diabetes and their families and carers at their regular diabetes reviews that:
- they are at higher risk of periodontitis
  - if they get periodontitis, managing it can improve their blood glucose control and can reduce their risk of hyperglycaemia. [2022]

- 1.3.91 Advise children and young people with type 2 diabetes to have regular oral health reviews (their oral healthcare or dental team will tell them how often, in line with the NICE guideline on dental checks: intervals between oral health reviews). **[2022]**
- 1.3.92 For guidance for oral healthcare and dental teams on how to provide oral health advice, see the NICE guideline on oral health promotion. **[2022]**

For a short explanation of why the committee made these recommendations, see the rationale and impact section on periodontitis.

Full details of the evidence and the committee's discussion are in evidence review C: periodontitis.

## 1.4 Diabetic ketoacidosis

### Recognition, referral and diagnosis

- 1.4.1 Measure capillary blood glucose at presentation in children and young people without known diabetes who have:
- increased thirst, polyuria, recent unexplained weight loss or excessive tiredness **and any of**
  - nausea, vomiting, abdominal pain, hyperventilation, dehydration or reduced level of consciousness. **[2015]**
- 1.4.2 For children or young people without known diabetes who have a plasma glucose level above 11 mmol/litre and symptoms that suggest diabetic ketoacidosis (DKA; see recommendation 1.4.1), suspect DKA and immediately send them to a hospital with acute paediatric facilities. **[2015]**
- 1.4.3 Be aware that children and young people taking insulin for diabetes may develop DKA with normal blood glucose levels. **[2015]**
- 1.4.4 Suspect DKA even if the blood glucose is normal in a child or young person with

known diabetes and any of the following:

- nausea or vomiting
- abdominal pain
- hyperventilation
- dehydration
- reduced level of consciousness. [2015]

1.4.5 When DKA is suspected in a child or young person with known diabetes, measure their blood ketones (beta-hydroxybutyrate), using a near-patient method if available. Immediately send them to a hospital with acute paediatric facilities if:

- their blood ketones are elevated
- a near-patient method for measuring their blood ketones is not available. [2015]

1.4.6 If DKA is suspected or confirmed in a child or young person, explain to them and to their families or carers that DKA is serious and that they need urgent hospital assessment. [2015]

1.4.7 When a child or young person with suspected or known DKA arrives at hospital, measure their:

- capillary blood glucose
- capillary blood ketones (beta-hydroxybutyrate) if near-patient testing is available, or urine ketones if it is not
- capillary or venous pH and bicarbonate. [2015]

1.4.8 Diagnose DKA in children and young people with diabetes who have:

- hyperglycaemia (plasma glucose more than 11 mmol/litre) **and**
- acidosis (indicated by blood pH below 7.3 or plasma bicarbonate below 15 mmol/litre) **and**

- ketonaemia (indicated by blood beta-hydroxybutyrate above 3 mmol/litre) or ketonuria (++ and above on the standard strip marking scale). [2015]

1.4.9 Diagnose DKA severity as follows:

- mild DKA if blood pH is below 7.3 or plasma bicarbonate is below 15 mmol/litre
- moderate DKA if blood pH is below 7.2 or plasma bicarbonate is below 10 mmol/litre
- severe DKA if blood pH is below 7.1 or plasma bicarbonate is below 5 mmol/litre. [2015]

## Initial management of diabetic ketoacidosis

1.4.10 Inform the responsible senior clinician when a child or young person is diagnosed with DKA. [2015]

1.4.11 Explain to the child or young person and their families or carers what DKA is, and what care that they may need. [2015]

1.4.12 When DKA is diagnosed in a child or young person in hospital, record their:

- level of consciousness
- heart rate, blood pressure, temperature, respiratory rate (look for Kussmaul breathing)
- history of nausea or vomiting
- clinical evidence of dehydration
- body weight. [2015]

1.4.13 When DKA is diagnosed in a child or young person in hospital, measure and record the capillary or venous:

- pH and pCO<sub>2</sub>

- plasma sodium, potassium, urea and creatinine
  - plasma bicarbonate. **[2015]**
- 1.4.14 Consider a near-patient blood ketone (beta-hydroxybutyrate) testing method for rapid diagnosis and monitoring of DKA in children and young people in hospital. **[2015]**
- 1.4.15 Children and young people with DKA should be cared for in a facility that can provide the level of monitoring and care for DKA specified in section 1.4 of this guideline. **[2015]**
- 1.4.16 Children and young people with DKA should be cared for with one-to-one nursing either on a high-dependency unit (preferably a paediatric unit) or on a general paediatric ward, if:
- they are younger than 2 years **or**
  - they have severe DKA (blood pH below 7.1). **[2015]**
- 1.4.17 Think about inserting a nasogastric tube if a child or young person with DKA has a reduced level of consciousness and is vomiting. **[2015]**
- 1.4.18 Seek urgent anaesthetic review and discuss with a paediatric critical care specialist if a child or young person with DKA cannot protect their airway because they have a reduced level of consciousness. **[2015]**
- 1.4.19 Discuss the use of inotropes with a paediatric critical care specialist if a child or young person with DKA is in hypotensive shock. **[2015]**
- 1.4.20 Think about sepsis in a child or young person with DKA who has any of the following:
- fever or hypothermia
  - hypotension
  - refractory acidosis

- lactic acidosis. [2015]

## Fluid and insulin therapy

- 1.4.21 Treat DKA with intravenous fluids and intravenous insulin if the child or young person is not alert, is nauseated or vomiting, or is clinically dehydrated. [2020]
- 1.4.22 Do not give oral fluids to a child or young person who is receiving intravenous fluids for DKA unless ketosis is resolving, they are alert, and they are not nauseated or vomiting. [2020]
- 1.4.23 For children and young people with DKA who are clinically dehydrated but not in shock:
- give an initial intravenous bolus of 10 ml/kg 0.9% sodium chloride over 30 minutes
  - discuss with the responsible senior paediatrician before giving more than one intravenous bolus of 10 ml/kg 0.9% sodium chloride
  - only consider giving a second 10 ml/kg 0.9% sodium chloride intravenous bolus if needed to improve tissue perfusion, and only after reassessing their clinical status
  - when calculating the total fluid requirement, subtract these initial bolus volumes from the total fluid deficit. [2020]
- 1.4.24 For children and young people who have signs of shock, that is weak, thready (low-volume) pulse and hypotension, give an initial intravenous bolus of 10 ml/kg 0.9% sodium chloride as soon as possible. When calculating the total fluid requirement, do not subtract this fluid bolus from the total fluid deficit. [2020]
- 1.4.25 Be aware that:
- shock is rare in children and young people with DKA
  - prolonged capillary refill, tachycardia and tachypnoea are common in children with moderate-to-severe DKA, but this does not mean the child or young

person is in shock (these are signs of vasoconstriction caused by metabolic acidosis and hypcapnia). [2020]

1.4.26 Calculate the total fluid requirement for the first 48 hours in children and young people with DKA by adding the estimated fluid deficit to the fluid maintenance requirement:

- For the fluid deficit:
  - in mild-to-moderate DKA (blood pH 7.1 or above), assume 5% dehydration (so a 10 kg child needs 500 ml)
  - in severe DKA (blood pH below 7.1), assume 10% dehydration
  - aim to replace the deficit evenly over the first 48 hours, but in critically ill children and young people, discuss the fluid regimen early with the senior paediatrician or paediatric intensivist (or both) because the risk of cerebral oedema is higher.
- For the fluid maintenance requirement, use the Holliday–Segar formula:
  - give 100 ml/kg for the first 10 kg of weight
  - give 50 ml/kg for the second 10 kg of weight
  - give 20 ml/kg for every kg after this
  - use a maximum weight of 75 kg in the calculation.

When calculating the total fluid requirement, subtract any initial bolus volumes from the total fluid deficit (unless the child or young person is in shock). [2020]

1.4.27 Use 0.9% sodium chloride without added glucose for both rehydration and maintenance fluid in children and young people with DKA, until the plasma glucose concentration is below 14 mmol/litre. [2020]

1.4.28 Be aware that some children and young people with DKA may develop hyperchloremic acidosis, but this resolves on its own over time and specific management is not needed. [2020]

- 1.4.29 Include 40 mmol/litre (or 20 mmol/500 ml) potassium chloride in all fluids (except the initial intravenous boluses) given to children and young people with DKA, unless they have anuria or their potassium level is above the normal range. Do not delay potassium replacement, because hypokalaemia can occur once the insulin infusion starts. **[2020]**
- 1.4.30 For children and young people with potassium levels above the normal range, only add 40 mmol/litre (or 20 mmol/500 ml) potassium chloride to their intravenous fluids if:
- their potassium is less than 5.5 mmol/litre **or**
  - they have a history of passing urine. **[2020]**
- 1.4.31 For children and young people with DKA who have hypokalaemia at presentation, include potassium chloride in intravenous fluids before starting the insulin infusion. **[2020]**
- 1.4.32 Monitor sodium levels throughout DKA treatment and calculate the corrected sodium initially to identify if the child or young person has hyponatraemia. **[2020]**
- 1.4.33 When monitoring serum sodium levels in children and young people with DKA, be aware that:
- serum sodium should rise as DKA is treated as blood glucose falls
  - falling serum sodium is a sign of possible cerebral oedema
  - a rapid and ongoing rise in serum sodium concentration may also be a sign of cerebral oedema, caused by the loss of free water in the urine. **[2020]**
- 1.4.34 Do not give intravenous sodium bicarbonate to children and young people with DKA unless:
- they have compromised cardiac contractility, caused by life-threatening hyperkalaemia or severe acidosis **and**
  - you have discussed with the paediatric intensivist. **[2020]**
- 1.4.35 Do not give children and young people with DKA additional intravenous fluid to

replace urinary losses. [2015]

- 1.4.36 Start an intravenous insulin infusion 1 to 2 hours after beginning intravenous fluid therapy in children and young people with DKA. If a child or young person with DKA is using an insulin pump, disconnect the pump when starting intravenous insulin therapy. [2015]
- 1.4.37 When treating DKA with intravenous insulin in children and young people, use a soluble insulin infusion at a dosage between 0.05 units/kg/hour and 0.1 units/kg/hour. Do not give bolus doses of intravenous insulin. [2015]
- 1.4.38 In discussion with a diabetes specialist, think about continuing subcutaneous basal insulin in a child or young person who was using a basal insulin before DKA started. [2015]
- 1.4.39 When the plasma glucose concentration falls below 14 mmol/litre in children and young people with DKA, change fluids to 0.9% sodium chloride with 5% glucose and 40 mmol/litre (or 20 mmol/500 ml) potassium chloride. [2020]
- 1.4.40 If a child or young person's plasma glucose falls below 6 mmol/litre during DKA treatment:
- increase the glucose concentration of the intravenous fluid infusion **and**
  - if they have persisting ketosis, continue to give insulin at a dosage of least 0.05 units/kg/hour. [2020]
- 1.4.41 If the blood beta-hydroxybutyrate level is not falling within 6 to 8 hours in a child or young person with DKA, think about increasing the insulin dosage to 0.1 units/kg/hour or more. [2015]
- 1.4.42 Think about stopping intravenous fluid therapy for DKA in a child or young person if:
- ketosis is resolving and their blood pH has reached 7.3 **and**
  - they are alert **and**
  - they can take oral fluids without nausea or vomiting.

Discuss with the responsible senior paediatrician before stopping intravenous fluid therapy and changing to oral fluids for DKA in a child or young person if they still have mild acidosis or ketosis. **[2020]**

- 1.4.43 Do not change from intravenous insulin to subcutaneous insulin in a child or young person with DKA until ketosis is resolving, they are alert, and they can take oral fluids without nausea or vomiting. **[2015]**
- 1.4.44 Start subcutaneous insulin in a child or young person with DKA at least 30 minutes before stopping intravenous insulin. **[2015]**
- 1.4.45 For a child or young person with DKA who is using an insulin pump, restart the pump at least 60 minutes before stopping intravenous insulin. Change the insulin cartridge and infusion set and insert the cannula into a new subcutaneous site. **[2015]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the [rationale and impact section on fluid therapy](#).

Full details of the evidence and the committee's discussion are in [evidence review A: fluid therapy for the management of diabetic ketoacidosis](#).

## Monitoring during therapy

- 1.4.46 Monitor and record the following at least hourly in children and young people with DKA:
  - capillary blood glucose
  - heart rate, blood pressure, temperature, respiratory rate (look for Kussmaul breathing)
  - fluid balance, with fluid input and output charts
  - level of consciousness (using the modified Glasgow Coma Scale). **[2015]**

- 1.4.47 Monitor and record the level of consciousness (using the modified Glasgow Coma Scale) and heart rate (to detect bradycardia) every 30 minutes in:
- children under 2 years with DKA
  - children and young people with severe DKA (blood pH below 7.1).
- This is because these children and young people are at an increased risk of cerebral oedema. [2015]
- 1.4.48 Monitor children and young people having intravenous therapy for DKA using continuous electrocardiogram (ECG) to detect signs of hypokalaemia (including ST-segment depression and prominent U-waves). [2015]
- 1.4.49 Ensure that healthcare professionals performing the monitoring described in recommendations 1.4.46, 1.4.47 and 1.4.48 know what to look for and when to seek advice. [2015]
- 1.4.50 At 2 hours after starting treatment, and then at least every 4 hours, carry out and record the results of the following blood tests in children and young people with DKA:
- glucose (laboratory measurement)
  - blood pH and pCO<sub>2</sub>
  - plasma sodium, potassium and urea
  - beta-hydroxybutyrate. [2015]
- 1.4.51 A doctor involved in the care of the child or young person with DKA should review them face-to-face at diagnosis and then at least every 4 hours, and more frequently if:
- they are aged under 2 years
  - they have severe DKA (blood pH below 7.1)
  - there are any other reasons for special concern. [2015]

- 1.4.52 At each face-to-face review of children and young people with DKA, assess the following:
- clinical status, including vital signs and neurological status
  - results of blood investigations
  - ECG trace
  - cumulative fluid balance record. [2015]
- 1.4.53 Update the child and young person with DKA and their families or carers regularly about their progress. [2015]

## Complications of diabetic ketoacidosis

### Cerebral oedema

- 1.4.54 Immediately assess children and young people with DKA for suspected cerebral oedema if they have any of these early manifestations:
- headache
  - agitation or irritability
  - unexpected fall in heart rate
  - increased blood pressure. [2015]
- 1.4.55 If cerebral oedema is suspected in a child or young person with DKA, start treatment immediately.
- 1.4.56 Start treatment for cerebral oedema immediately in children and young people with DKA and any of these signs:
- deterioration in level of consciousness
  - abnormalities of breathing pattern, such as respiratory pauses

- oculomotor palsies
- pupillary inequality or dilatation. [2015]

1.4.57 When treating cerebral oedema in children and young people with DKA, use the most readily available of:

- mannitol (20%, 0.5 g/kg to 1 g/kg over 10 to 15 minutes) **or**
- hypertonic sodium chloride (2.7% or 3%, 2.5 ml/kg to 5 ml/kg over 10 to 15 minutes). [2015]

1.4.58 After starting treatment for cerebral oedema with mannitol or hypertonic sodium chloride in a child or young person with DKA, immediately seek specialist advice on further management, including which care setting would be best. [2015]

## Hypokalaemia

1.4.59 If a child or young person with DKA develops hypokalaemia (potassium below 3 mmol/litre):

- think about temporarily suspending the insulin infusion
- discuss hypokalaemia management urgently with a paediatric critical care specialist because a central venous catheter is needed to give intravenous potassium solutions above 40 mmol/litre. [2015]

## Venous thromboembolic disease

1.4.60 Be aware of the increased risk of venous thromboembolism in children and young people with DKA, especially if they have a central venous catheter. [2015]

## Avoiding future episodes of diabetic ketoacidosis

1.4.61 After a child or young person with known diabetes has recovered from an

episode of DKA, discuss what may have led to the episode with them and their families or carers. [2015]

- 1.4.62 Think about the possibility of non-adherence to therapy in children and young people with established type 1 diabetes who present with DKA, especially if they have had multiple episodes of DKA. [2004, amended 2015]
- 1.4.63 Advise children and young people who have had DKA and their families or carers how to reduce the risk of future episodes. In particular, explain the importance of managing intercurrent illnesses. [2015]

## 1.5 Service provision

- 1.5.1 Offer children and young people with diabetes an ongoing integrated package of care, provided by a multidisciplinary paediatric diabetes team. [2004, amended 2015]
- 1.5.2 The diabetes team should include members with training in clinical, educational, dietetic, lifestyle, mental health and foot care aspects of diabetes for children and young people. [2004, amended 2015]
- 1.5.3 Offer children and young people with diabetes and their families or carers 24-hour access to advice from their diabetes team. [2004, amended 2015]
- 1.5.4 Involve children and young people with diabetes and their families or carers in making decisions about the package of care provided by their diabetes team. [2004, amended 2015]
- 1.5.5 At diagnosis, offer children and young people with diabetes either home-based or inpatient management, depending on their clinical need, family circumstances and preferences. Explain that home-based care with support from the local paediatric diabetes team (including 24-hour telephone access) is safe, and is as effective as initial inpatient management. [2004, amended 2015]
- 1.5.6 Offer initial inpatient management to children with diabetes who are under 2 years old. [2004, amended 2015]

- 1.5.7 Think about initial inpatient management for children and young people with diabetes if there are social or emotional factors that would make home-based management inappropriate, or if they live a long way from the hospital. **[2004, amended 2015]**
- 1.5.8 Diabetes teams should speak regularly with school staff who look after children and young people with type 1 diabetes, to provide diabetes education and practical information. **[2004, amended 2015]**
- 1.5.9 Record the details of children and young people with diabetes on a population-based, practice-based or clinic-based diabetes register. **[2004, amended 2015]**

## Transition from paediatric to adult care

- 1.5.10 Give young people with diabetes enough time to understand how transition from paediatric to adult services will work, because this improves clinic attendance. **[2004, amended 2015]**
- 1.5.11 Agree specific local protocols for transferring young people with diabetes from paediatric to adult services. **[2004, amended 2015]**
- 1.5.12 Base the decision on when a young person should transfer to the adult service on their physical development and emotional maturity, and on local circumstances. **[2004, amended 2015]**
- 1.5.13 Ensure that transition from the paediatric service occurs at a time of relative stability in the young person's health, and that it is coordinated with other life transitions. **[2004, amended 2015]**
- 1.5.14 Explain to young people with type 1 diabetes who are preparing for transition to adult services that some aspects of diabetes care will change. **[2004, amended 2015]**

## Terms used in this guideline

This section defines terms that have been used in a particular way for this guideline.

### Continuous glucose monitoring

This covers both real-time (rtCGM) and intermittently scanned (isCGM, commonly referred to as 'flash') continuous glucose monitoring.

A continuous glucose monitor is a device that measures blood glucose levels and sends the readings to a display device or smartphone.

### Hyperchloremic acidosis

A persisting base deficit or low bicarbonate concentration, despite evidence of resolving ketosis and clinical improvement.

### Insulin pump

Continuous subcutaneous insulin infusion. A programmable pump and insulin storage device that gives a regular or continuous amount of insulin (usually a rapid-acting insulin analogue or short-acting insulin) through a subcutaneous needle or cannula.

### Level 3 carbohydrate counting

Carbohydrate counting with adjustment of insulin dosage according to an insulin to carbohydrate ratio.

### Multiple daily injection basal-bolus regimen

Injections of short-acting insulin or rapid-acting insulin analogue before meals, together with 1 or more separate daily injections of intermediate-acting insulin or long-acting insulin analogue.

### Periodontitis

A chronic inflammatory gum disease that destroys the supporting tissues of the teeth (the

periodontium).

Gingivitis is a milder form of periodontal disease than periodontitis. However, gingivitis still causes inflammation in the gum, and if not treated it can lead to periodontitis.

## Once-, twice-, or three-times daily mixed insulin injections

These are usually injections of short-acting insulin or rapid-acting insulin analogue mixed with intermediate-acting insulin.

## Recommendations for research

The guideline committee has made the following recommendations for research.

### 1 Use of routinely collected real-world data to examine the effectiveness and cost effectiveness of continuous glucose monitoring

Based on routinely collected real-world data, what is the effectiveness and cost effectiveness of continuous glucose monitoring devices to improve glycaemic control in children and young people? [2022]

For a short explanation of why the committee made this recommendation for research, see the [rationale section on continuous glucose monitoring](#).

Full details of the evidence and the committee's discussion are in [evidence review B: continuous glucose monitoring in children and young people with type 1 diabetes](#).

### 2 Effectiveness of glucose-lowering agents used to manage blood glucose levels in children and young people with type 2 diabetes

In children and young people with type 2 diabetes, what is the effectiveness of glucose-lowering agents used to manage blood glucose levels in adults with type 2 diabetes? [2023]

For a short explanation of why the committee made this recommendation and how it might affect practice, see the [rationale section on glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

Full details of the evidence and the committee's discussion are in [evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

### 3 Weekly treatment with glucose-lowering agents for managing blood glucose levels

In children and young people with type 2 diabetes, what is the effectiveness of weekly treatment with glucose-lowering agents for managing blood glucose levels compared to daily treatment? [2023]

For a short explanation of why the committee made this recommendation and how it might affect practice, see the [rationale section on glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

Full details of the evidence and the committee's discussion are in [evidence review D: glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes](#).

### 4 Continuous glucose monitor sensor adhesive to prevent sensitivities

What is the best continuous glucose monitor sensor adhesive to prevent sensitivities to the device, for example local skin reactions? [2022]

For a short explanation of why the committee made this recommendation for research, see the rationale section on continuous glucose monitoring.

Full details of the evidence and the committee's discussion are in evidence review B: continuous glucose monitoring in children and young people with type 1 diabetes.

# Rationale and impact

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

## Continuous glucose monitoring in children with type 1 diabetes

Recommendations 1.2.60 to 1.2.70

### Why the committee made the recommendations

The evidence on real-time continuous glucose monitoring (rtCGM) showed it leads to:

- a decrease in HbA1c **and**
- an increase in time in range.

This reflected the committee's experience in clinical practice. They highlighted that the continuous nature of rtCGM, and the fact that it can be connected to the phone or device of a parent or carer so they can track the data, were particularly important components for children and young people.

Because the evidence showed similar benefits of rtCGM for children and young people as for adults, the committee extrapolated the cost-effectiveness results from adults, concluding that rtCGM was cost effective in this population.

The committee agreed that children and young people needed support to understand how continuous glucose monitoring (CGM) works, the accuracy of devices and the benefits it can provide, so they emphasised that rtCGM should be provided along with education on how to use it.

Intermittently scanned CGM (isCGM) had no clinically meaningful effect on any of the outcomes that were looked at in the evidence. In the committee's experience, the intermittent nature of isCGM can affect adherence in children and young people.

Since the same clinical benefits were not found for isCGM in children and young people as in adults, the committee agreed those cost-effectiveness findings could not be extrapolated, so they could not conclude that isCGM is a cost-effective technology for the full population of children and young people. They therefore agreed that isCGM should be restricted to children and young people who are unable or do not want to use rtCGM, or who would prefer isCGM. Children and young people who prefer isCGM are likely to have better adherence with this type of device, so it would provide more benefit. The recommendation limits isCGM to children aged 4 and over because no isCGM devices are licensed in children under 4.

The committee did not make a recommendation on using specific devices because CGM technologies are changing very quickly and this recommendation would soon be out of date. Local healthcare services are better placed to assess which devices are evidence-based and suitable for use at any given time.

The committee wanted to highlight the importance of providing choice between the different CGM devices because the best device for each person would vary, so they produced a list of what to consider when discussing this with children and young people.

The committee recommended keeping capillary blood glucose monitoring as a back-up for situations such as when blood glucose levels are changing quickly or when technology fails.

CGM should also be included in the continuing programme of education that children and young people with type 1 diabetes are offered. This will increase the likelihood that people will scan and report the results frequently, allowing them to understand and manage their diabetes effectively. In addition, children and young people should be supported by a team with expertise in using CGM. This will help them to use the technology effectively to manage their diabetes.

The committee made the recommendation about discussing possible problems with children and young people who are not using their device 70% of the time because it is important that the CGM device is used for a significant proportion of time for it to have a positive effect. They wanted to avoid a child or young person feeling 'punished' for using it less than that, but agreed that less than 70% use should trigger a discussion to find out if extra support is needed. While they did not make recommendations on stopping CGM, the committee acknowledged that it may not be offered as a permanent solution and that it can be stopped if it is not being used effectively or not perceived to be providing enough

benefit.

Despite the positive recommendations on CGM, the committee were concerned that existing health inequalities may still lead to lower uptake of CGM in some groups of people. To address this, the committee made a recommendation outlining actions for commissioners, providers and healthcare professionals.

One of the known factors determining the use of CGM devices among children and young people with type 1 diabetes is sensitivities to the device, such as local skin reactions to the adhesive used in the sensor. The committee agreed that research is needed to investigate strategies to reduce local skin reactions to promote ease of use and adherence of these devices, so they made a recommendation for research on continuous glucose monitor sensor adhesive to prevent sensitivities.

The committee also made a recommendation for research using routinely collected real-world data to examine the effectiveness and cost effectiveness of CGM. They agreed that this has the potential to show the direct effects of implemented technology in children and young people instead of interpreting it through the results of clinical trials. Increased monitoring of routine healthcare data including registries and audits would ensure the findings from a broader population is captured.

## How the recommendations might affect practice

These recommendations are likely to result in broader access to rtCGM and isCGM devices for children and young people. This will increase costs but should reduce inequalities and enable more people to access the technology. Currently, children and young people, and their parents and carers, who have more time and knowledge to advocate or self-advocate are often more likely to gain access to these devices.

Some children and young people have insulin insufficiency because of other conditions. The committee noted that these children and young people would get the same care as children and young people with type 1 diabetes, so they should have access to CGM.

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## Periodontitis

Recommendations 1.2.1, 1.2.130 to 1.2.132, and 1.3.90 to 1.3.92

## Why the committee made the recommendations

There was no evidence for children and young people, so the committee extrapolated from the evidence for adults with type 1 and type 2 diabetes. There was a lot of consistent evidence showing that adults with diabetes are at increased risk of periodontitis and that non-surgical treatment can improve diabetic control. The clinical and cost effectiveness of periodontal treatment in adults were sufficient to justify the recommendations for children and young people with diabetes.

Children and young people with diabetes are at increased risk of developing periodontitis. However, in the committee's experience, they are often unaware of this and may not be having regular oral health reviews. To address this, the committee recommended routinely discussing the risk of periodontitis at the child or young person's regular diabetes reviews, alongside eye disease and foot problems.

Oral hygiene and the need for regular oral health reviews has been added to the standard education children and young people with diabetes should receive, because this will help them prevent periodontitis.

## How the recommendations might affect practice

For oral healthcare professionals, the long-term impact of the recommendations is uncertain. The recommendations specify that people should follow existing NICE guidelines on oral health. However, the recommendations may also increase awareness of periodontitis, leading to a possible short-term increase in the number of oral health reviews. Any increase in the number of oral health reviews will potentially impact on services as NHS dental services already have capacity issues.

A short-term increase in the number of oral health reviews will also lead to a short-term increase in costs. However, there is likely to be a larger long-term reduction in costs from the improvement to oral health and diabetes control.

Oral healthcare and dental teams will need clear advice on what they need to do for people with diabetes. They will need clear care pathways to improve quality of care and service delivery, in line with the [NHS England commissioning standard on dental care for people with diabetes](#).

NHS dental services are free for children and young people under 18, although not

everyone makes use of this. The recommendations may encourage more children and young people with diabetes to have regular oral health reviews. Combined with proactive engagement and enhanced support for children and young people with diabetes, this may broaden access to dental and oral healthcare and help to reduce oral health inequalities.

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## Glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes

### Education and information

[Recommendations 1.3.1, 1.3.2, 1.3.4 and 1.3.5](#)

#### Why the committee made the recommendations

Type 2 diabetes in children and young people can be effectively managed through a combination of:

- lifestyle changes (for example, diet and exercise)
- blood glucose monitoring and
- glucose-lowering agents.

The committee made recommendations to provide information and education to support all 3.

They also made 3 further recommendations about education and information. They agreed that:

- Insulin therapy to manage blood glucose levels is a complicated and demanding treatment. Children and young people with type 2 diabetes should be given the opportunity to learn about it so that they can more effectively manage their disease.
- Information should be provided in a way that takes the specific needs and preferences of children and young people with type 2 diabetes into account and supports shared

decision making.

- Information and education about CGM for those receiving insulin or who are in specific groups should be part of a continuing programme of education because it is likely that they will use it at least once during the course of their lives.

## How the recommendations might affect practice

The recommendations are not expected to substantially affect practice.

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## At diagnosis

Recommendations 1.3.23 to 1.3.25

### Why the committee made the recommendations

In the committee's experience, children and young people with type 2 diabetes are sometimes not cared for by a multidisciplinary team, in a specialist paediatric diabetes clinic. When this is the case, the child or young person is not able to access additional essential services such as telephone or mental health support. The committee therefore made a recommendation to ensure equal access to paediatric diabetes services for all children and young people with type 2 diabetes.

Various formulations of metformin are available, but only the standard-release tablets are licensed for use in a paediatric population. As of April 2023, use of other formulations would be off-label. However, the committee left the choice of metformin monotherapy formulation open on the basis that:

- alternative formulations may be more acceptable or better tolerated, and it is common practice for these to be used off-label in such cases
- the unit cost per day of modified-release tablets is the same as that of standard-release tablets.

The committee also recommended, using their knowledge and experience, that children and young people with type 2 diabetes should be offered capillary blood glucose monitoring equipment to allow them to monitor their own glucose levels.

The committee agreed, based on their knowledge and experience, that a high HbA1c level at diagnosis justifies adding insulin therapy to metformin to reduce:

- blood glucose levels, and therefore reduce the risk of hyperglycaemia
- the risk of developing diabetic ketoacidosis (DKA)
- the risk of hyperglycaemia-related complications in the long term.

They did not specify which insulin therapy should be used (for example, short-, long-, or intermediate-acting) because they agreed that this choice should be left to the relevant healthcare professional to allow flexibility of treatment.

They also agreed that the presence of ketosis indicates a current insulin deficiency, so a multiple daily (basal-bolus) insulin injection is needed to ensure, as a matter of safety, that DKA does not develop.

## How the recommendations might affect practice

The recommendations are not expected to substantially affect practice because dietary management is standard practice. It is also common for different metformin formulations to be used because some children and young people prefer formulations other than the standard-release tablet. Given the relatively small number of children and young people with type 2 diabetes in England and Wales (1,560 in all NHS settings as of 2019/20, according to the [NHS Digital report on Young People with type 2 diabetes, 2019-20](#)), the provision of equipment for both capillary blood glucose monitoring and insulin is not expected to have a significant resource impact.

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## Monitoring blood glucose levels and reviewing treatment

[Recommendations 1.3.26 to 1.3.29](#)

### Why the committee made the recommendations

The committee agreed that, for children and young people with type 2 diabetes, it is important to:

- achieve an HbA1c level of 48 mmol/mol (6.5%) or lower as early as possible in the treatment pathway to avoid later complications (such as cardiovascular, kidney and liver disease) and
- avoid staying on the same treatment for too long without reassessing its effectiveness.

As a result, they also agreed that current guidance to measure HbA1c levels every 3 months should be retained but supplemented with new recommendations, to make provision for an initial visit earlier than 3 months after diagnosis and for the use of data from capillary blood glucose monitoring or CGM. This is because combining HbA1c and glucose monitoring data will allow seeing trends quicker than changes in HbA1c levels alone.

The target HbA1c level of 48 mmol/mol (6.5%) or lower was chosen because:

- it can be used to diagnose type 2 diabetes and
- staying below this level is recommended to minimise the risk of long-term complications (see recommendation 1.3.31).

The committee agreed, using their knowledge and experience, that a first visit to review glucose data should take place after 4 weeks of metformin monotherapy. A period of 4 weeks was agreed because:

- at least 4 weeks of glucose monitoring data is needed to assess whether glucose levels are improving or whether treatment needs to be escalated
- although current guidance is for the first clinical visit to take place 3 months after diagnosis, in practice, this occurs earlier because newly diagnosed children and young people with type 2 diabetes often need more support than those whose glucose levels have already stabilised
- for children and young people with type 2 diabetes who are also on insulin therapy, safely reducing and stopping insulin typically takes 2 to 6 weeks, so a review of additional CGM data at 4 weeks will help.

Given the above considerations and the many differences between individual children and young people with type 2 diabetes, the committee agreed that healthcare professionals should carry out subsequent reviews at least every 3 months (the recommended frequency of HbA1c measurements). However, they recognised and allowed for the fact

that reviews may be required more often (especially if the child or young person is on insulin therapy).

The committee acknowledged that there are rare cases in which HbA1c measurements cannot be used (for example, when the child or young person has abnormal haemoglobin). Using their knowledge and experience, they recommended 3 alternative methods of estimating average glycaemia for use in such cases.

They also agreed that the frequency of monitoring should be based on several factors:

- the type of treatment
- the duration of the child or young person's type 2 diabetes and
- their general ability to maintain blood glucose within the target range.

For example, children and young people with type 2 diabetes who are on insulin but not using CGM will need to test their capillary blood glucose 4 to 5 times a day while those using insulin and CGM will not need to test it so often. As blood glucose levels stabilise, frequency of capillary blood glucose monitoring can be reduced. Given these considerations, enough test strips should be prescribed to enable the person to self-monitor as required by their treatment until the next review.

## **How the recommendations might affect practice**

The recommendations on capillary blood glucose monitoring and an initial review 4 weeks after diagnosis reflect current practice in England and therefore are not expected to have a significant impact.

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## **Continuous glucose monitoring**

[Recommendations 1.3.38 to 1.3.47](#)

### **Why the committee made the recommendations**

CGM is already recommended for everyone with type 1 diabetes and in some adults with type 2 diabetes, and the committee agreed that children and young people with type 2

diabetes should be offered the same.

The committee's decision to include these recommendations was also based on the following:

- Type 2 diabetes in children and young people is the most aggressive form of the disease, and this population will live with the condition for longer than adults with type 2 diabetes, so timely intervention is important to reduce the risk of developing severe long-term (and possibly life-threatening) complications, such as peripheral neuropathy.
- Many children and young people experience health inequalities because of comorbidities (for example, special educational needs or learning disabilities), which can make it difficult for them to conduct capillary blood glucose measurements.
- Capillary blood glucose monitoring often requires several finger-prick tests a day, which can be tiring, stressful and have a negative psychological impact on the person. CGM provides another, less invasive way for children and young people with diabetes to manage their blood glucose levels.
- Some CGM devices allow glucose data to be shared electronically.
- Using CGM, even in the short term, is likely to improve the child or young person's understanding of their own blood glucose patterns because of the continuous and visual way CGM allows glucose data to be presented.

The evidence base for the effectiveness of CGM in this population is limited, mostly because of the small number of children and young people with type 2 diabetes. As a result, the committee based recommendations on CGM for this population on the recommendations about CGM for children and young people with type 1 diabetes, in this guideline, and on the recommendations about CGM for adults in NICE's guideline on type 2 diabetes in adults.

The 2022 evidence review on the effectiveness of CGM to improve blood glucose level management in children and young people with type 1 diabetes concluded that:

- rtCGM is more effective than capillary blood glucose monitoring
- isCGM is no more effective than capillary blood glucose monitoring.

Therefore, the committee agreed that rtCGM should be considered when children and

young people with type 2 diabetes are on insulin therapy because of:

- the increased risk of hypoglycaemia
- comorbidities associated with type 2 diabetes in children and young people and
- the decreasing costs over time of available and appropriate devices.

As for adults, the committee agreed that CGM should not be considered for all children and young people with type 2 diabetes because some will be able to maintain their blood glucose levels within the target range using glucose-lowering agents that do not increase the risk of hypoglycaemia (such as metformin monotherapy).

The option to consider isCGM for people over 4 years old was provided because:

- some children and young people with type 2 diabetes have difficulties using rtCGM or may prefer isCGM to rtCGM
- in May 2023, isCGM was licensed for children aged 4 years and over.

The committee agreed that a stronger recommendation to offer rtCGM to 3 specific groups was justified, regardless of whether they are having insulin therapy, because of the child or young person's individual needs and the treatment burden associated with capillary blood glucose monitoring.

Regardless of the reason the child or young person with type 2 diabetes is offered CGM, the committee agreed that it should be provided by a team with expertise in its use, so that support can be provided and any issues with it can be quickly resolved.

The committee agreed that CGM should not replace capillary blood glucose monitoring because it is still needed both for checking the CGM device and as a back-up. They made some further recommendations about choosing and using a CGM device to encourage adherence and provide support.

Finally, the committee agreed, in line with the recommendations for children and young people with type 1 diabetes, that inequalities in access and uptake of CGM may still occur for those with type 2 diabetes, so they added a recommendation to address this. For example, obesity and type 2 diabetes are also closely associated, as are childhood obesity and socioeconomic status (it is highest among children living in the most deprived areas).

## How the recommendations might affect practice

The availability of devices for rtCGM or isCGM that allow remote sharing of data is increasing, although there can be wide variation in their cost. Some children or young people will also not have access to a mobile phone or compatible electronic device, which the CGM devices may require, so some provision for this may be needed. However, the number of children and young people with type 2 diabetes who will be eligible for CGM will also be relatively low. So, the recommendations to consider or offer CGM is unlikely to have a significant resource impact.

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## When to reduce insulin for people who have been on it from diagnosis

[Recommendation 1.3.48](#)

### Why the committee made the recommendation

The committee recognised that insulin use substantively increases the risk of hypoglycaemia and weight gain and that it should be gradually reduced and stopped when the person's HbA1c levels is under the 48 mmol/mol (6.5%) threshold. They agreed 3 criteria for when to reduce insulin use, based on those recommended for type 1 diabetes (see [recommendation 1.2.55](#)).

The committee also recognised that the choice of how often glucose levels could exceed the target ranges was somewhat arbitrary, but they were keen to avoid basing decisions on single events and agreed that having low glucose levels more often than not (for example, on 4 or more days a week) would certainly indicate that insulin can be reduced.

### How the recommendation might affect practice

The recommendation is not expected to substantially affect practice.

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## Adding liraglutide, dulaglutide, or empagliflozin

### Recommendations 1.3.49 to 1.3.55

#### Why the committee made the recommendations

The committee made separate recommendations about combining metformin with other glucose-lowering agents for children and young people with type 2 diabetes who are or are not on insulin therapy because insulin therapy is associated with specific risks (such as hypoglycaemia) not associated with metformin monotherapy. However, the overall rationale for these recommendations remains broadly the same and any differences relating to insulin therapy will be noted below.

#### Thresholds for adding liraglutide, dulaglutide, or empagliflozin to metformin

Three thresholds were chosen for when to initiate metformin therapy with liraglutide, dulaglutide, or empagliflozin (rather than insulin) for children and young people with type 2 diabetes. These thresholds reflect the chosen HbA1c threshold and upper limits of the blood glucose target ranges in recommendation 1.3.48.

Overall, the evidence showed that 2 GLP-1 receptor agonists, liraglutide and dulaglutide, and one SGLT2 inhibitor, empagliflozin, were generally effective in the short term at reducing glucose levels in children and young people with type 2 diabetes. Liraglutide and dulaglutide had significant effects on the majority of critical outcomes, including change in HbA1c level, mean fasting plasma glucose level, and use of insulin rescue medication. Empagliflozin also had significant effects on change in HbA1c percentage level and mean fasting plasma glucose level. No difference on the important outcomes (serious adverse events, gastrointestinal symptoms) was found in the short term.

Only one trial reported long-term data, comparing liraglutide to placebo, which showed that its effectiveness for managing blood glucose levels was maintained after 52 weeks. However, there was an increased risk of nausea and vomiting.

Though the recommendations mean potentially combining dulaglutide, liraglutide or empagliflozin with metformin earlier than it would be combined for an adult, the committee agreed it is justified by the relatively small number of available treatments for the paediatric population and the risks associated with:

- not achieving an HbA1c level of 48 mmol/mol (6.5%) or lower, and
- developing complications related to diabetes.

The committee agreed that this should be done in preference to offering insulin because of the risks of hypoglycaemia and weight gain associated with insulin use.

The restriction to children and young people aged 10 years or over reflects the licensing conditions for liraglutide.

The weaker strength of recommendation for empagliflozin reflects the evidence, suggesting that it is slightly less effective at managing blood glucose levels than liraglutide and dulaglutide, although there was no direct evidence comparing any of these agents to each other.

### **Dose of liraglutide, dulaglutide or empagliflozin**

The committee also agreed that the lowest dose of liraglutide, dulaglutide, and empagliflozin needed to maintain the target ranges specified in recommendation 1.3.48 should be maintained. This is because higher doses can lead to side effects and poorer treatment adherence. The committee also agreed, using their experience, that a specific warning about the use of empagliflozin was needed because its use as a glucose-lowering agent in the paediatric population is relatively recent.

### **Adding or increasing insulin**

Insulin use is associated with an increased risk of hypoglycaemia and weight gain. Given this, the committee recommended that, for children and young people with type 2 diabetes on metformin only, insulin should only be offered when other treatments have failed to stabilise glucose levels.

Similarly, the committee agreed that, for children and young people with type 2 diabetes who are on both metformin and insulin, insulin should only be increased when adding other treatments has failed to stabilise glucose levels. However, the committee recognised that there may be some children and young people with type 2 diabetes in whom other treatments (that is, liraglutide, dulaglutide or empagliflozin) may be contraindicated or not tolerated. The committee agreed that this should not prevent increasing their insulin dose and added a specific provision in the criteria to account for this.

### Note on body mass index

The committee also discussed whether body mass index should be a criterion for starting treatment with glucose-lowering agents – as it is for adults – but decided that this was not needed because a small proportion of children and young people with type 2 diabetes are not overweight and specifying such a criterion would exclude this group from treatment.

### Choosing the appropriate glucose-lowering agent

Dulaglutide is administered as a weekly injection, whereas liraglutide requires daily injections. Empagliflozin is an oral (tablet) treatment. Because some children and young people may prefer 1 treatment regimen over the other, the committee agreed to recommend both liraglutide and dulaglutide injections and, if contraindicated, oral empagliflozin, even though:

- There is an increased risk of nausea and vomiting associated with long-term use of liraglutide.
- There was no long-term comparative data for dulaglutide or empagliflozin.
- Dulaglutide, liraglutide or both may be contraindicated in some children and young people with type 2 diabetes.

The committee recognised that they did not have direct evidence comparing the effectiveness of weekly treatments compared to daily treatments with glucose-lowering agents for managing blood glucose levels. So, they made a research recommendation to:

- address this gap
- assess whether weekly injections could help reduce stigma and treatment burden for children and young people with type 2 diabetes.

There are a lot of medicines that can be used to manage blood glucose levels in adults with type 2 diabetes. In contrast, there are very few licensed, effective and safe medicines to manage blood glucose levels for children and young people with type 2 diabetes. The committee thus made a research recommendation for further clinical trials in children and young people of medicines used for adults.

## Other licensed treatments

As of April 2023, there are 4 other medicines that are licensed for use in the UK in a paediatric population:

- exenatide (a GLP-1 receptor agonist)
- dapagliflozin (an SGLT2 inhibitor)
- insulin detemir (a long-acting insulin)
- neutral protamine Hagedorn (NPH) insulin (an intermediate-acting insulin).

The committee agreed that the evidence was not sufficient for either of the first 2 licensed medicines to be recommended, nor for one insulin to be recommended over the other.

## How the recommendations might affect practice

Liraglutide and dulaglutide are relatively expensive compared to other possible treatments but recommending them is unlikely to surpass NICE's £1 million threshold for significant resource impact. Empagliflozin is approximately half the price of both liraglutide and dulaglutide. However, there was insufficient evidence to construct a full cost-effectiveness model. The committee indicated that the difference in unit cost per dose is relatively small, especially when considering the low prevalence of type 2 diabetes in children and young people. Similar considerations apply to using insulin at diagnosis where the prevalence of type 2 diabetes combined with a high HbA1c level or high blood ketones is even lower.

Increased support from a paediatric diabetic nurse and consultant will be needed when the child or young person starts on liraglutide, dulaglutide or empagliflozin. However, once the child or young person's HbA1c levels are stabilised, this will no longer be required because repeat prescriptions can be made by the GP.

Insulin is a last resort in the management of type 2 diabetes in children and young people and the recommendations are not expected to substantially affect practice.

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## Insulin therapy

[Recommendations 1.3.56 to 1.3.60](#)

## Why the committee made the recommendations

The committee based their recommendations on insulin therapy on those for children and young people with type 1 diabetes. Overall, the committee agreed that the choice of insulin therapy should be left to the child or young person with type 2 diabetes (or their families or carers), in consultation with the specialist diabetes paediatric team. The committee made some general recommendations about choosing an insulin regimen, providing appropriate equipment for injections, reviewing injection sites, and providing additional support when their glucose levels are not optimal.

## How the recommendations might affect practice

Insulin is a last resort in the management of type 2 diabetes in children and young people and the recommendations are not expected to substantially affect practice.

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## Changing treatments and updating school healthcare plans

### Recommendation 1.3.61

#### Why the committee made the recommendation

The committee agreed that the paediatric diabetes team should update the child or young person's school healthcare plan annually, and when treatment changes in a way that affects the child or young person while they are at school. This will enable coordination of care with the child's or young person's school.

#### How the recommendation might affect practice

The recommendation is not expected to substantially affect practice.

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## Fluid therapy for diabetic ketoacidosis

### Recommendations 1.4.21 to 1.4.34, 1.4.39, 1.4.40 and 1.4.42

## Why the committee made the recommendations

### Route of fluid administration

The 2015 recommendations caused some confusion around when to use oral or intravenous fluids. To address this, the committee looked for research evidence that would help them make clearer recommendations. There was no evidence that compared different routes of administration or different oral fluids for hydration, so the committee updated the recommendations based on their experience and expertise.

### Rate of fluid administration

In the 2015 guideline, the rate of fluid administration in DKA was restricted because rapid fluid administration was believed to cause cerebral oedema. However, for the 2020 update there was some randomised controlled trial evidence (particularly the PECARN FLUID trial) comparing the effect of different DKA protocols on outcomes such as mortality or clinically apparent brain injury. This evidence showed no significant difference between the 2 protocols, and it demonstrated that the restrictions on the rate of fluid administration were not needed.

In response to this evidence, and applying their clinical expertise, the committee updated the recommendations to use more rapid fluid administration (including fluid boluses). They also made a separate recommendation for children and young people who are in shock, as this group need a higher volume of fluids and they need these fluids to be given more rapidly.

### Total fluid requirement

When the 2015 recommendations were made, rapid fluid administration was believed to cause cerebral oedema. However, more recent randomised controlled trial evidence (particularly the PECARN FLUID trial) has shown that brain injury in this group may be caused by DKA itself because of the resulting cerebral hypoperfusion, reperfusion and neuro-inflammation. If DKA is the cause of brain injury, children and young people would benefit from receiving more fluids in the first 48 hours than was recommended in the 2015 guideline. To address this, the committee updated the recommendation on calculating the fluid maintenance requirement, based on their clinical knowledge and on evidence from the PECARN FLUID trial. The Holliday–Segar formula that they recommended is commonly used in practice and has not been shown to cause any adverse events.

## Potassium

No evidence was identified on the use of potassium. The committee used their expertise and their understanding of the evidence on the pathophysiology of DKA to update the recommendation. They added more detail about how to care for children and young people with anuria or potassium levels above the normal range. It is essential to not delay adding potassium to fluids because insulin can cause hypokalaemia in this population, which can lead to cardiac arrhythmias and death.

## Hyperchloremic acidosis

The committee also used their expertise to make recommendations highlighting complications such as hyperchloremic acidosis.

## Hyponatraemia

The committee used their expertise to make recommendations on monitoring serum sodium levels and identifying children and young people with hyponatraemia.

## How the recommendations might affect practice

There is variation in practice due to the different beliefs on the causes of cerebral oedema. The new recommendations will be a change in practice in some areas, but they are in line with randomised trial evidence and with other clinical guidance (such as the 2018 International Society for Paediatric and Adolescent Diabetes DKA guideline).

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## Context

Diabetes is a long-term condition that can have a major impact on the life of a child or young person, as well as their family or carers. In addition to glucose-lowering agents for managing blood glucose levels, diabetes management should include education, support and access to psychological services, as detailed in this guideline. Preparations should also be made for the transition from paediatric to adult services, which have a somewhat different model of care and evidence base.

Type 1 diabetes is becoming more common in the UK, and since 2004 type 2 diabetes is also being diagnosed with increasing frequency. The [2020/21 National Paediatric Diabetes Audit](#) identified 29,000 children and young people with type 1 diabetes and 973 with type 2 being managed within a paediatric diabetes unit.

Much of the general care for type 2 diabetes is the same as for type 1 diabetes, although the initial management is different. In addition, overweight and obesity associated with type 2 diabetes bring an increased risk of renal complications and problems such as hypertension and dyslipidaemia. These differences in management and complications need guidance specific to type 2 diabetes. A variety of genetic conditions (such as maturity-onset diabetes in the young) and other conditions (such as cystic fibrosis-related diabetes) may also lead to diabetes in children and young people, but the care of these diverse conditions is beyond the scope of this guideline.

This guideline recommends attempting to reach a glycated haemoglobin (HbA1c) level near the normal range and near normoglycaemia. This is to further reduce the long-term risks associated with diabetes. Newer technology such as continuous subcutaneous glucose monitoring may also help children and young people to have better blood glucose management, although this is not currently recommended for all children and young people with type 2 diabetes.

By implementing the strict blood glucose management recommended in this guideline, improvements can be made to diabetes care that reduce the impact of the condition on the future health of children and young people.

## Finding more information and committee details

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

For full details of the evidence and the guideline committee's discussions, see the [evidence reviews](#). 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

**May 2023:** We have reviewed the evidence on glucose-lowering agents for managing blood glucose levels in children and young people with type 2 diabetes. We have amended or made new recommendations in the sections on:

- education and information
- at diagnosis
- monitoring blood glucose levels and reviewing treatment
- when to reduce insulin for people who have been on it from diagnosis
- adding liraglutide, dulaglutide, or empagliflozin
- insulin therapy
- changing treatments and updating healthcare plans.

These recommendations are marked [2015, amended 2023] or [2023].

**June 2022:** We have reviewed evidence on periodontitis in children and young people with type 1 and type 2 diabetes. We have amended recommendation 1.2.1 and made new recommendations. The amended recommendation and the new recommendations are marked [2022].

**March 2022:** We have reviewed the evidence and made new recommendations on continuous glucose monitoring (CGM) for children and young people with type 1 diabetes. These recommendations are marked [2022].

We have also made one change without an evidence review: in the section on monitoring capillary blood glucose, wording has been added to the heading and recommendations to make it clear that recommendations apply to children and young people who are using capillary blood glucose monitoring rather than CGM. These recommendations are marked [2015, amended 2022].

Recommendations marked [2004], [2015], [2004, amended 2015] or [2020] last had an evidence review in that year. In some cases, minor changes have been made to the

wording to bring the language and style up to date, without changing the meaning.

**December 2020:** We have reviewed the evidence and made new recommendations on fluid therapy for children and young people with diabetic ketoacidosis. These recommendations are marked **[2020]**.

We have also amended recommendations 1.2.4, 1.2.125 and 1.3.84 without an evidence review. This is to provide clarity about eye examinations and to bring them in line with the diabetic eye screening programme. These recommendations are marked **[2015, amended 2020]**.

We have also amended recommendation 1.2.1 to highlight a Medicines and Healthcare products Regulatory Agency (MHRA) safety update reminding patients to rotate insulin injection sites within the same body region to avoid cutaneous amyloidosis.

### **Minor changes since publication**

**March 2025:** Links were updated following publication of NICE's guideline on overweight and obesity management.

**October 2024:** Empagliflozin is now licensed in children aged 10 and over, so the off label note about this medicine has been removed from recommendations 1.3.50 and 1.3.53.

**August 2024:** We added links to NICE's guideline on diabetic retinopathy.

**February 2024:** We removed reference to 'or a combination of them' from the first bullet of recommendation 1.3.54, because this was included in error.

**October 2022:** In recommendation 1.4.24 we updated the volume of fluid bolus used for intravenous fluid therapy from 20 ml/kg to 10 ml/kg for children and young people with diabetic ketoacidosis and signs of shock. See the surveillance report for more information.

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