



A summary of prescribing recommendations from NICE guidance

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

## NICE NG18: 2015

This guideline discusses the management of **type 1 and 2 diabetes** in children and young people. Recommendations throughout this bulletin may refer to type 1 or 2 diabetes or both. This is clearly stated in each section.

### Definition of terms

HbA1c	glycated haemoglobin (A1c)
CV	cardiovascular
DKA	diabetic ketoacidosis
BP	blood pressure
CSII	continuous subcutaneous insulin infusion
MDI	multiple daily injection
IM	intramuscular
ACR	albumin:creatinine ratio

### Diagnosis – see [NICE pathway](#)

- ♦ Characteristics of **type 1 diabetes** in children/young people include:
  - > hyperglycaemia (random plasma glucose >11 mmol/litre),
  - > polyuria,
  - > polydipsia,
  - > weight loss,
  - > excessive tiredness.
- ♦ Refer children/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.
- ♦ At diagnosis, assume type 1 diabetes unless there are strong indications of type 2, monogenic or mitochondrial diabetes.
- ♦ Confirm **type 1 diabetes** using plasma glucose criteria in the [World Health Organisation's 2006 report](#).
- ♦ Think about the possibility of **type 2 diabetes** in children/young people with suspected diabetes who:
  - > have a strong family history of type 2 diabetes,
  - > are obese at presentation,
  - > are of black or Asian family origin,
  - > have no insulin requirement, or have an insulin requirement of <0.5 units/kg body weight/day after the partial remission phase,
  - > show evidence of insulin resistance e.g. acanthosis nigricans.
- ♦ Think about the possibility of types of diabetes other than types 1 or 2 – see [NICE pathway](#).
- ♦ **Do NOT** measure C-peptide and/or diabetes-specific autoantibody titres at initial presentation to distinguish type 1 diabetes from type 2 diabetes.
- ♦ Consider measuring C-peptide after initial presentation if there is difficulty distinguishing type 1 diabetes from other types of diabetes. Be aware that C-peptide concentrations have better discriminative value the longer the interval between initial presentation and the test.
- ♦ Perform genetic testing if atypical disease behaviour, clinical characteristics or family history suggest monogenic diabetes.

### Education and information; Type 1 and 2 diabetes

- ♦ Offer children/young people and their family members/carers a continuing programme of education from diagnosis:
  - > Type 1 diabetes - see [NICE pathway](#).
  - > Type 2 diabetes – see box on page 3.

### Smoking and substance misuse

- ♦ Explain general health problems associated with smoking in particular the risks of developing vascular complications. Encourage children/young people not to smoke.
- ♦ Offer smoking cessation programmes to children/young people who smoke. See [NICE pathway; smoking prevention and cessation](#).
- ♦ Explain the general dangers of substance misuse and possible effects on blood glucose control.

### Immunisation

- ♦ Recommend annual immunisation against influenza for children/young people with diabetes >6 months old.
- ♦ Recommend immunisation against pneumococcal infection for children/young people with diabetes who need insulin or oral hypoglycaemic medicines.

### Monitoring

#### Blood glucose; Type 1 diabetes

- ♦ Advise children/young people to aim for:
  - > fasting plasma glucose level of 4 to 7 mmol/litre on waking,
  - > a plasma glucose level of 4 to 7 mmol/litre before meals at other times of the day,
  - > a plasma glucose level of 5 to 9 mmol/litre after meals,
  - > a plasma glucose level of at least 5 mmol/litre when driving.
- ♦ Advise that achieving and maintaining blood glucose levels towards the lower end of the target optimal ranges will help achieve the lowest attainable HbA1c.
- ♦ Ensure problematic hypoglycaemia or undue emotional distress is not experienced when achieving, or attempting to achieve, blood glucose and HbA1c targets.
- ♦ There may be conflict between children/young people and their family members/carers about blood glucose and HbA1c targets, and an agreed compromise may be needed.
- ♦ Advise children/young people to routinely perform at least 5 capillary blood glucose tests per day.
- ♦ Advise that more frequent testing is often needed e.g. with physical activity and during intercurrent illness, and ensure they have enough test strips for this.
- ♦ Offer a choice of equipment for monitoring capillary blood glucose, so blood glucose control can be optimised in response to adjustment of insulin, diet and exercise.
- ♦ Explain that blood glucose levels should be interpreted in the context of the 'whole child', which includes social, emotional and physical environment.
- ♦ Offer ongoing real-time continuous glucose monitoring with alarms to children/young people who have:
  - > frequent severe hypoglycaemia, **OR**
  - > impaired awareness of hypoglycaemia associated with adverse consequences e.g. seizures or anxiety, **OR**
  - > inability to recognise, or communicate about, symptoms of hypoglycaemia e.g. because of cognitive or neurological disabilities.

**Recommendations** – wording used such as 'offer' and 'consider' denote the [strength of the recommendation](#).

**Drug recommendations** – the guideline assumes that prescribers will use a drug's [Summary of Product Characteristics \(SPC\)](#) to inform treatment decisions.

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

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## Blood glucose; Type 1 diabetes continued.....

- ◆ Consider ongoing real-time continuous glucose monitoring:
  - > for neonates, infants and pre-school children,
  - > for children/young people who undertake high levels of physical activity e.g. sport at a regional, national or international level,
  - > for children/young people with comorbidities e.g. anorexia nervosa, or who are receiving treatments that can make blood glucose control difficult e.g. corticosteroids.
- ◆ Consider intermittent (real-time or retrospective) continuous glucose monitoring to help improve blood glucose control in children/young people who continue to have hyperglycaemia despite insulin adjustment and additional support.

## HbA1c measurement and targets

### Type 1 and 2 diabetes

- ◆ Use methods to measure HbA1c that have been calibrated according to International Federation of Clinical Chemistry standardisation.
- ◆ Explain the benefits of safely achieving and maintaining the lowest attainable HbA1c and give support to achieve this.
- ◆ Explain that an HbA1c target level of  $\leq 48$  mmol/mol (6.5%) is ideal to minimise the risk of long-term complications.
- ◆ Explain to children/young people who have an HbA1c level  $> 48$  mmol/mol (6.5%) that any reduction in HbA1c level reduces the risk of long-term complications.
- ◆ Agree an individualised lowest achievable HbA1c target taking into account daily activities, individual life goals, complications, comorbidities and the risk of hypoglycaemia.
- ◆ Measure HbA1c levels:
  - > every 3 months in **type 1 diabetes** and **type 2 diabetes**.  
More frequent testing may be appropriate if there is concern about suboptimal blood glucose control.
- ◆ Document the proportion of children/young people who achieve an HbA1c of  $\leq 53$  mmol/mol (7%).

## Treatment and management; Type 1 diabetes

### Diet – see [NICE pathway](#)

- ◆ Support children/young people to develop a good working knowledge of nutrition and how it affects their diabetes.
- ◆ Explain regularly how healthy eating (including eating foods with a low glycaemic index, fruit and vegetables, and appropriate types and amounts of fats) can reduce risk of CV disease.
- ◆ Encourage children/young people to eat at least 5 portions of fruit and vegetables each day.
- ◆ At each clinic visit measure height and weight, and plot on an appropriate growth chart. Calculate BMI.
- ◆ Check for normal growth and/or significant changes in weight because these may reflect changes in blood glucose control.
- ◆ Provide arrangements for weighing children/young people that respect their privacy.

### Exercise

- ◆ Encourage regular exercise to reduce risk of developing CV disease in the long term.
- ◆ Explain that children/young people can take part in all exercise, provided appropriate attention is given to changes in insulin and dietary management.
- ◆ Explain the effects of exercise on blood glucose levels and about strategies for avoiding hypo- or hyperglycaemia during or after physical activity.
- ◆ Encourage the monitoring of blood glucose levels before and after exercise. See [NICE pathway](#)
- ◆ Explain that additional carbohydrate should be consumed as appropriate to avoid hypoglycaemia.

- ◆ Carbohydrate-based foods should be readily available during and after exercise. Consume additional carbohydrate if plasma glucose level is  $< 7$  mmol/litre before exercising.
- ◆ Any changes in daily exercise patterns may require insulin dose and/or carbohydrate intake to be altered.

### Insulin regimens

There are three basic types of insulin regimen.

- ◆ **MDI basal-bolus insulin regimens:** injections of short-acting insulin or rapid-acting insulin analogue before meals, together with one or more separate daily injections of intermediate-acting insulin or long-acting insulin analogue.
- ◆ **CSII (insulin pump therapy):** 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) by a subcutaneous needle or cannula.
- ◆ **One, two or three insulin injections per day:** usually injections of short-acting insulin or rapid-acting insulin analogue mixed with intermediate-acting insulin.

## Pharmacological treatment; Type 1 diabetes

### Insulin therapy

- ◆ Take into account the personal and family circumstances of the child/young person and discuss personal preferences with them when choosing an insulin regimen.
- ◆ **First-line:** offer MDI basal-bolus insulin regimens. If a MDI regimen is not appropriate, consider CSII (insulin pump therapy).
- ◆ Encourage adjusting the insulin dose if appropriate after each blood glucose measurement.
- ◆ Explain that injecting rapid-acting insulin analogues before eating (rather than after eating) reduces blood glucose levels after meals and helps to optimise blood glucose control.
- ◆ Encourage children/young people using twice-daily injection regimens to adjust insulin dose according to general trend in pre-meal, bedtime and occasional night-time blood glucose.
- ◆ Explain to newly diagnosed children/young people that a partial remission phase (a 'honeymoon period') may be experienced during which a low dosage of insulin (0.5 units/kg body weight/day) may be sufficient to maintain an HbA1c level  $< 48$  mmol/mol (6.5%).
- ◆ Provide rapid-acting insulin analogues for use during intercurrent illness or episodes of hyperglycaemia.
- ◆ If a child/young person does not have optimal blood glucose control:
  - > offer appropriate additional support such as increased contact frequency with their diabetes team, **AND**
  - > if necessary, offer an alternative insulin regimen (MDI, CSII or once-, twice- or three-times daily mixed insulin injections).

### Insulin delivery

- ◆ Offer a choice of insulin delivery systems that takes account of insulin requirements and personal preferences.
- ◆ Provide insulin injection needles that are of an appropriate length for the body fat of the child/young person.
- ◆ Offer a review of injection sites at each clinic visit.
- ◆ Provide suitable containers for collecting used needles and other sharps. Arrangements should be available for disposal of these containers.

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## CSII (insulin pump)

- ◆ Provide specific training in its use.
- ◆ Provide ongoing support from a specialist team, particularly in the period immediately after starting CSII. Specialist teams should agree a common core of advice for CSII users.

## Oral medicines

- ◆ **Do NOT** offer acarbose or sulphonylureas (glibenclamide, gliclazide, glipizide, tolazamide or glyburide) in combination with insulin because they may increase risk of hypoglycaemia without improving blood glucose control.
- ◆ Metformin in combination with insulin is only suitable within research studies because effectiveness of this combined treatment in improving blood glucose control is uncertain.

## Hypoglycaemia; Type 1 diabetes

- ◆ Explain strategies for avoiding and managing hypoglycaemia.
- ◆ Offer education for children/young people, their family members/carers, and schoolteachers about recognising and managing hypoglycaemia.
- ◆ Explain that they should always have access to an immediate source of fast-acting glucose and blood glucose monitoring equipment for immediate confirmation and safe management of hypoglycaemia.
- ◆ Family members/carers and, where appropriate, school nurses and other carers should be trained and equipped to give IM glucagon for severe hypoglycaemia in an emergency.
- ◆ See [NICE pathway](#) for further advice on acute management.

## Hyperglycaemia, blood ketone monitoring and intercurrent illness; Type 1 diabetes

- ◆ Provide clear 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 insulin regimen,
  - > food and fluid intake,
  - > when and where to seek further advice or help.
- ◆ Revisit the advice at least annually.
- ◆ Offer blood ketone testing strips and a meter, and advise to test for ketonaemia if the child/young person is ill or has hyperglycaemia.
- ◆ Explain that it is important to ensure that blood ketone testing strips are not used after the specified ('use-by') date.

## Difficulties maintaining blood glucose control; Type 1 diabetes

- ◆ Think about the possibility of non-adherence to therapy in children/ young people who have suboptimal blood glucose control, especially in adolescence. Adolescence can be a period of worsening blood glucose control, which may in part be due to non-adherence to therapy.
- ◆ Raise the issue of non-adherence in a sensitive manner.
- ◆ Be aware of the possible negative psychological impact of setting targets that may be difficult for some children/young people to achieve and maintain.

## Monitoring for complications; Type 1 diabetes

- ◆ Monitor for thyroid disease at diagnosis and annually thereafter until transfer to adult services.
- ◆ Offer annual monitoring from 12 years for:
  - > diabetic retinopathy,

- > moderately increased albuminuria (ACR 3 to 30 mg/mmol; 'microalbuminuria') to detect diabetic kidney disease,
- > hypertension.
- ◆ Be aware of the following rare complications and associated conditions when children/young people with type 1 diabetes attend clinic visits:
  - > juvenile cataracts,
  - > necrobiosis lipoidica,
  - > Addison's disease.
- ◆ Explain the importance of annual monitoring from 12 years for diabetic retinopathy and diabetic kidney disease.
- ◆ For guidance on monitoring for coeliac disease – see [NICE pathway: Coeliac disease](#)

**Alcohol consumption** – see [NICE pathway](#)

## Type 2 diabetes

**Education and information** – see [NICE pathway](#)

- ◆ Offer children/young people with **type 2 diabetes** and their family members/carers (as appropriate) a continuing programme of education from diagnosis. Ensure the programme includes the following core topics:
  - > HbA1c monitoring and targets,
  - > the effects of diet, physical activity, body weight and intercurrent illness on blood glucose control,
  - > the aims of metformin therapy and possible adverse effects,
  - > the complications of type 2 diabetes and how to prevent them.

## Treatment and management

**Diet** – see [NICE pathway](#)

- ◆ Regularly provide advice about benefits of physical activity and weight loss, and provide support towards achieving this.
- ◆ Offer dietetic support to help optimise body weight and blood glucose control.
- ◆ Advise how healthy eating can help to:
  - > reduce hyperglycaemia,
  - > reduce CV risk,
  - > promote weight loss.
- ◆ Provide dietary advice in a sensitive manner, taking into account the difficulties that many people encounter with weight reduction, and emphasise the additional advantages of healthy eating for blood glucose control and avoiding complications.
- ◆ Take into account social and cultural considerations when providing advice on dietary management.
- ◆ Encourage children/young people to eat at least 5 portions of fruit and vegetables each day.
- ◆ At each clinic visit measure height and weight, and plot on an appropriate growth chart. Calculate BMI.
- ◆ Check for normal growth and/or significant changes in weight because these may reflect changes in blood glucose control.
- ◆ Provide arrangements for weighing children/young people that respect their privacy.

## Pharmacological treatment

- ◆ Offer standard-release metformin from diagnosis.



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

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**Monitoring for complications; Type 2 diabetes**

- ◆ Explain the importance of, and offer annual monitoring for:
  - > hypertension starting at diagnosis,
  - > dyslipidaemia starting at diagnosis,
  - > diabetic retinopathy from 12 years,
  - > moderately increased albuminuria (ACR 3 to 30 mg/mmol; 'microalbuminuria') to detect diabetic kidney disease, starting at diagnosis.

**Diabetic retinopathy; Type 2 diabetes** – see [NICE pathway](#)

- ◆ Consider referring children/young people with **type 2 diabetes** who are <12 years to an ophthalmologist for retinal examination if blood glucose control is suboptimal.

**Diabetic kidney disease; Type 2 diabetes**

- ◆ Monitoring for moderately increased albuminuria (ACR 3 to 30mg/mmol; 'microalbuminuria') to detect diabetic kidney disease begins at 12 years because diabetic kidney disease under 12 is extremely rare.
- ◆ Use the first urine sample of the day ('early morning urine') to screen for moderately increased albuminuria, as this reduces the risk of false positive results.
- ◆ If moderately increased albuminuria is detected, improving blood glucose control will reduce the risk of this progressing to significant diabetic kidney disease.
- ◆ Annual monitoring from 12 years is important because, if diabetic kidney disease is found, early treatment will improve the outcome.
- ◆ If initial albumin:creatinine ratio is >3 mg/mmol but <30 mg/mmol, confirm by repeating the test on 2 further occasions using first urine samples of the day ('early morning urine') before starting further investigation and therapy.
- ◆ Investigate further if the initial albumin:creatinine ratio is ≥30 mg/mmol (proteinuria).

**Dyslipidaemia and hypertension; Type 2 diabetes**

- ◆ Explain that monitoring is important because if dyslipidaemia or hypertension is found, early treatment will reduce the risk of complications.
- ◆ When monitoring for dyslipidaemia, measure total cholesterol, high-density lipoprotein (HDL) cholesterol, non-HDL cholesterol and triglyceride concentrations.
- ◆ Confirm dyslipidaemia using a repeat sample (fasting or non-fasting) before deciding on further management strategies.
- ◆ When measuring BP, use a cuff large enough for the child/young person.
- ◆ If repeated resting BP measurements are greater than the 95th percentile for age and sex, confirm hypertension using 24-hour ambulatory blood pressure monitoring before starting antihypertensive therapy.

**Diabetic ketoacidosis; Type 1 and 2 diabetes** – see[NICE pathway](#)**Assessment**

- ◆ Measure capillary blood glucose at presentation in children/young people without known diabetes who have increased thirst, polyuria, recent unexplained weight loss or excessive tiredness and any of the following:
  - > nausea or vomiting,
  - > abdominal pain,
  - > hyperventilation,
  - > dehydration,
  - > reduced level of consciousness.
- ◆ If the plasma glucose level is >11 mmol/litre in a child/young person **without** known diabetes, and they have symptoms that suggest DKA, immediately send them to a hospital with acute paediatric facilities.

- ◆ Children/young people taking insulin for diabetes may develop DKA with normal blood glucose levels.
- ◆ Suspect DKA even if the blood glucose is normal in a child or young person **with diabetes** and any of the following:
  - > nausea or vomiting,
  - > abdominal pain,
  - > hyperventilation,
  - > dehydration,
  - > reduced level of consciousness.
- ◆ When DKA is suspected in a child/young person **with known diabetes**:
  - > measure the blood ketones (beta-hydroxybutyrate), using a near-patient method if available. If this is not possible **or** if the level is elevated, immediately send them to a hospital with acute paediatric facilities.
- ◆ If DKA is suspected or confirmed explain that DKA is a serious matter that needs urgent hospital assessment.
- ◆ When a child/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.
- ◆ Diagnose DKA in children/young people with diabetes who have:
  - > acidosis (indicated by blood pH <7.3 or plasma bicarbonate <18 mmol/litre) **AND**
  - > ketonaemia (indicated by blood beta-hydroxybutyrate >3 mmol/litre) or ketonuria (++ and above on the standard strip marking scale).
- ◆ Diagnose severe DKA in children and young people with DKA who have a blood pH <7.1.

**Treatment and management** – see [NICE pathway](#)**Avoiding future episodes**

- ◆ When a child/young person with known diabetes has recovered from an episode of DKA, discuss factors that may have led to the episode.
- ◆ Consider the possibility of non-adherence to therapy in children/young people with established **type 1 diabetes** who present with DKA, especially if this is recurrent.
- ◆ Provide advice on reducing the risk of future episodes. In particular, the importance of managing intercurrent illnesses.

**Managing foot problems in children/young people with diabetes** – see [NICE pathway](#)**Surgery for children/young people with diabetes** – see [NICE pathway](#)**Psychological and social issues** – see [NICE pathway](#)**Transition from paediatric to adult care** – see [NICE pathway](#)**Further resources**

Resources and tools, including slide sets, audit tools, uptake reports are available to help put the guidance into practice:

[www.nice.org.uk/guidance/ng18/resources](http://www.nice.org.uk/guidance/ng18/resources)