



A summary of prescribing recommendations from NICE guidance

Type 1 diabetes

NICE NG17: 2015

This guideline discusses the management of type 1 diabetes in adults.

Definition of terms

| | |
|----------|------------------------------------------|
| Hb | haemoglobin |
| HbA1c | glycated haemoglobin (A1c) |
| CVS | cardiovascular |
| DKA | diabetic ketoacidosis |
| BP | blood pressure |
| CSII | continuous subcutaneous insulin infusion |
| MDI | multiple daily injection |
| IM | intramuscular |
| IV | intravenous |
| ACEI | angiotensin converting enzyme inhibitor |
| PDE-5 | phosphodiesterase-5 |
| U | unlicensed |

Diagnosis – see [NICE pathway](#)

- ◆ Make a diagnosis on clinical grounds in adults presenting with hyperglycaemia. People with type 1 diabetes typically (but not always) have one or more of:
 - > ketosis,
 - > rapid weight loss,
 - > age of onset <50 years,
 - > BMI <25 kg/m²,
 - > personal and/or family history of autoimmune disease.
- ◆ **Do NOT** discount a diagnosis of type 1 diabetes if an adult presents with a BMI of ≥25 kg/m² or is aged ≥50 years.
- ◆ **Do NOT** routinely measure C-peptide and/or diabetes-specific autoantibody titres to confirm type 1 diabetes.

Support and individualised care – see [NICE pathway](#)

Early care plan – see [NICE pathway](#)

Education and information

- ◆ Teach self-monitoring skills at the time of diagnosis and initiation of insulin therapy.
- ◆ Educate adults about how to measure their blood glucose level, interpret the results and know what action to take. Review these skills at least annually.
- ◆ Support adults to make the best use of data from self-monitoring of blood glucose through structured education.
- ◆ Give clear guidelines and protocols ('sick-day rules') to all adults with type 1 diabetes to help them to adjust insulin doses appropriately during periods of illness.

Monitoring

HbA1c measurement and targets

- ◆ Measure HbA1c levels every 3 to 6 months.
- ◆ Consider measuring HbA1c levels more often if the person's blood glucose control is suspected to be changing rapidly e.g. if the HbA1c level has risen unexpectedly above a previously sustained target.
- ◆ Use methods to measure HbA1c that have been calibrated according to International Federation of Clinical Chemistry standardisation.
- ◆ Inform adults of their HbA1c results after each measurement ensuring the most recent result is available at consultation.
- ◆ If HbA1c monitoring is invalid because of disturbed erythrocyte turnover or abnormal Hb type, estimate trends in blood glucose control using one of the following:
 - > fructosamine estimation,

- > quality-controlled blood glucose profiles,
- > total glycated Hb estimation (if abnormal haemoglobins).

Targets

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

Self-monitoring

- ◆ Advise routine self-monitoring of blood glucose levels for all adults with type 1 diabetes. Recommend testing at least 4 times a day, including before each meal and before bed.
- ◆ Support adults to test at least 4 times a day, and up to 10 times a day if any of the following apply:
 - > the desired target HbA1c level is not achieved,
 - > the frequency of hypoglycaemic episodes increases,
 - > there is a legal requirement to do so (such as before driving, in line with [DVLA guidance](#))
 - > during periods of illness,
 - > before, during and after sport,
 - > when planning pregnancy, during pregnancy and while breastfeeding. See [NICE pathway; Diabetes in pregnancy](#)
 - > if there is a need to know blood glucose levels >4 times a day for other reasons (e.g. impaired awareness of hypoglycaemia, high-risk activities).
- ◆ Enable additional blood glucose testing (>10 times a day) if necessary because of the person's lifestyle (e.g. driving for a long period of time, undertaking high-risk activity or occupation, travel) or if the person has impaired awareness of hypoglycaemia.
- ◆ When choosing blood glucose meters:
 - > take into account individual needs,
 - > ensure that meters meet current ISO standards.
- ◆ Monitoring blood glucose using sites other than the fingertips cannot be recommended as a routine alternative to conventional self-monitoring of blood glucose.

Blood glucose levels

- ◆ Advise adults with type 1 diabetes to aim for:
 - > a fasting plasma glucose level of 5 to 7 mmol/litre on waking, **AND**
 - > a plasma glucose level of 4 to 7 mmol/litre before meals at other times of the day.
- ◆ Advise adults who choose to test after meals to aim for a plasma glucose level of 5 to 9 mmol/litre at least 90 minutes after eating. (This timing may be different in pregnancy. See [NICE pathway; Diabetes in pregnancy](#).)
- ◆ Agree bedtime target plasma glucose levels that take into account timing of last meal and its related insulin dose, and are consistent with recommended fasting level on waking.

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Continuous blood glucose monitoring

- ◆ **Do NOT** offer real-time continuous glucose monitoring routinely to adults with type 1 diabetes.
- ◆ Consider real-time continuous glucose monitoring for adults who are willing to commit to using it at least 70% of the time and to calibrate it as needed, and who have any of the following despite optimised use of insulin therapy and conventional blood glucose monitoring:
 - > more than 1 episode a year of severe hypoglycaemia with no obviously preventable precipitating cause,
 - > complete loss of awareness of hypoglycaemia,
 - > frequent (>2 episodes a week) asymptomatic hypoglycaemia that is causing problems with daily activities,
 - > extreme fear of hypoglycaemia,
 - > hyperglycaemia (HbA1c level of ≥ 75 mmol/mol [9%]) that persists despite testing at least 10 times a day.
- ◆ Continue real-time continuous glucose monitoring only if HbA1c can be sustained ≤ 53 mmol/mol (7%) and/or there has been a fall in HbA1c of ≥ 27 mmol/mol (2.5%).
- ◆ Use the principles of flexible insulin therapy with either a MDI insulin regimen or CSII or insulin pump therapy.
- ◆ Real-time continuous glucose monitoring should be provided by a centre with expertise in its use, as part of strategies to optimise a person's HbA1c levels and reduce the frequency of hypoglycaemic episodes.

Thyroid disease monitoring

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

Treatment and management**Diet** - see [NICE pathway](#)

- ◆ Offer dietary advice about issues other than blood glucose control, such as weight control and CVS risk management, as indicated clinically.
- ◆ Provide nutritional information sensitive to personal needs and culture from the time of diagnosis.

Carbohydrate counting

- ◆ Offer carbohydrate-counting training to adults as part of structured education programmes for self-management.
- ◆ Consider carbohydrate-counting courses for adults who are waiting for a more detailed structured education programme or are unable to take part in a stand-alone structured education programme.
- ◆ **Do NOT** advise adults with type 1 diabetes to follow a low glycaemic index diet for blood glucose control

Physical activity - see [NICE pathway](#)

- ◆ Advise adults that physical activity can reduce their enhanced CVS risk in the medium and longer term.

Insulin regimens

There are several different types of insulin treatment, which vary in both the insulins used and the number of injections. People with type 1 diabetes should usually be offered two insulins that act in different ways:

- > a 'background' (also known as a 'basal' or 'long-acting') insulin ideally injected twice a day, **AND**
- > a 'quick-acting' (also known as a 'bolus' or 'rapid-acting') insulin injected before each meal to deal with the rise in blood glucose from eating.

[See Information for patients](#)

Insulins

- ◆ **First-line:** offer MDI basal–bolus insulin regimens, rather than twice-daily mixed insulin regimens, for all adults with type 1 diabetes and provide guidance on use.
- ◆ **Do NOT** offer adults newly diagnosed with type 1 diabetes non-basal–bolus insulin regimens (i.e. twice-daily mixed, basal only or bolus only).

Long acting insulin

- ◆ Offer **twice-daily** insulin detemir as basal insulin therapy for adults with type 1 diabetes.
- ◆ Consider, as an alternative basal insulin therapy:
 - > an existing insulin regimen being used by the person that is achieving their agreed targets,
 - > **once-daily** insulin glargine or insulin detemir if twice-daily basal insulin injection is not acceptable to the person, or not tolerated.
- ◆ Consider other basal insulin regimens only if the regimens above do not deliver agreed targets. Take account of the person's preferences and acquisition cost.

Rapid-acting insulin

- ◆ Offer rapid-acting insulin *analogues* injected **before** meals, rather than rapid-acting soluble human or animal insulins, for mealtime insulin replacement
- ◆ **Do NOT** advise routine use of rapid-acting insulin analogues **after** meals.
- ◆ If an adult has a strong preference for an alternative mealtime insulin, respect their wishes and offer the preferred insulin.

Mixed insulin

- ◆ Consider a twice-daily human mixed insulin if a MDI basal–bolus insulin regimen is not possible and a twice-daily mixed insulin regimen is chosen.
- ◆ Consider a trial of a twice-daily *analogue* mixed insulin regimen if an adult using a twice-daily *human* mixed insulin regimen has hypoglycaemia that affects their quality of life.

CSII or 'insulin pump'

- ◆ CSII ('insulin pump') therapy is recommended as a treatment option for adults and children ≥ 12 years with type 1 diabetes mellitus provided that:
 - > attempts to achieve target HbA1c levels with MDIs result in the person experiencing disabling hypoglycaemia (defined as repeated and unpredictable occurrence of hypoglycaemia that results in persistent anxiety about recurrence and is associated with a significant adverse effect on quality of life.), **OR**
 - > HbA1c levels remain high ($\geq 8.5\%$ [69 mmol/mol]) on MDI therapy (including, if appropriate, the use of long-acting insulin analogues) despite a high level of care.
- ◆ CSII therapy should be initiated only by a trained specialist team, including a physician with a specialist interest in insulin pump therapy, a diabetes specialist nurse and a dietitian. Specialist teams should provide structured education programmes and advice on diet, lifestyle and exercise appropriate for people using CSII.
- ◆ Only continue CSII therapy if it results in a sustained improvement in glycaemic control, evidenced by a fall in HbA1c levels, or a sustained decrease in the rate of hypoglycaemic episodes. Appropriate targets for such improvements should be set by the responsible physician, in discussion with the person receiving treatment or their carer.

Insulin delivery

- ◆ Adults should have access to the insulin injection delivery device that allows them optimal wellbeing, often using one or more types of insulin injection pen.

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- ◆ Provide adults who have special visual or psychological needs with injection devices or needle-free systems that they can use independently for accurate dosing.
- ◆ Offer needles of different lengths to adults who are having problems such as pain, local skin reactions and injection site leakages.
- ◆ After taking clinical factors into account, choose needles with the lowest acquisition cost to use with pre-filled and reusable insulin pen injectors.
- ◆ Advise adults to rotate insulin injection sites and avoid repeated injections at the same point within sites.
- ◆ Provide suitable containers for collecting used needles and other sharps. Arrangements should be made for suitable disposal of these containers. See [NICE pathway: Prevention and control of healthcare-associated infections](#).
- ◆ Check injection site condition at least annually and if new problems with blood glucose control occur.

Optimising insulin therapy

- ◆ For adults with erratic and unpredictable blood glucose control (hyperglycaemia and hypoglycaemia at no consistent times), rather than a change in a previously optimised insulin regimen, consider the following:
 - > injection technique and injection sites,
 - > self-monitoring skills,
 - > knowledge and self-management skills,
 - > nature of lifestyle,
 - > psychological and psychosocial difficulties,
 - > possible organic causes such as gastroparesis.
- ◆ Consider adding metformin to insulin therapy if an adult with type 1 diabetes and BMI of $\geq 25 \text{ kg/m}^2$ (23 kg/m^2 for people from South Asian and related minority ethnic groups) wants to improve their blood glucose control while minimising their effective insulin dose.

Hypoglycaemia

- ◆ Assess awareness of hypoglycaemia at each annual review. Use the Gold score or Clarke score checking that the questionnaire items have been answered correctly.
- ◆ Explain that impaired awareness of symptoms of plasma glucose $< 3 \text{ mmol/litre}$ is associated with a significantly increased risk of severe hypoglycaemia.

Awareness of Hypoglycaemia

- ◆ Ensure that adults with impaired awareness of hypoglycaemia have had structured education in flexible insulin therapy using basal-bolus regimens and are following its principles correctly.
- ◆ Offer additional education focusing on avoiding and treating hypoglycaemia to adults who continue to have impaired awareness of hypoglycaemia after structured education in flexible insulin therapy.
- ◆ Avoid relaxing individualised blood glucose targets as a treatment for adults with impaired awareness of hypoglycaemia.
- ◆ Reinforce recommended targets if target blood glucose levels are lower than recommended.
- ◆ Review insulin regimens and doses and prioritise strategies to avoid hypoglycaemia in adults with impaired awareness of hypoglycaemia, including:
 - > reinforcing the principles of structured education,
 - > offering CSII (insulin pump) therapy,
 - > offering real-time continuous glucose monitoring.
- ◆ If impaired awareness of hypoglycaemia is associated with recurrent severe hypoglycaemia despite these interventions, consider referring the person to a specialist centre.

Preventing and managing hypoglycaemia

- ◆ Explain that a fast-acting form of glucose is needed for management of hypoglycaemic symptoms or signs in people who are able to swallow.
- ◆ Adults with a decreased level of consciousness as a result of hypoglycaemia who are unable to take oral treatment safely should be:
 - > given IM glucagon by a family member or friend who has been shown how to use it (IV glucose may be used by healthcare professionals skilled in obtaining IV access),
 - > monitored for response at 10 minutes, and then given IV glucose if their level of consciousness is not improving significantly,
 - > then given oral carbohydrate when it is safe to administer it, and placed under continued observation by a third party who has been warned of the risk of relapse.
- ◆ Explain that some hypoglycaemic episodes are an inevitable consequence of insulin therapy in most people using any insulin regimen, and that they should use a regimen that avoids or reduces the frequency of hypoglycaemic episodes while maintaining as optimal a level of blood glucose control as is feasible. Make advice available to assist in obtaining the best balance from any insulin regimen.
- ◆ If hypoglycaemia becomes unusually problematic or of increased frequency, review the following possible contributory causes:
 - > inappropriate insulin regimens (incorrect dose distributions and insulin types),
 - > meal and activity patterns, including alcohol,
 - > injection technique and skills, including insulin resuspension if necessary,
 - > injection site problems,
 - > possible organic causes including gastroparesis,
 - > changes in insulin sensitivity (including drugs affecting the renin-angiotensin system and renal failure),
 - > psychological problems,
 - > previous physical activity,
 - > lack of appropriate knowledge and skills for self-management.
- ◆ Manage nocturnal hypoglycaemia (symptomatic or detected on monitoring) by:
 - > reviewing knowledge and self-management skills,
 - > reviewing current insulin regimen, evening eating habits and previous physical activity,
 - > choosing an insulin type and regimen that is less likely to induce low glucose levels at night.
- ◆ If early cognitive decline occurs in adults on long-term insulin therapy consider or investigate possible brain damage resulting from overt or covert hypoglycaemia, and the need to ameliorate this.

Ketone monitoring

- ◆ Consider ketone monitoring (blood or urine) as part of 'sick-day rules' for adults with type 1 diabetes, to facilitate self-management of an episode of hyperglycaemia.
- ◆ In adults with type 1 diabetes presenting to emergency services, consider capillary blood ketone testing if:
 - > DKA is suspected, **OR**
 - > the person has uncontrolled diabetes with a period of illness, and urine ketone testing is positive.
- ◆ Consider capillary blood ketone testing for inpatient management of DKA in adults with type 1 diabetes that is incorporated into a formal protocol.

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Management of DKA - see [NICE pathway](#)

- ◆ Professionals managing DKA in adults should be adequately trained, including regular updating, and be familiar with all aspects of management which are associated with mortality and morbidity.
- ◆ For primary fluid replacement use isotonic saline, not given too rapidly except in cases of circulatory collapse.
- ◆ **Do NOT** generally use bicarbonate or phosphate replacement.
- ◆ Give IV insulin by infusion to adults with DKA.
- ◆ Once plasma glucose concentration has fallen to 10 to 15 mmol/litre, give glucose-containing fluids (not more than 2 litres in 24 hours) to allow continued infusion of insulin at a sufficient rate to clear ketones (e.g. 6 units/hour monitored for effect).
- ◆ Begin potassium replacement early, with frequent monitoring for development of hypokalaemia.
- ◆ In adults with DKA whose conscious level is impaired, consider inserting a nasogastric tube, monitoring urine production using a urinary catheter and giving heparin.
- ◆ To reduce the risk of catastrophic outcomes in adults with DKA, ensure monitoring is continuous and review covers all aspects of clinical management at frequent intervals.

CVS risk prevention

- ◆ **Do NOT** offer aspirin for primary prevention of CVS disease to adults with type 1 diabetes.
- ◆ Assess CVS risk factors annually. See [NICE pathway: Lipid modification](#)

Blood pressure management

- ◆ Intervention levels for recommending BP management in adults with type 1 diabetes should be:
 - > 135/85 mmHg, **OR**
 - > 130/80 mmHg. If there is albuminuria or ≥ 2 features of metabolic syndrome.
- ◆ Discuss the following to allow informed choice of treatment for hypertension:
 - > reasons for choice of intervention level,
 - > substantial potential gains from small improvements in BP control,
 - > possible negative consequences of therapy.
- ◆ **First-line:** start a trial of a renin-angiotensin system blocking drug.
- ◆ Provide information on lifestyle changes to improve BP control and associated outcomes. Offer assistance to achieve their aims in this area.
- ◆ **Do NOT** allow concerns over potential side effects to inhibit advising and offering necessary use of any class of drugs, unless side effects become symptomatic or otherwise clinically significant. In particular:
 - > **Do NOT** avoid selective beta-adrenergic blockers where indicated in adults on insulin,
 - > low-dose thiazides may be combined with beta-blockers,
 - > when calcium channel antagonists are prescribed, use only long-acting preparations,
 - > use direct questioning to detect potential side effects of erectile dysfunction, lethargy and orthostatic hypotension with different drug classes.

See [NICE pathway: Chronic kidney disease](#)

Care of adults with type 1 diabetes in hospital – see [NICE pathway](#)

Managing complications

Eye disease, chronic painful diabetic neuropathy, autonomic neuropathy, acute painful neuropathy, diabetic foot problems, psychological problems – see [NICE pathway](#).

Diabetic Kidney disease

- ◆ Ask all adults with type 1 diabetes with or without detected nephropathy to bring in the first urine sample of the day ('early morning urine') once a year. Send this for estimation of albumin:creatinine ratio. Estimation of urine albumin concentration alone is a poor alternative. Serum creatinine should be measured at the same time.
- ◆ Discuss the significance of a finding of albuminuria with the person concerned.
- ◆ Start ACEI and titrate to full dose in all adults with confirmed nephropathy (including those with moderately increased albuminuria ['microalbuminuria'] alone) and type 1 diabetes.
- ◆ If ACEIs are not tolerated, substitute angiotensin 2 receptor antagonists. Combination therapy is **NOT** recommended.
- ◆ Maintain blood pressure <130/80 mmHg by addition of other anti-hypertensive drugs if necessary.
- ◆ Advise adults with type 1 diabetes and nephropathy about the advantages of not following a high-protein diet.

Gastroparesis

- ◆ Advise mashed or pureed food for symptomatic relief for adults who have vomiting caused by gastroparesis.
- ◆ Consider CSII (insulin pump) therapy.
- ◆ Explain that: there is no strong evidence that any available antiemetic therapy is effective.
- ◆ Some people have had benefit with domperidone*, erythromycin^U or metoclopramide**
- ◆ The strongest evidence for effectiveness is for domperidone*, but prescribers must take into account its safety profile, in particular its cardiac risk and potential interactions with other medicines.
- ◆ For treating vomiting caused by gastroparesis in adults with type 1 diabetes:
 - > consider alternating use of erythromycin^U and metoclopramide**,
 - > consider domperidone* only in exceptional circumstances and in accordance with [MHRA guidance](#).
- ◆ Refer adults with type 1 diabetes who have gastroparesis for specialist advice if the interventions above are not beneficial or not appropriate.

Erectile dysfunction

- ◆ Offer men with type 1 diabetes the opportunity to discuss erectile dysfunction as part of their regular review.
- ◆ Offer a PDE-5 inhibitor to men with type 1 diabetes with isolated erectile dysfunction unless contraindicated. Choose one with lowest acquisition cost.
- ◆ Consider referral to a service offering further assessment and other management options of erectile dysfunction if PDE-5 inhibitor treatment is unsuccessful or contraindicated.

Referral for islet or pancreas transplantation – see [NICE pathway](#)

* See [MHRA guidance: domperidone prescribing](#)

** See [MHRA guidance: metoclopramide prescribing](#)

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.