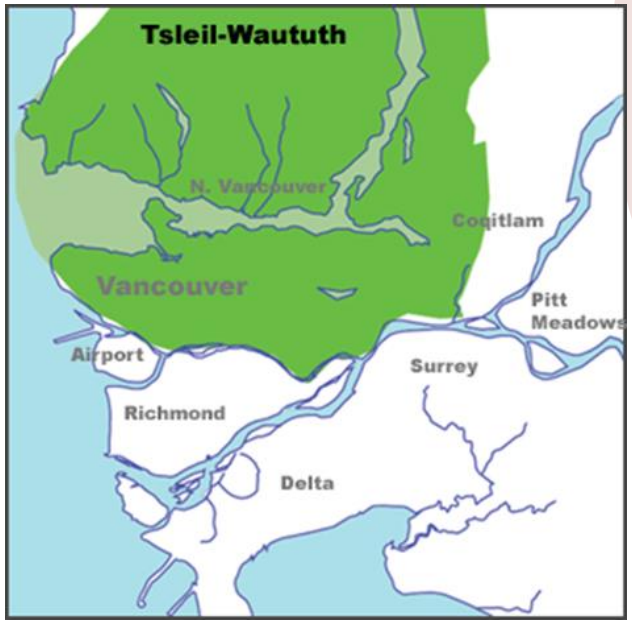
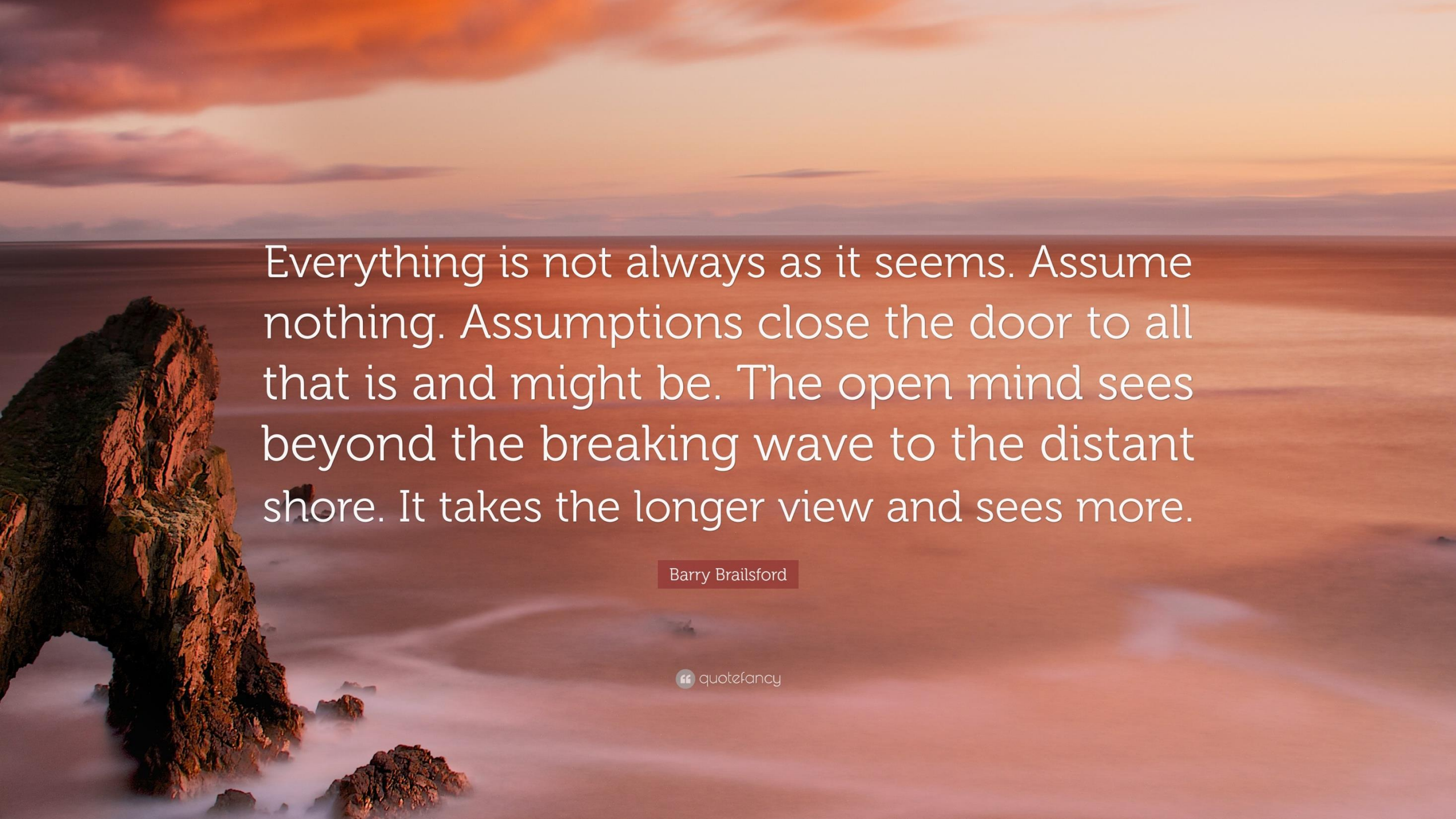
We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.

Source: www.johomaps.net/na/canada/bc/vancouver/firstnations/firstnations.html



Diagnostic Dilemmas & Classification Conundrums in Diabetes


Everything is not always as it seems. Assume nothing. Assumptions close the door to all that is and might be. The open mind sees beyond the breaking wave to the distant shore. It takes the longer view and sees more.
Barry Brailsford
quotefancy

Kevin Fernando FRCGP FRCP Edin. FAcadMEd MSc Diabetes

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Disclosures 2024/5

Speaker Fees: AstraZeneca, Bayer, Boehringer Ingelheim, Dexcom, Daiichi Sankyo, Grunenthal, Lilly, Menarini, Idorsia, Thornton & Ross, Boston Scientific

Consultancy Fees: AstraZeneca, Dexcom, Boehringer Ingelheim, Lilly, Menarini, Roche, Oviva, Idorsia, Grunenthal, Boston Scientific

Congress Attendance: Menarini, Daiichi Sankyo, Lilly, Bayer

The Diagnosis and Classification of Diabetes in Primary Care

Medscape UK X Guidelines
Primary Care Hacks

Author: Dr Kevin Fernando, GP Partner, North Berwick Health Centre; Content Advisor, Medscape Global and UK. Email: kfernando@webmd.net

	T1D	LADA	T2D	Monogenic Diabetes	GDM	T3cD (Pancreatogenic)
Pathophysiology	Autoimmune destruction of pancreatic beta cells Clinical diagnosis ± PG and ketone levels. Urgent specialist discussion required It is increasingly challenging to differentiate T1D from T2D, partly due to the obesity epidemic. Often the safest strategy is to presume T1D until proven otherwise See this BMJ article on new advances in T1D	LADA is essentially 'slow-onset' T1D Gradual autoimmune destruction of pancreatic beta cells. Diagnosis and management similar to T1D See this international consensus statement on the management of LADA and this Carel-OH resource on the diagnosis and treatment of LADA See also this article on differentiating LADA from other forms of diabetes	IR with relative insulin deficiency T2D is usually diagnosed when HbA_{1c} ≥48 mmol/mol. If use of HbA_{1c} is inappropriate (e.g. pregnant women, genetic variants [HbS or HbC trait], acute or chronic blood loss, end-stage kidney disease) then T2D is diagnosed by an FPG ≥7 mmol/l If asymptomatic, the diagnosis should never be based on a single abnormal HbA_{1c} or PG level; at least one additional abnormal test is essential See this Lancet article on T2D	Genetic mutation leading to diabetes. The most common is MODY See diabetesgenes.org for diagnosis guidance	Impaired glucose tolerance in pregnancy due to pancreatic beta-cell dysfunction on background of IR NICE NG3[1] diagnostic criteria: FPG ≥5.6 mmol/l or 2-hour PG post-75-g OGTT ≥7.8 mmol/l, i.e. much lower than the diagnostic criteria for non-pregnant individuals Some areas use FPG levels ≥5.1 mmol/l, as any degree of hyperglycaemia in pregnancy increases the risk of both adverse fetal and maternal outcomes	Diabetes associated with disease, trauma, or surgery of the exocrine pancreas Causes include acute and chronic pancreatitis, pancreatic surgery, CF, haemochromatosis, and pancreatic cancer See Pancreatic Cancer Action's information on T3cD and this factsheet on the recognition and management of T3cD Often misdiagnosed as T2D
Age at Diagnosis	Usually <25 years but can occur at any age	Can occur at any adult age Often initially mistaken for T2D	Both adults and children at any age	MODY onset often during 2nd to 5th decades and usually <45 years	Can occur in any women of childbearing age Women with GDM have a nearly 10-fold higher risk of developing T2D[1] Follow up after delivery: women require lifelong annual HbA_{1c} (NICE NG3)[1]	Both adults and children at any age Exclude pancreatic cancer in those >60 years (NICE NG12)[2] or >55 years (Scottish referral guidelines for suspected cancer)[3] with new-onset diabetes and unexplained weight loss
Weight at Diagnosis	Usually underweight but can occur at any weight Marked weight loss common	Variable	Usually overweight	Variable	RFs for GDM include overweight/obesity but baseline weight can be variable	Variable
Family History of Diabetes	Infrequent (5–10%)	Variable	Frequent (75–90%)	Multigenerational MODY is AD Strong FH of diabetes (any type) involving two or three consecutive generations may point towards a diagnosis of MODY	FH of diabetes is an important RF for GDM	Variable Haemochromatosis and CF are AR
History of Autoimmune Disease	Often personal or FH, e.g. thyroid and coeliac disease	Variable	Variable	Variable	Variable	Variable but often PEI present, e.g. diarrhoea and steatorrhoea, abdominal discomfort, flatulence, and bloating Check stool sample for faecal elastase-1. Low levels suggestive of PEI
Pancreatic Autoantibodies	Present	Present	Absent	Absent	Absent	Absent
C-peptide Levels	Low/absent	Initially normal then low/absent	Normal to high	Normal	Normal to high	Low
Insulin Sensitivity	Normal when treated	Normal when treated	Reduced	Normal (maybe reduced if obese)	Reduced	Compensatory increase in peripheral insulin sensitivity
Insulin Requirements	Immediate; specialist input urgently required	Latent; months to years	Variable	Variable	Variable	Variable Much more likely to need insulin within 5 years of diagnosis
Risk of DKA	High	Low initially but high once insulin-deficient	Low but euglycaemic DKA is a rare side effect of SGLT2is. See the Guidelines Primary Care Hack, What Next After Metformin? Part 2	Low	Low	Low but hypoglycaemia is common and can be prolonged

Table based on the author's clinical experience and appraisal of the literature.

Commonly Used Drugs That Can Induce Hyperglycaemia or Cause Diabetes

- Corticosteroids e.g. prednisolone, dexamethasone (see Useful Resources for more information)
- Thiazide diuretics e.g. bendroflumethiazide, indapamide
- Beta-blockers e.g. atenolol, propranolol
- Antipsychotics e.g. olanzapine, quetiapine, risperidone
- Statins—especially higher-potency statins.

Useful Resources

- Barker et al: Practical guide to glucocorticoid induced hyperglycaemia and diabetes
- Joint British Diabetes Societies for Inpatient Care: Management of hyperglycaemia and steroid (glucocorticoid) therapy
- Diabetes UK: Steroid-induced diabetes
- The Guidelines Primary Care Hack, Identifying People at High Risk of Type 2 Diabetes and other Primary Care Hacks

Abbreviations
AD=autosomal dominant; **AR**=autosomal recessive; **BMJ**=British Medical Journal; **CF**=cystic fibrosis; **DKA**=diabetic ketoacidosis; **FH**=family history; **FPG**=fasting plasma glucose; **GDM**=gestational diabetes mellitus; **HbA_{1c}**=haemoglobin A_{1c}; **HbC**=haemoglobin C; **HbS**=haemoglobin S; **IR**=insulin resistance; **LADA**=latent autoimmune diabetes in adults; **MODY**=maturity onset diabetes of the young; **NG**=NICE Guideline; **OGTT**=oral glucose tolerance test; **PEI**=pancreatic exocrine insufficiency; **PG**=plasma glucose; **RF**=risk factor; **SGLT2i**=sodium–glucose co-transporter-2 inhibitor; **T1D**=type 1 diabetes; **T2D**=type 2 diabetes; **T3cD**=type 3c diabetes.

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For references and to see the latest updates, view this Primary Care Hack online at medscape-uk.co/Hack-diabetes

Last updated: November 2023 (reviewed November 2024).

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Identifying People at High Risk of Type 2 Diabetes

Medscape UK X Guidelines
Primary Care Hacks

Authors: Dr Kevin Fernando, Portfolio GP, East Lothian; Content Advisor, Medscape Global and UK (email: kfernando@webmd.net); **Dr Eimear Darcy**, GP Partner, Grange Family Practice, Omagh

What Is Prediabetes?

- Prediabetes refers to raised blood glucose levels above normal but not above the diagnostic threshold for T2D. **HbA_{1c} values of 42–47 mmol/mol indicate prediabetes**[1] and a **single test** is sufficient. People living with prediabetes have an increased risk of developing T2D
- Depending on what test is used, prediabetes can also be referred to as:[2]
  - **nondiabetic hyperglycaemia** (HbA_{1c} 42–47 mmol/mol[3])
  - **impaired fasting glucose** (FPG ≥6.1 and <6.9 mmol/l[4])
  - **impaired glucose tolerance** (2-hour oral glucose tolerance test ≥7.8 and <11.1 mmol/l[4])
- **Prediabetes is associated with an increased risk of all-cause mortality and CVD in the general population and in those with atherosclerotic CVD.**[5] This has implications for the screening and management of prediabetes in the primary and secondary prevention of CVD[6]
- **Prediabetes is more than just dysglycaemia.** A recent prospective cohort study found that reversion to normoglycaemia in those with prediabetes was only associated with lower risks of death and a longer life expectancy when accompanied by significant lifestyle change such as high levels of physical activity, not smoking, and maintaining a healthy bodyweight.[6]

Identifying Those at High Risk of T2D

NICE PH38 recommends a **two-stage strategy to identify people at high risk of T2D** (and those with undiagnosed T2D)[4]:

1. A **risk assessment** should be offered using a validated computer-based risk assessment tool that can use routinely available data from individuals' electronic health records, such as QDiabetes-2018
2. For those with high risk scores for developing T2D (e.g., QDiabetes score ≥10%), a **blood test for HbA_{1c}** should be offered

Additionally, if aged ≥25 years and of South Asian or Chinese descent with BMI >23 kg/m², there is no need to use a risk assessment tool; instead, directly offer an HbA_{1c} blood test.

Matching Interventions to Risk in People with Prediabetes[4,7,8]

Risk factors for developing T2D

- Obesity
- Family history of T2D
- GDM
- MASLD (formerly NAFLD; see also the Primary Care Hack on MASLD/MASH)
- CVD
- OSAHS
- Hypertension requiring treatment (see also the Primary Care Hack on lifestyle changes for managing hypertension)
- PCOS
- Learning disabilities
- SMI, e.g., bipolar disorder or schizophrenia
- Certain medications including regular steroids, statins, and atypical antipsychotics
- People in highly deprived socioeconomic situations

- People aged 25–39 years of South Asian, Chinese, Black African, African–Caribbean descent or other high-risk Black and minority ethnic groups
- A recent retrospective cross-sectional US study suggested the need for screening for T2D among high-risk Asian groups even at healthy BMI levels[7]

- People aged ≥40 years (except pregnant women)
- NICE PH38 stresses that nobody should be excluded from assessment on the basis of age, as everyone can reduce their risk, including those aged ≥75 years

Stage 1
- Use a risk assessment tool such as **QDiabetes-2018**
- If aged ≥25 years and of South Asian or Chinese descent with BMI >23 kg/m², omit the risk assessment tool and instead directly offer an HbA_{1c} blood test

If low or intermediate risk score, e.g. **QDiabetes-2018 <10%**, no HbA_{1c} blood test is required

Give brief advice on the risks of developing T2D and offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g. Diabetes UK's *Information prescriptions for people with diabetes*

Reassess risk at least every 5 years

If high risk score, e.g. **QDiabetes-2018 ≥10%**, offer HbA_{1c} blood test

If HbA_{1c} <42 mmol/mol, the individual is at **moderate risk** of developing T2D

Discuss brief advice on the risks of developing T2D

Offer a brief intervention to help them change their lifestyle, e.g. structured weight-loss programmes

Offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g. Diabetes UK's *Information prescriptions for people with diabetes*

Reassess risk at least every 3 years

If HbA_{1c} 42–47 mmol/mol, the individual is at **high risk** of developing T2D

If HbA_{1c} ≥48 mmol/mol, this is **suggestive of T2D**

Repeat HbA_{1c} blood test within 4 weeks to confirm diagnosis. If repeat HbA_{1c} ≥48 mmol/mol, a diagnosis of T2D is confirmed and should be managed as usual

If repeat HbA_{1c} <48 mmol/mol, follow recommendations below

Discuss brief advice on the risks of developing T2D

Offer referral to a local, evidence-based, quality-assured intensive lifestyle change programme to increase physical activity and achieve and maintain weight loss

Offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g Diabetes UK's *Information prescriptions for people with diabetes*

Offer an HbA_{1c} blood test and reassess weight at least annually

Special Populations of Note

People Living with an Eating Disorder

- The prevalence of T2D is higher in people with binge eating disorder than the general population[9]
- Additional caution should be taken discussing prediabetes and weight loss with people who are living with or suspected to have an eating disorder, as weight-loss interventions may be contraindicated and may exacerbate the condition.[9]

Gestational Diabetes

- **Women with a history of GDM are almost 10 times more likely to develop T2D** over their lifetime than women without a history of GDM[10]
- For women previously diagnosed with GDM and whose blood glucose levels return to normal after birth, NICE and SIGN both recommend:[11,12]
  - lifestyle advice (including weight management, diet, and exercise)
  - **offer an FPG 6–13 weeks after delivery** to exclude T2D (HbA_{1c} should not be used until 3 months postpartum but can be used if an FPG has not been carried out by 13 weeks). Practically, this can be part of the 6-week postnatal check
    - **if FPG <6.0 mmol/l** (HbA_{1c} <39 mmol/mol), there is a low probability of T2D. Lifestyle advice should be reinforced; ensure they are under recall for **lifelong annual HbA_{1c}** to check for progression to T2D
    - **if FPG 6.0–6.9 mmol/l** (HbA_{1c} 39–47 mmol/mol), the individual is at high risk of developing T2D and the *Matching Interventions to Risk* flowchart should be followed
    - **if FPG ≥7.0 mmol/l** (HbA_{1c} ≥48 mmol/mol), a diagnosis of T2D is likely and the *Matching Interventions to Risk* flowchart should be followed.

Polycystic Ovary Syndrome

- **Women living with PCOS are 1.4 times more likely to develop T2D** over their lifetime than women without PCOS[13]
- This increased risk is **independent of baseline bodyweight**;[13] NICE recommends assessing glycaemic status with an HbA_{1c} blood test at baseline in **all** women living with PCOS. Thereafter, glycaemic assessment should take place **every 1–3 years lifelong**, depending on the presence of other risk factors for developing T2D.[14]

People Living with Severe Mental Illness

- **People living with SMI are 1.3 times more likely to develop T2D** over their lifetime than people without SMI[15]
- The *Lester UK adaptation: positive cardiometabolic health resource* 2023 update gives recommendations relating to monitoring physical health in people living with SMI such as psychosis and schizophrenia.[15] The aim of this resource is to help reduce the **health inequality of a 15–20-year mortality gap** in people living with SMI[16]
- For all people in the 'red zone' as depicted in the *Lester UK adaptation* intervention framework for people experiencing psychosis and schizophrenia, including those with HbA_{1c} ≥42 mmol/mol: **don't just screen, intervene!**
- Care should always be person-centred, tailoring discussion to the needs of the person to enable shared decision-making. Refer for investigation, diagnosis, and treatment as appropriate
- For those at high risk of T2D (HbA_{1c} of 42–47 mmol/mol), offer referral to an evidence-based lifestyle change programme. If ineffective, offer metformin modified release if safe and appropriate. Aim for HbA_{1c} <42 mmol/mol.

Metformin

- NICE recommends using clinical judgement on whether (and when) to offer metformin to support lifestyle changes in people at risk of T2D with rising HbA_{1c} blood tests. Consider metformin if:[4]
  - HbA_{1c} continues to rise despite participation in an intensive lifestyle change programme
  - the individual is unable to participate in a lifestyle change programme, particularly if BMI is >35 kg/m²
- If commencing metformin, **start low and go slow**, e.g. 500 mg once daily and increase gradually as tolerated to 2000 mg daily. If the individual is intolerant of standard-release metformin, consider using modified-release metformin[4]
- Prescribe metformin for 6–12 months initially. Check HbA_{1c} at 3-month intervals and stop metformin if no benefit is seen.[4]

Managing Prediabetes—Key Interventions

- By making changes to diet, increasing physical activity, and losing weight, **around half of cases of T2D can be prevented or delayed**[17]
- Review coexisting risk factors such as blood pressure, lipids, and smoking status
- Pharmacological interventions, most notably incretin therapies, may be appropriate as an adjunct to a reduced-calorie diet and increased physical activity for weight management in adults with overweight or obesity[18]—see also the Primary Care Hack on liraglutide, semaglutide, and tirzepatide for managing overweight and obesity in primary care
- Bariatric and metabolic surgery may also be appropriate for certain individuals; referral for MDT assessment is recommended if a person has prediabetes, has received optimal nonsurgical weight-management treatment, has a BMI >35 kg/m² (or 32.5 kg/m² in people with a South Asian, Chinese, other Asian, Middle Eastern, Black African, African–Caribbean, or Arab family background), and agrees to adhere to the requirements for long-term follow up[19]
- Also see *Metformin*, above
- In the SURMOUNT-1 trial, 3 years of treatment with tirzepatide in people living with obesity and prediabetes resulted in significant and sustained weight reduction (nearly 20% with tirzepatide 15 mg) and 90% fewer new diagnoses of T2D compared to placebo.[20]

Clinical Coding

- SIGN recommends a more uniform approach to coding in primary care of those at high risk of T2D:[8]
  - consider maintaining a register of people at high risk of developing T2D and offering then an annual review. This annual review should also cover any coexisting cardiometabolic long-term conditions
  - a single read code (**C11y500—'pre-diabetes'**) is recommended for all cases of prediabetes, including impaired glucose tolerance, impaired fasting glucose, and nondiabetic hyperglycaemia
  - the additional recall code is recommended to ensure that these individuals are properly followed up (**66Az—'high risk of diabetes annual review'**).

Useful Resources

For Patients

- Diabetes UK: *Prediabetes*
- Diabetes UK: *Weight loss and diabetes*
- Diabetes UK: *Type 2 diabetes—know your risk*
- QDiabetes-2018 risk calculator
- Diabetes Research Centre: *Could you have type 2 diabetes?*
- Diabetes Scotland: *Your guide to type 2 diabetes*
- NHS Lose Weight website.

For Healthcare Professionals

- Diabetes UK: *Information prescriptions for healthcare professionals*
- *UK Chief Medical Officers' physical activity guidelines*
- Gardner M, Wang J, Hazlehurt J et al. Risk of progression from prediabetes to type 2 diabetes in a large UK adult cohort. *Diabet Med* 2023; **40**(3): e14996.
- Public Health Scotland: *Challenging weight stigma learning hub*
- Babysteps online programme for GDM.

Abbreviations
BMI=body mass index; **CVD**=cardiovascular disease; **FPG**=fasting plasma glucose; **GDM**=gestational diabetes mellitus; **HbA_{1c}**=glycated haemoglobin; **MASH**=metabolic dysfunction-associated steatohepatitis; **MASLD**=metabolic dysfunction-associated steatotic liver disease; **MDT**=multidisciplinary team; **NAFLD**=nonalcoholic fatty liver disease; **OSAHS**=obstructive sleep apnoea/hypopnoea syndrome; **PCOS**=polycystic ovary syndrome; **PH**=Public Health Guideline; **SIGN**=Scottish Intercollegiate Guidelines Network; **SMI**=severe mental illness; **T2D**=type 2 diabetes.

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@GLNS_Medscape @drkevinfernando medscape.co.uk/guidelines

For references and to view this Primary Care Hack online, go to: medscape-uk.co/Hack-prediabetes

Last updated: April 2025.

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Talking Points

- Characterising & identifying diabetes
- Case studies

Characterising Diabetes

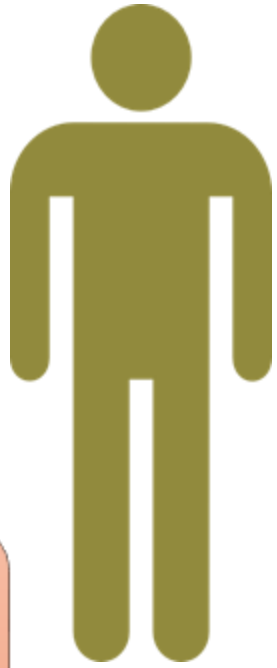
Acute onset

Weight loss

Osmotic Symptoms

Likely autoimmune disease

(Weak) Family History



Slow onset

Overweight

Few symptoms

Metabolic syndrome

- **Hypertension**
- **Waist Circumference**
- **Dyslipidaemia**

(Strong) Family History

Insulin deficiency

? Insulin resistance

•Hyperinsulinaemia

? Insulin deficiency

•B-cell exhaustion / down-regulation /Autoimmune

? Hepatoglucogenesis

•Glucagon excess

? Reduced renal glucose clearance

Insulin resistance

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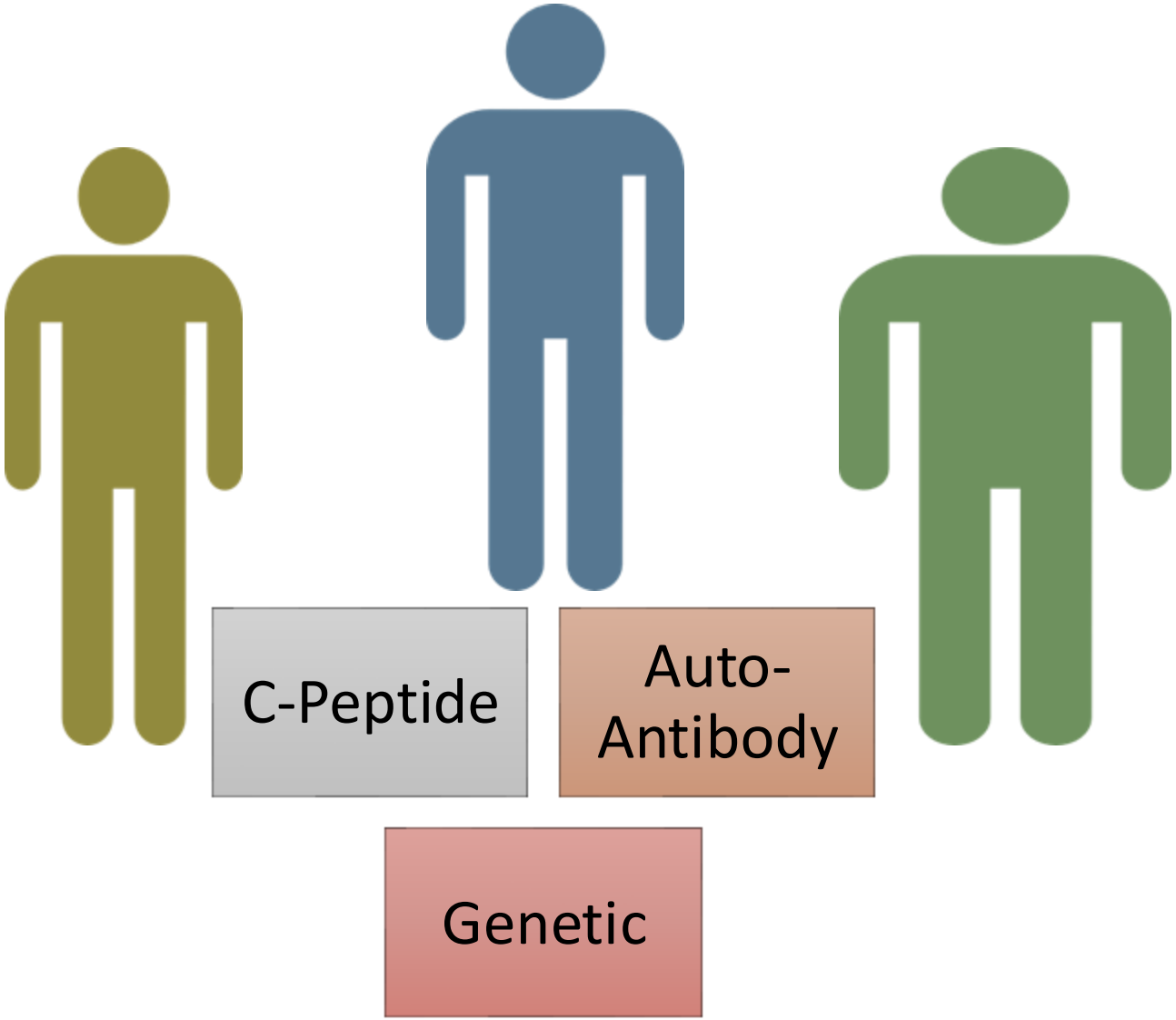

Slow onset

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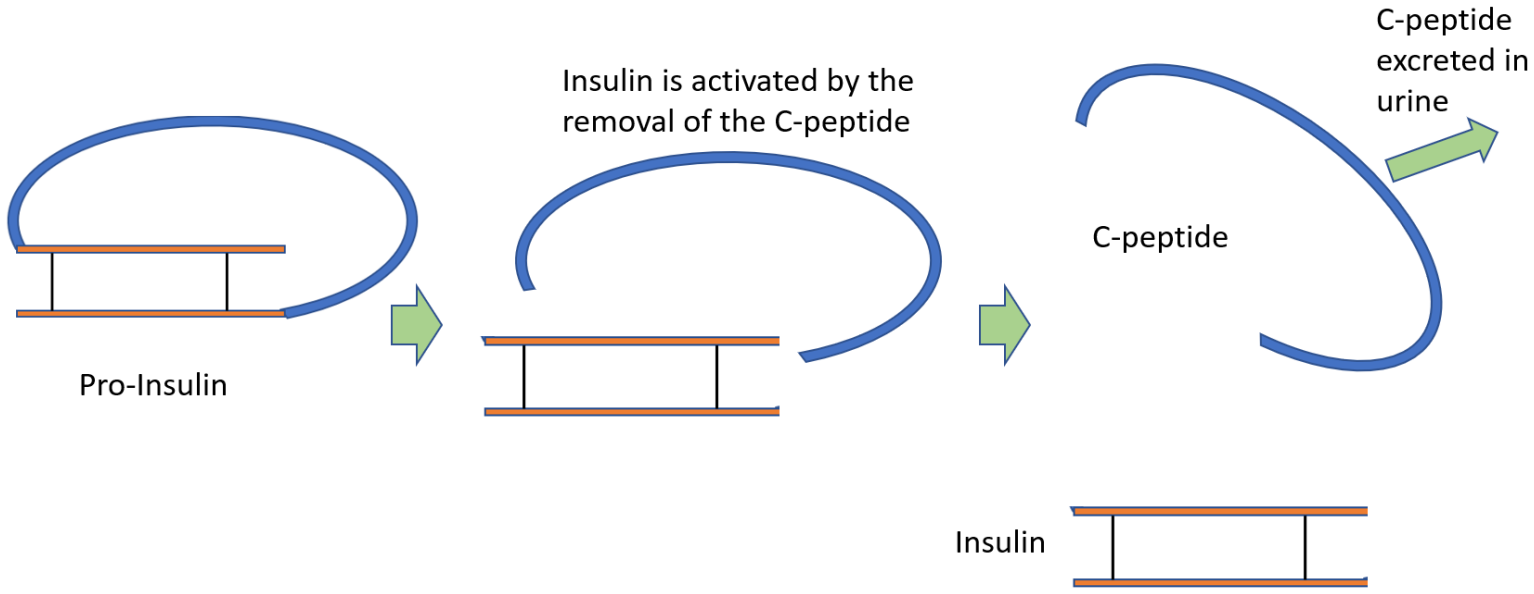
- **Waist Circumference**
- **Dyslipidaemia**

(Strong Family History)

C-Peptide

C-peptide is a useful indicator of beta cell function, allowing discrimination between insulin-sufficient and insulin-deficient individuals with diabetes.

The urinary C-peptide creatinine ratio (UCPCR) result is best measured on a post prandial sample taken approximately two hours after a meal stimulus.

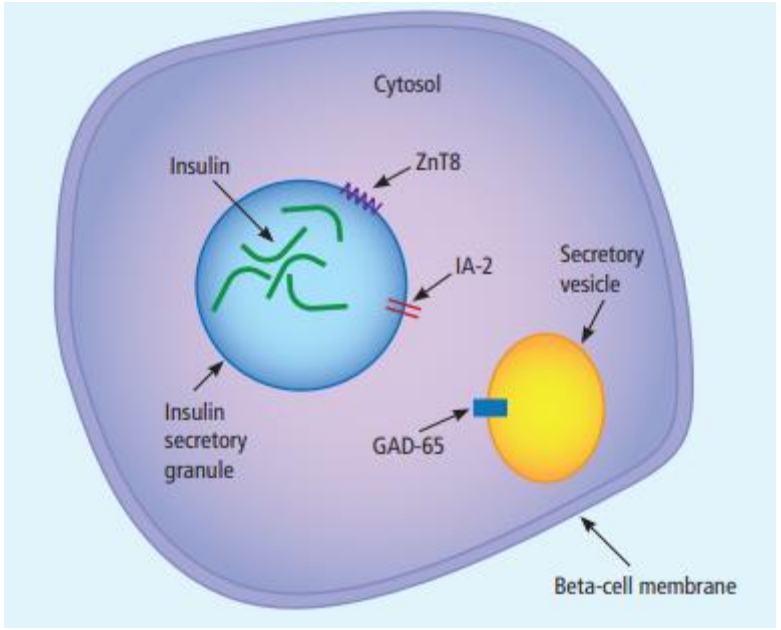


C-peptide

- correlates with diabetes type, duration of disease, and age of diagnosis.
- is associated with microvascular complications.

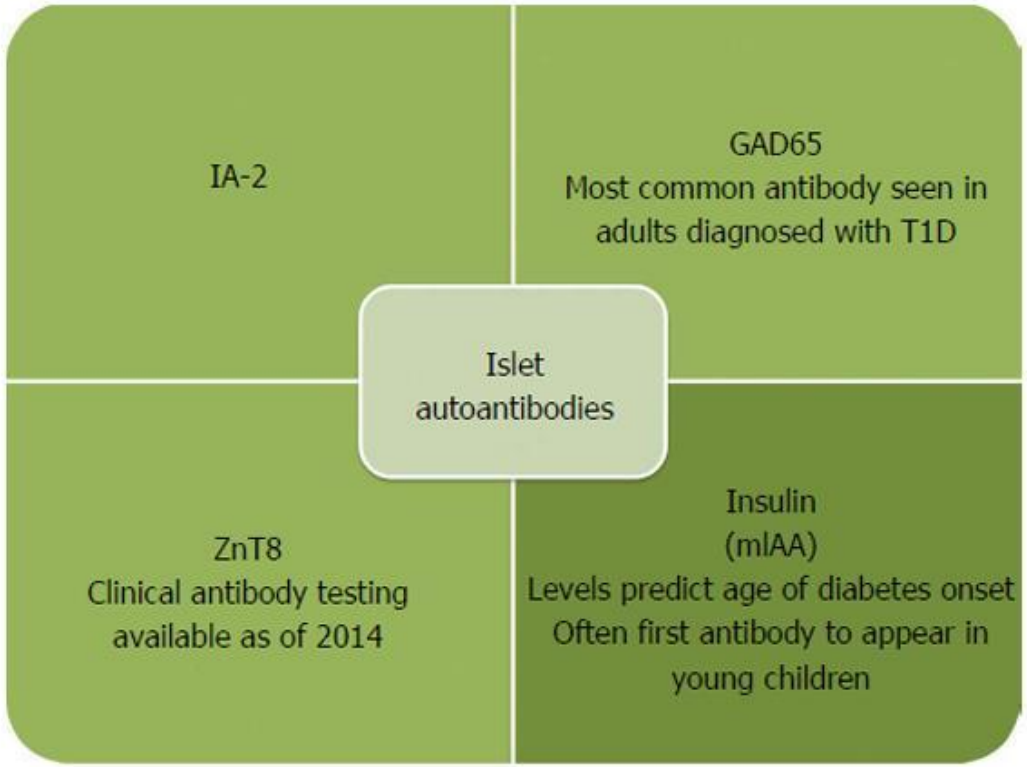
Antibodies

Pancreatic autoantibodies form against components of the pancreatic beta-cell and may be detected in people with type 1 diabetes.



Shivani Misra
PRACTICAL DIABETES VOL. 34 NO. 6

Antibodies



Type 1 diabetes;

- **GAD65: Glutamic decarboxylase;**
- **IA-2: Islet antigen 2;**
- **ZnT8: Zinc transporter 8**

Insulin autoantibodies are often the first antibody to develop in young children.

Adults most often are **GAD65 and IA-2 autoantibody** positive at diagnosis.

The **ZnT8 antibody** is the most recently identified autoantibody with commercial testing now available.

Simmons KM, Michels AW. Type 1 diabetes: A predictable disease. *World J Diabetes* 2015; 6(3): 380-390 [PMID: 25897349 DOI: 10.4239/wjd.v6.i3.380]

Antibody testing

Children presenting with diabetes should be assumed to have type 1 diabetes at diagnosis, so that there are no delays in initiating life-sustaining insulin treatment.

- Routine pancreatic autoantibody testing is not recommended and is reserved for cases where there may be uncertainty around diagnosis

It is important to test several pancreatic autoantibodies, as a proportion of individuals may be negative to one but positive to another.

- When testing antibodies in adults,
  - 60% of individuals were positive to GAD only;
  - 80% were positive to GAD and/or IA-2.2

Antibod

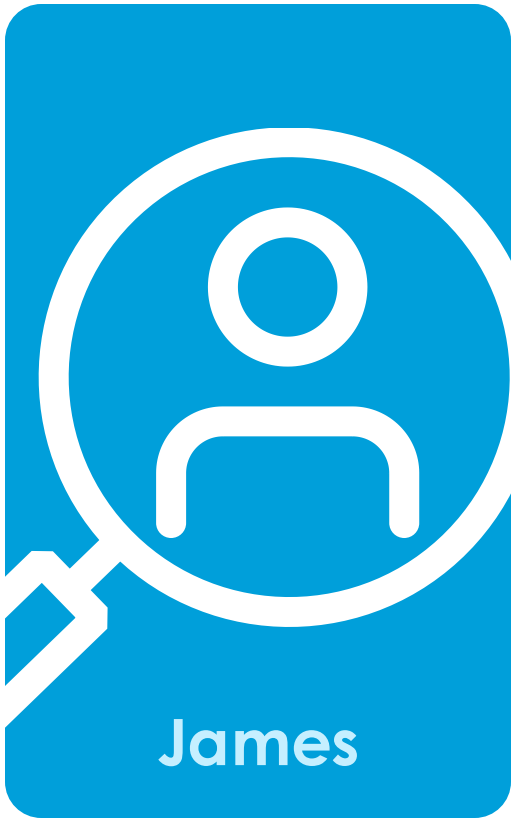
Children prese **abetes at diagnosis, so t** **treatment.**

- Routine pancr where there may be uncertainty

It is important of individuals may be negati

- When testing
  - 60% of indiv
  - 80% were po

Case study

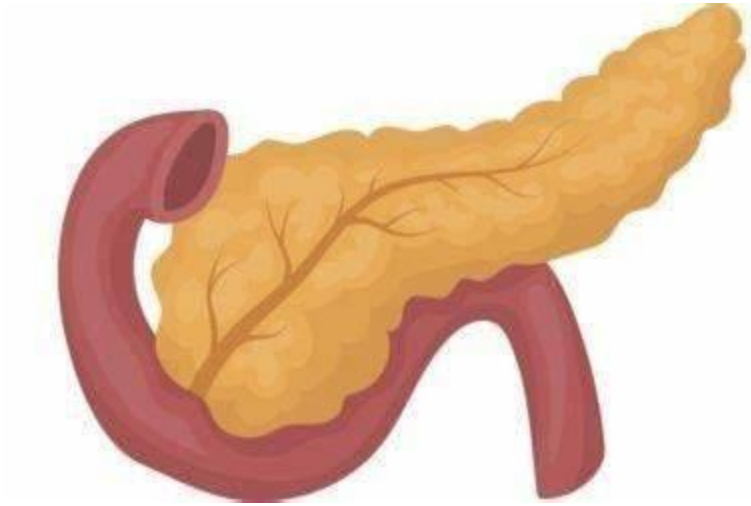


Patient characteristics	Age: 48 years Sex: Male BMI: 22 kg/m^2 Waist-to-height ratio 0.48 Ethnicity: Scottish Caucasian
Family history	None of note
Medical history	Type 2 diabetes diagnosed 4 years ago. Recurrent episodes of acute pancreatitis in his 20's secondary to alcohol
Current treatments	Metformin 1 g bd, empagliflozin 25mg od, sitagliptin 100mg od
Assessments	HbA_{1c}: 88 mmol/mol
Current status summary	Erratic blood sugars (has CGM as had a couple of hypos) and loose bowel motions. Weight stable. Currently abstinent from alcohol
Patient views	Worried about his risk of diabetes complications

What do you do next?

Switch	metformin to SR preparation
Add in	4th line oral hypoglycaemic agent
Add in	injectable therapy with GLP1RA
Add in	injectable therapy with insulin
Send off	a stool sample
Check	C-peptide levels & pancreatic autoantibodies
Do	something else?

Type 3c Diabetes



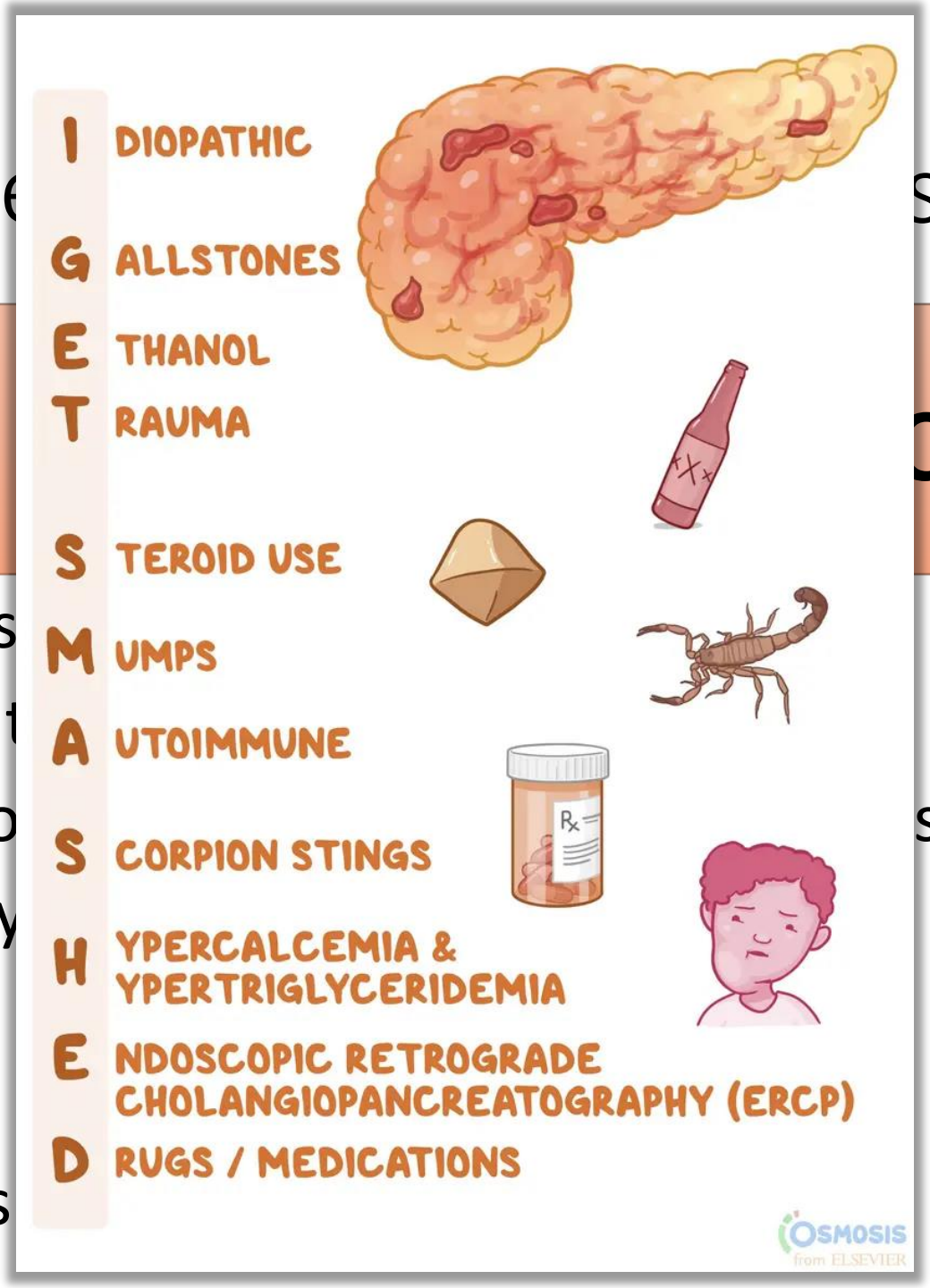
Type 3c Diabetes

- Diabetes associated with disease, trauma or surgery of the exocrine pancreas
  - Exocrine dysfunction (digestive enzyme production)
  - Endocrine dysfunction (hormone-secreting: alpha & beta cells)

Pancreato-ge s

Causes of c diabetes

- Acute pancreatitis
- Chronic pancreatit
- Pancreatic carcino sease)
- Pancreatic surgery
- Trauma
- Cystic fibrosis
- Haemochromatos



Type 3c Diabetes

- **Frequently misclassified as T2D**

- Nearly twice as likely to have suboptimal glycaemic control
    - Increased risk of hypoglycaemia; can be quite prolonged

- Much more likely to need insulin within 5 years of diagnosis
    - **Ask about a history of pancreatic disease when diagnosing diabetes (any type)**

- Features that may point towards type 3c diabetes or pancreatic exocrine insufficiency (PEI):
  - Diarrhoea & steatorrhoea
  - Abdominal discomfort, flatulence & bloating
  - Weight loss & fatigue
  - Erratic blood glucose control if severe

- Diagnose by sending a stool sample for **faecal elastase-1**
  - Low levels suggest PEI
- Pancreatic antibodies absent & C-peptide levels low

- Management
  - Appropriate management of malabsorption with pancreatic enzyme replacement therapy (e.g. Creon, Nutrizym, Pancrease, Pancrex)
  - Fat-soluble vitamin replacement (vitamins A, D, E & K)
  - Increased risk of osteoporosis & pancreatic cancer
  - Avoid incretin therapies (gliptins, GLP1 & GLP/GIP RAs). Metformin ok

I'm concerned

Just diagnosed, what should I ask my doctor?

Specialist Centres

Living with pancreatic cancer

- Type 3C diabetes (secondary diabetes)
- Palliative and end of life care

Patient information booklets

Life after pancreatic cancer treatment

Patient and carer stories #PeopleofPanCan

Bereavement

Sources of support

Online Resources

Type 3C diabetes (secondary diabetes)

On this page, we explain what Type 3c Diabetes is, how it is diagnosed, its symptoms and treatment and management.

One of the functions of the pancreas is to produce hormones to keep blood glucose levels within a normal range (between 3.5-7 mmols/l). Insulin is one of these hormones, and it is needed to allow the glucose (or sugar) in our blood from the food we eat to enter our cells and fuel our bodies, providing us with energy.

What is type 3c diabetes?

Type 3c Diabetes (or Pancreatogenic Diabetes) can develop when the pancreas stops producing enough of the hormone called insulin. This can happen due to an illness or condition that affects or damages the pancreas. It can also occur if you have had surgery on your pancreas or if it is removed. When there isn't enough insulin in the body, the blood glucose levels begin to rise above the average level, and if left

PATIENT INFORMATION BOOKLETS

Control the symptoms of pancreatic cancer

This booklet covers the different procedures used to control pancreatic cancer symptoms with practical information about your hospital visit and returning home. Includes a section about second opinions, clinical trials and questions to ask your doctor and a glossary to explain some of the terms

WHAT IS TYPE 3C DIABETES?

You may have heard of the more common types of diabetes like type 1, type 2 and gestational. But there are actually many other types of diabetes that aren't as well known.

Type 3c diabetes develops because of the damage to the pancreas, which can happen for a few different reasons. And although it's different to other types, you can get a wrong diagnosis of **type 2** because type 3c isn't as well known and the term 3c isn't always used. Type 3c can also be called diabetes related to disorders of the pancreas or pancreatogenic diabetes mellitus.

Not getting the right diagnosis can be really difficult to deal with emotionally. You might feel angry at not getting the right treatment or you could just get worn out by the whole process. So make sure you find someone to talk to. Our **forum** has a lot of threads about type 3c from people who've experienced similar things to you. Being part of a community like that can help get you through difficult time.

You can also speak to our **helpline** to get support. Call **0345 123 2399** or use the live chat.

What causes type 3c diabetes?

Type 3c can happen when the pancreas is damaged and it stops producing enough insulin for the body. And we all need insulin to live. It allows the glucose (or sugar) in our blood to enter our cells and fuel our bodies. If you have type 3c diabetes your

Show me more

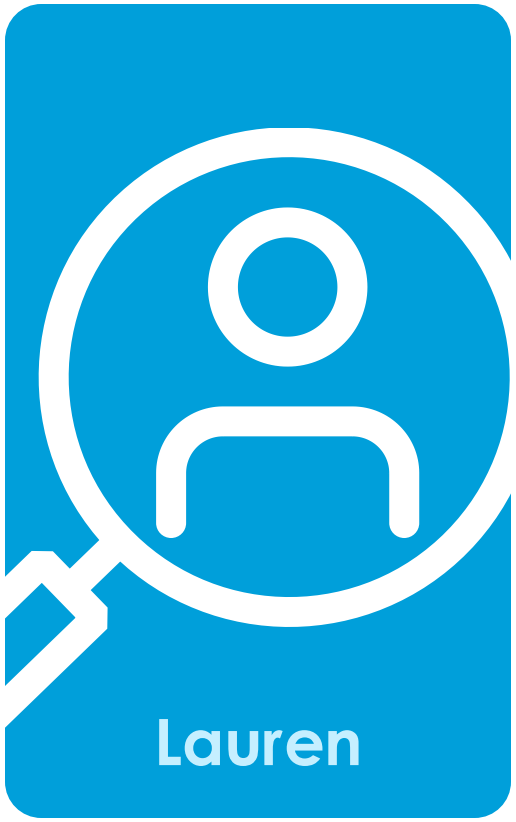
What is diabetes?

Other types of diabetes

Haemochromatosis

“If you say you have Type 3c diabetes, nobody knows what you’re talking about.”

Case study



Patient characteristics	Age: 55 years Sex: Female BMI: 24 kg/m^2 Waist-to-height ratio 0.51 Ethnicity: Scottish Caucasian
Family history	Strong FH of T2D
Medical history	Nil of note
Current treatments	Nil
Assessments	**HbA_{1c}: 68 mmol/mol**; **ALT 62** (10-50), **AST 63** (8-50), **ALP 85** (40-125) **GGT 65** (5-55) **Bilirubin 17** (3-21); **TC 5.4 TRG 3.7 HDL 0.7 LDL 2.9**; **FBC normal**
Current status summary	Attends feeling increasingly tired and thirsty and has lost a fair amount of weight recently

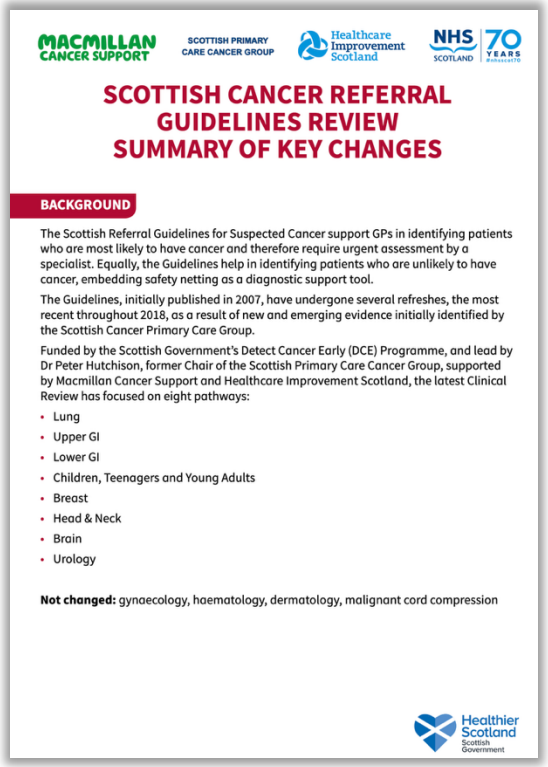
What do you do next?

Establish	a diagnosis of T2D
Exclude	MASLD/MASH
Check	C-peptide levels & pancreatic autoantibodies
Refer	for abdominal imaging
Do	something else?

- NICE NG12 Suspected Cancer 2015
  - **Urgent abdominal imaging (ideally CT within 2 weeks) if aged >60y with weight loss <u>and</u>:**
    - Diarrhoea
    - Back pain
    - Abdominal pain
    - Nausea and/or vomiting
    - Constipation
    - **New-onset diabetes (any type)**
  - USS may miss up to 10% of pancreatic cancers

NICE
National Institute for Health and Care Excellence

- Scottish Cancer Referral Guidelines 2019
  - **Suggests >55 years old and above factors for urgent suspicion of cancer referral**



MACMILLAN CANCER SUPPORT · SCOTTISH PRIMARY CARE CANCER GROUP · Healthcare Improvement Scotland · NHS SCOTLAND 70 YEARS

SCOTTISH CANCER REFERRAL GUIDELINES REVIEW SUMMARY OF KEY CHANGES

BACKGROUND

The Scottish Referral Guidelines for Suspected Cancer support GPs in identifying patients who are most likely to have cancer and therefore require urgent assessment by a specialist. Equally, the Guidelines help in identifying patients who are unlikely to have cancer, embedding safety netting as a diagnostic support tool.

The Guidelines, initially published in 2007, have undergone several refreshes, the most recent throughout 2018, as a result of new and emerging evidence initially identified by the Scottish Cancer Primary Care Group.

Funded by the Scottish Government's Detect Cancer Early (DCE) Programme, and lead by Dr Peter Hutchison, former Chair of the Scottish Primary Care Cancer Group, supported by Macmillan Cancer Support and Healthcare Improvement Scotland, the latest Clinical Review has focused on eight pathways:

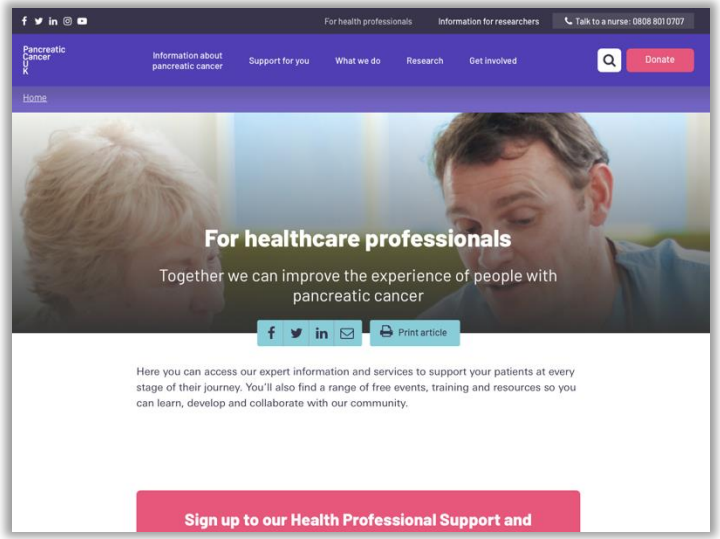
- Lung
- Upper GI
- Lower GI
- Children, Teenagers and Young Adults
- Breast
- Head & Neck
- Brain
- Urology

Not changed: gynaecology, haematology, dermatology, malignant cord compression

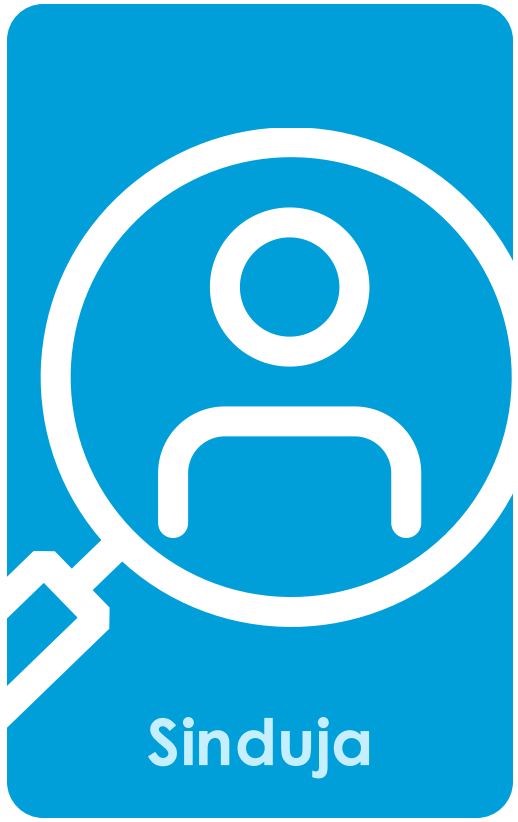
Healthier Scotland · Scottish Government

- Pancreatic Cancer Research Fund
- Pancreatic Cancer UK

- Around 10,000 new cases diagnosed each year
  - Lowest survival rate of all common cancers: 5-year survival rate around 5%
- Often silent until advanced
- Risk factors include:
  - Age – mainly affects 50-80y
  - Obesity (2x)
  - Smoking (2-3x)
  - Diabetes (2x) & chronic pancreatitis (8x)



Case study



Patient characteristics	Age: 38 years Sex: Female BMI: 28 kg/m^2 Waist-to-height ratio 0.58 Ethnicity: Sri Lankan
Family history	Strong FH of T2D
Medical history	Nil of note
Current treatments	Nil
Assessments	FBC normal; FBG 5.7mmol/L
Current status summary	Happily 29 weeks pregnant and uncomplicated pregnancy to date

Does Sinduja have gestational diabetes mellitus (GDM)?

Yes	And needs referred to high-risk antenatal obstetric clinic
No	

	FBG (mmol/l)	2-hour BG post 75g OGTT (mmol/l)
Diagnosis of GDM	≥5.6	≥7.8

- NICE NG3 Diabetes in Pregnancy (2015)
  - New tighter diagnostic criteria for the diagnosis of GDM
  - Follow-up after pregnancy:
    - BMJ 2020: Women with a history of GDM have a nearly **10-fold** higher risk of developing T2DM cf. healthy controls
    - Offer lifestyle advice & referral as appropriate
    - **Offer FBG 6–13 weeks after birth to exclude T2D** e.g. 6w postnatal check
      - Do not routinely offer a 75g 2-hour OGTT
      - Assess result using non-pregnant diagnostic criteria
    - Offer **life-long annual HbA1c**
      - QIA

NICE
National Institute for Health and Care Excellence

Identifying People at High Risk of Type 2 Diabetes

Medscape UK X Guidelines
Primary Care Hacks

Authors: Dr Kevin Fernando, Portfolio GP, East Lothian; Content Advisor, Medscape Global and UK (email: kfernando@webmd.net); **Dr Eimear Darcy**, GP Partner, Grange Family Practice, Omagh

What Is Prediabetes?

- Prediabetes refers to raised blood glucose levels above normal but not above the diagnostic threshold for T2D. **HbA_{1c} values of 42–47 mmol/mol indicate prediabetes**[1] and a **single test** is sufficient. People living with prediabetes have an increased risk of developing T2D
- Depending on what test is used, prediabetes can also be referred to as:[2]
  - **nondiabetic hyperglycaemia** (HbA_{1c} 42–47 mmol/mol[3])
  - **impaired fasting glucose** (FPG ≥6.1 and <6.9 mmol/l[4])
  - **impaired glucose tolerance** (2-hour oral glucose tolerance test ≥7.8 and <11.1 mmol/l[4])
- **Prediabetes is associated with an increased risk of all-cause mortality and CVD in the general population and in those with atherosclerotic CVD.**[5] This has implications for the screening and management of prediabetes in the primary and secondary prevention of CVD[6]
- **Prediabetes is more than just dysglycaemia.** A recent prospective cohort study found that reversion to normoglycaemia in those with prediabetes was only associated with lower risks of death and a longer life expectancy when accompanied by significant lifestyle change such as high levels of physical activity, not smoking, and maintaining a healthy bodyweight.[6]

Identifying Those at High Risk of T2D

NICE PH38 recommends a **two-stage strategy to identify people at high risk of T2D** (and those with undiagnosed T2D)[4]:

1. A **risk assessment** should be offered using a validated computer-based risk assessment tool that can use routinely available data from individuals' electronic health records, such as QDiabetes-2018
2. For those with high risk scores for developing T2D (e.g., QDiabetes score ≥10%), a **blood test for HbA_{1c}** should be offered

Additionally, if aged ≥25 years and of South Asian or Chinese descent with BMI >23 kg/m², there is no need to use a risk assessment tool; instead, directly offer an HbA_{1c} blood test.

Matching Interventions to Risk in People with Prediabetes[4,7,8]

Risk factors for developing T2D

- Obesity
- Family history of T2D
- GDM
- MASLD (formerly NAFLD; see also the Primary Care Hack on MASLD/MASH)
- CVD
- OSAHS
- Hypertension requiring treatment (see also the Primary Care Hack on lifestyle changes for managing hypertension)
- PCOS
- Learning disabilities
- SMI, e.g., bipolar disorder or schizophrenia
- Certain medications including regular steroids, statins, and atypical antipsychotics
- People in highly deprived socioeconomic situations

- People aged 25–39 years of South Asian, Chinese, Black African, African–Caribbean descent or other high-risk Black and minority ethnic groups
- A recent retrospective cross-sectional US study suggested the need for screening for T2D among high-risk Asian groups even at healthy BMI levels[7]

- People aged ≥40 years (except pregnant women)
- NICE PH38 stresses that nobody should be excluded from assessment on the basis of age, as everyone can reduce their risk, including those aged ≥75 years

Stage 1
- Use a risk assessment tool such as **QDiabetes-2018**
- If aged ≥25 years and of South Asian or Chinese descent with BMI >23 kg/m², omit the risk assessment tool and instead directly offer an HbA_{1c} blood test

If low or intermediate risk score, e.g. **QDiabetes-2018 <10%**, no HbA_{1c} blood test is required

Give brief advice on the risks of developing T2D and offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g. Diabetes UK's *Information prescriptions for people with diabetes*

Reassess risk at least every 5 years

If high risk score, e.g. **QDiabetes-2018 ≥10%**, offer HbA_{1c} blood test

If HbA_{1c} <42 mmol/mol, the individual is at **moderate risk** of developing T2D

Discuss brief advice on the risks of developing T2D

Offer a brief intervention to help them change their lifestyle, e.g. structured weight-loss programmes

Offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g. Diabetes UK's *Information prescriptions for people with diabetes*

Reassess risk at least every 3 years

If HbA_{1c} 42–47 mmol/mol, the individual is at **high risk** of developing T2D

If HbA_{1c} ≥48 mmol/mol, this is **suggestive of T2D**

Repeat HbA_{1c} blood test within 4 weeks to confirm diagnosis. If repeat HbA_{1c} ≥48 mmol/mol, a diagnosis of T2D is confirmed and should be managed as usual

If repeat HbA_{1c} <48 mmol/mol, follow recommendations below

Discuss brief advice on the risks of developing T2D

Offer referral to a local, evidence-based, quality-assured intensive lifestyle change programme to increase physical activity and achieve and maintain weight loss

Offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g Diabetes UK's *Information prescriptions for people with diabetes*

Offer an HbA_{1c} blood test and reassess weight at least annually

Special Populations of Note

People Living with an Eating Disorder

- The prevalence of T2D is higher in people with binge eating disorder than the general population[9]
- Additional caution should be taken discussing prediabetes and weight loss with people who are living with or suspected to have an eating disorder, as weight-loss interventions may be contraindicated and may exacerbate the condition.[9]

Gestational Diabetes

- **Women with a history of GDM are almost 10 times more likely to develop T2D** over their lifetime than women without a history of GDM[10]
- For women previously diagnosed with GDM and whose blood glucose levels return to normal after birth, NICE and SIGN both recommend:[11,12]
  - lifestyle advice (including weight management, diet, and exercise)
  - **offer an FPG 6–13 weeks after delivery** to exclude T2D (HbA_{1c} should not be used until 3 months postpartum but can be used if an FPG has not been carried out by 13 weeks). Practically, this can be part of the 6-week postnatal check
    - **if FPG <6.0 mmol/l** (HbA_{1c} <39 mmol/mol), there is a low probability of T2D. Lifestyle advice should be reinforced; ensure they are under recall for **lifelong annual HbA_{1c}** to check for progression to T2D
    - **if FPG 6.0–6.9 mmol/l** (HbA_{1c} 39–47 mmol/mol), the individual is at high risk of developing T2D and the *Matching Interventions to Risk* flowchart should be followed
    - **if FPG ≥7.0 mmol/l** (HbA_{1c} ≥48 mmol/mol), a diagnosis of T2D is likely and the *Matching Interventions to Risk* flowchart should be followed.

Polycystic Ovary Syndrome

- **Women living with PCOS are 1.4 times more likely to develop T2D** over their lifetime than women without PCOS[13]
- This increased risk is **independent of baseline bodyweight**;[13] NICE recommends assessing glycaemic status with an HbA_{1c} blood test at baseline in **all** women living with PCOS. Thereafter, glycaemic assessment should take place **every 1–3 years lifelong**, depending on the presence of other risk factors for developing T2D.[14]

People Living with Severe Mental Illness

- **People living with SMI are 1.3 times more likely to develop T2D** over their lifetime than people without SMI[15]
- The *Lester UK adaptation: positive cardiometabolic health resource* 2023 update gives recommendations relating to monitoring physical health in people living with SMI such as psychosis and schizophrenia.[15] The aim of this resource is to help reduce the **health inequality of a 15–20-year mortality gap** in people living with SMI[16]
- For all people in the 'red zone' as depicted in the *Lester UK adaptation* intervention framework for people experiencing psychosis and schizophrenia, including those with HbA_{1c} ≥42 mmol/mol: **don't just screen, intervene!**
- Care should always be person-centred, tailoring discussion to the needs of the person to enable shared decision-making. Refer for investigation, diagnosis, and treatment as appropriate
- For those at high risk of T2D (HbA_{1c} of 42–47 mmol/mol), offer referral to an evidence-based lifestyle change programme. If ineffective, offer metformin modified release if safe and appropriate. Aim for HbA_{1c} <42 mmol/mol.

Metformin

- NICE recommends using clinical judgement on whether (and when) to offer metformin to support lifestyle changes in people at risk of T2D with rising HbA_{1c} blood tests. Consider metformin if:[4]
  - HbA_{1c} continues to rise despite participation in an intensive lifestyle change programme
  - the individual is unable to participate in a lifestyle change programme, particularly if BMI is >35 kg/m²
- If commencing metformin, **start low and go slow**, e.g. 500 mg once daily and increase gradually as tolerated to 2000 mg daily. If the individual is intolerant of standard-release metformin, consider using modified-release metformin[4]
- Prescribe metformin for 6–12 months initially. Check HbA_{1c} at 3-month intervals and stop metformin if no benefit is seen.[4]

Managing Prediabetes—Key Interventions

- By making changes to diet, increasing physical activity, and losing weight, **around half of cases of T2D can be prevented or delayed**[17]
- Review coexisting risk factors such as blood pressure, lipids, and smoking status
- Pharmacological interventions, most notably incretin therapies, may be appropriate as an adjunct to a reduced-calorie diet and increased physical activity for weight management in adults with overweight or obesity[18]—see also the Primary Care Hack on liraglutide, semaglutide, and tirzepatide for managing overweight and obesity in primary care
- Bariatric and metabolic surgery may also be appropriate for certain individuals; referral for MDT assessment is recommended if a person has prediabetes, has received optimal nonsurgical weight-management treatment, has a BMI >35 kg/m² (or 32.5 kg/m² in people with a South Asian, Chinese, other Asian, Middle Eastern, Black African, African–Caribbean, or Arab family background), and agrees to adhere to the requirements for long-term follow up[19]
- Also see *Metformin*, above
- In the SURMOUNT-1 trial, 3 years of treatment with tirzepatide in people living with obesity and prediabetes resulted in significant and sustained weight reduction (nearly 20% with tirzepatide 15 mg) and 90% fewer new diagnoses of T2D compared to placebo.[20]

Clinical Coding

- SIGN recommends a more uniform approach to coding in primary care of those at high risk of T2D:[8]
  - consider maintaining a register of people at high risk of developing T2D and offering then an annual review. This annual review should also cover any coexisting cardiometabolic long-term conditions
  - a single read code (**C11y500—'pre-diabetes'**) is recommended for all cases of prediabetes, including impaired glucose tolerance, impaired fasting glucose, and nondiabetic hyperglycaemia
  - the additional recall code is recommended to ensure that these individuals are properly followed up (**66Az—'high risk of diabetes annual review'**).

Useful Resources

For Patients

- Diabetes UK: *Prediabetes*
- Diabetes UK: *Weight loss and diabetes*
- Diabetes UK: *Type 2 diabetes—know your risk*
- QDiabetes-2018 risk calculator
- Diabetes Research Centre: *Could you have type 2 diabetes?*
- Diabetes Scotland: *Your guide to type 2 diabetes*
- NHS Lose Weight website.

For Healthcare Professionals

- Diabetes UK: *Information prescriptions for healthcare professionals*
- *UK Chief Medical Officers' physical activity guidelines*
- Gardner M, Wang J, Hazlehurt J et al. Risk of progression from prediabetes to type 2 diabetes in a large UK adult cohort. *Diabet Med* 2023; **40**(3): e14996.
- Public Health Scotland: *Challenging weight stigma learning hub*
- Babysteps online programme for GDM.

Abbreviations
BMI=body mass index; **CVD**=cardiovascular disease; **FPG**=fasting plasma glucose; **GDM**=gestational diabetes mellitus; **HbA_{1c}**=glycated haemoglobin; **MASH**=metabolic dysfunction-associated steatohepatitis; **MASLD**=metabolic dysfunction-associated steatotic liver disease; **MDT**=multidisciplinary team; **NAFLD**=nonalcoholic fatty liver disease; **OSAHS**=obstructive sleep apnoea/hypopnoea syndrome; **PCOS**=polycystic ovary syndrome; **PH**=Public Health Guideline; **SIGN**=Scottish Intercollegiate Guidelines Network; **SMI**=severe mental illness; **T2D**=type 2 diabetes.

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@GLNS_Medscape @drkevinfernando medscape.co.uk/guidelines

For references and to view this Primary Care Hack online, go to: medscape-uk.co/Hack-prediabetes

Last updated: April 2025.

bitly

GESTATIONAL DIABETES

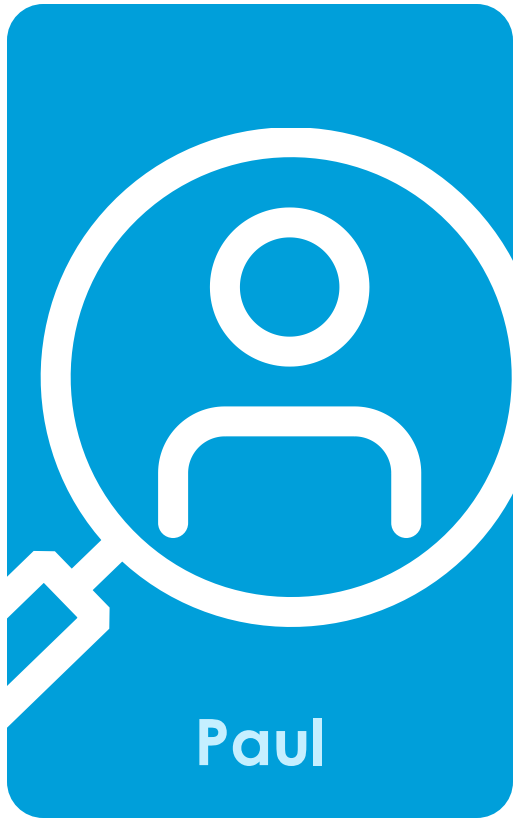
Gestational diabetes is diabetes that can develop during pregnancy. It affects women who don't already have another type of diabetes.

It means you have **high blood sugar** and need to take extra care of yourself and your bump. This will include **eating well** and **keeping active**.

It usually goes away again after giving birth. It is usually diagnosed from a blood test 24 to 28 weeks into pregnancy.

If you've found out you have gestational diabetes, you're not alone. You'll get lots of extra care and support from your **care team** at every stage. And we're here to support you and your loved ones too. Contact our **helpline** for support, advice or just a chat

Case study



Patient characteristics	Age: 58 years Sex: Male BMI: 26 kg/m^2 Waist-to-height ratio 0.48 Ethnicity: Scottish Caucasian
Family history	Father had bowel cancer
Medical history	Type 2 diabetes diagnosed 5 years ago. Hypertension
Current treatments	Metformin 1g / empagliflozin 5mg 1 tablet bd, atorvastatin 20mg od, lisinopril 20mg nocte
Assessments	**HbA_{1c}: 74 mmol/mol; BP 129/79**
Current status summary	Attends for diabetes review very frustrated with his recent HbA1c as blood sugars at home around 7-8mmol/L (self-funds CGM) in the morning and has also lost several kilos in weight recently

What do you do next?

Reinforce	lifestyle advice, monitor blood sugars & repeat HbA1c 3 months
Increase	to metformin 1g/empagliflozin 12.5mg 1 tab bd
Add in	3rd line oral hypoglycaemic agent
Add in	injectable agent e.g. incretin therapy or basal insulin
Refer	weight management service
Check	some further bloods – which ones?

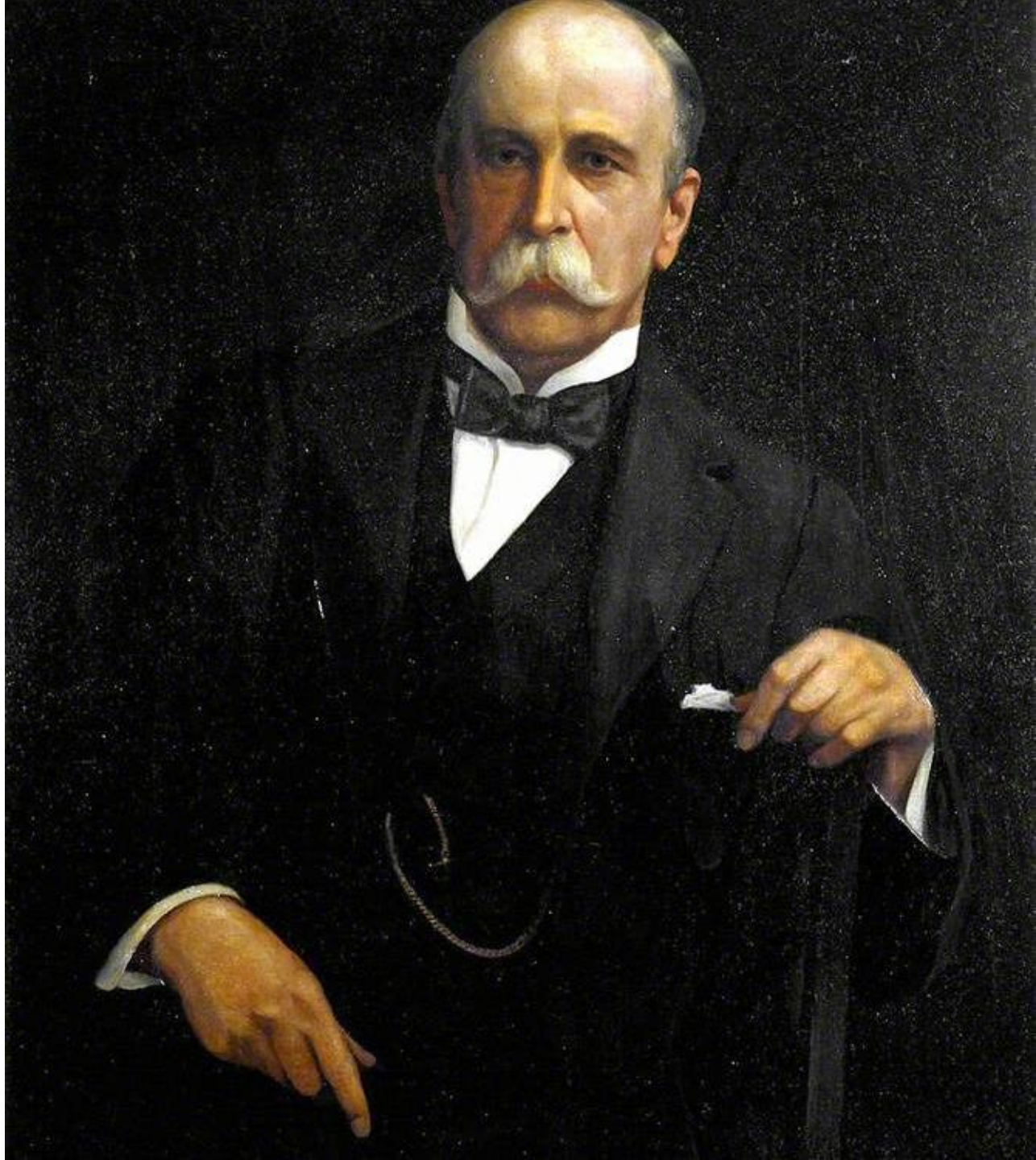
Hb 79 MCV 61 Ferritin <5 Haematinics normal

Referred for urgent GI investigations which revealed a sigmoid cancer

“

‘The good physician treats the disease; the great physician treats the patient who has the disease’

Sir William Osler 1849–1919



When to Interpret HbA1c with Caution

- RBC life span
- Abnormal haemoglobin structure

Chronic iron-deficient anaemia

Vitamin B12 deficiency

Thalassaemias

Haemolysis

Acute blood loss

CKD & haemodialysis

Hypertriglyceridaemia

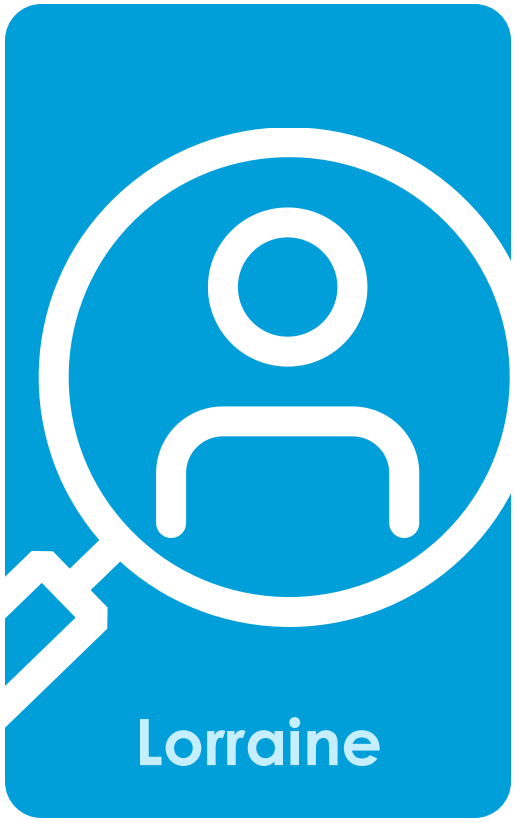
Recent transfusion

Haemachromatosis

HbA1C (%)	HbA1C (mmol/mol)	AVERAGE BLOOD GLUCOSE READINGS OVER LAST 2-3 MONTHS (mmol/mol)
6	42	7.0
7	53	8.6
8	64	10.2
9	75	11.8
10	86	13.4
11	97	14.9
12	108	16.5

- NICE NG28 (updated 2022) suggests the use of fructosamine, quality-controlled plasma glucose profiles or total glycated albumin if HbA1c unsuitable

Case study

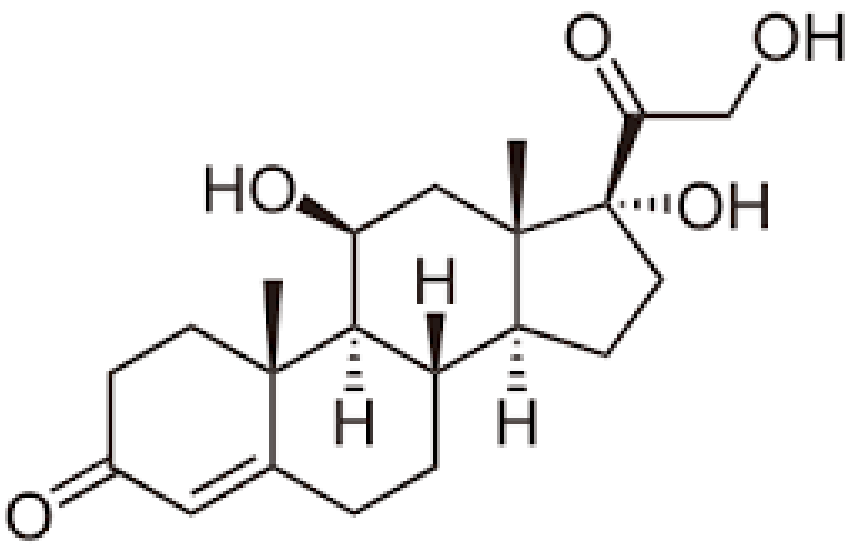


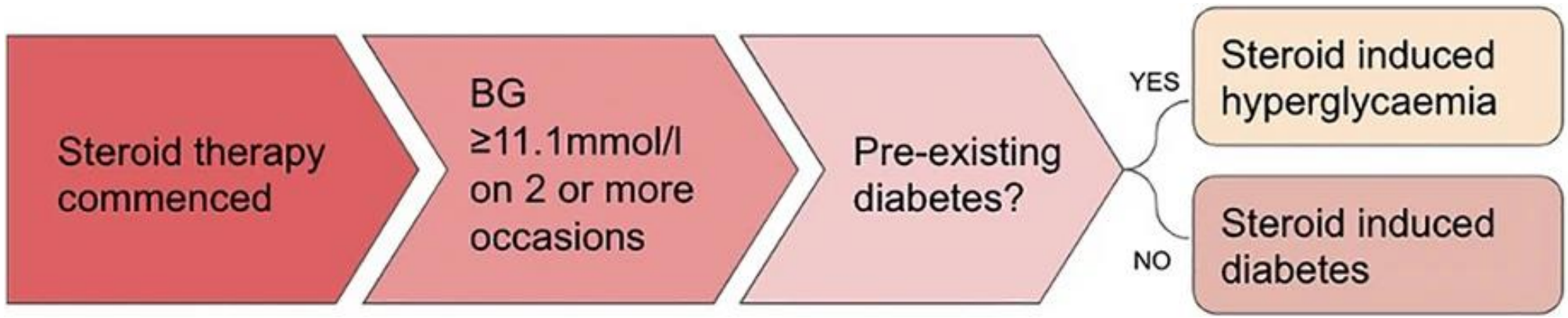
Patient characteristics	Age: 67 years Sex: Female Ethnicity: Scottish Caucasian
Medical history	T2D 12 years. Diagnosed with polymyalgia rheumatica and commenced on steroids 4 months ago
Current treatments	Metformin 1g bd, dapagliflozin 10mg, atorvastatin 20mg, losartan 50mg, prednisolone 9mg (reducing schedule), omeprazole 10mg, risedronate 35mg weekly,
Assessments	**BG 19.1, HbA_{1c}: 83 mmol/mol** (previously 55mmol/mol)
Current status summary	Attends feeling very thirsty with blurred vision

What do you do next?

Refer	for consideration of insulin therapy
Add in	gliclazide 40mg once daily in the morning
Add in	incretin therapy
Reduce	dose of prednisolone
Offer	SMBG or CGM
Do	something else

Steroid Induced Hyperglycaemia & Diabetes





Practical Guide to Glucocorticoid Induced Hyperglycaemia and Diabetes

Practical Approach | Open access | Published: 24 March 2023
Volume 14, pages 937–945, (2023) Cite this article

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Diabetes Therapy
Aims and scope →
Submit manuscript →

Hannah L. Barker, Deborah Morrison, Andrea Llano, Christopher A. R. Sainsbury & Gregory C. Jones

Part of a collection:
Practical Approaches to Diabetes Care

Abstract

Glucocorticoids, also known as steroids, are a class of anti-inflammatory drugs utilised widely in clinical practice for a variety of conditions. They are associated with a range of

Pharmacological factors

- Potency and dose of drug
- Total daily dose exceeding physiological levels as below:
  - Hydrocortisone 20mg
  - Prednisolone 5mg
  - Methylprednisolone 4mg
  - Dexamethasone 0.75mg
  - Betamethasone 0.75mg
- Duration of course
- Frequency of treatment course

Demographic factors

- Pre-existing diabetes mellitus
- People at increased risk of diabetes (e.g. obesity, family history of diabetes, previous gestational diabetes, ethnic minorities, polycystic ovarian syndrome)
- Impaired fasting glucose or impaired glucose tolerance, HbA1c 42-47mmol/mol
- Previously hyperglycaemia with glucocorticoid therapy
- Co-administered diabetogenic drugs e.g. tacrolimus

Home > Diabetes Therapy > Article

Practical Guide to Glucocorticoid Induced Hyperglycaemia and Diabetes

Practical Approach | Open access | Published: 24 March 2023

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Diabetes Therapy

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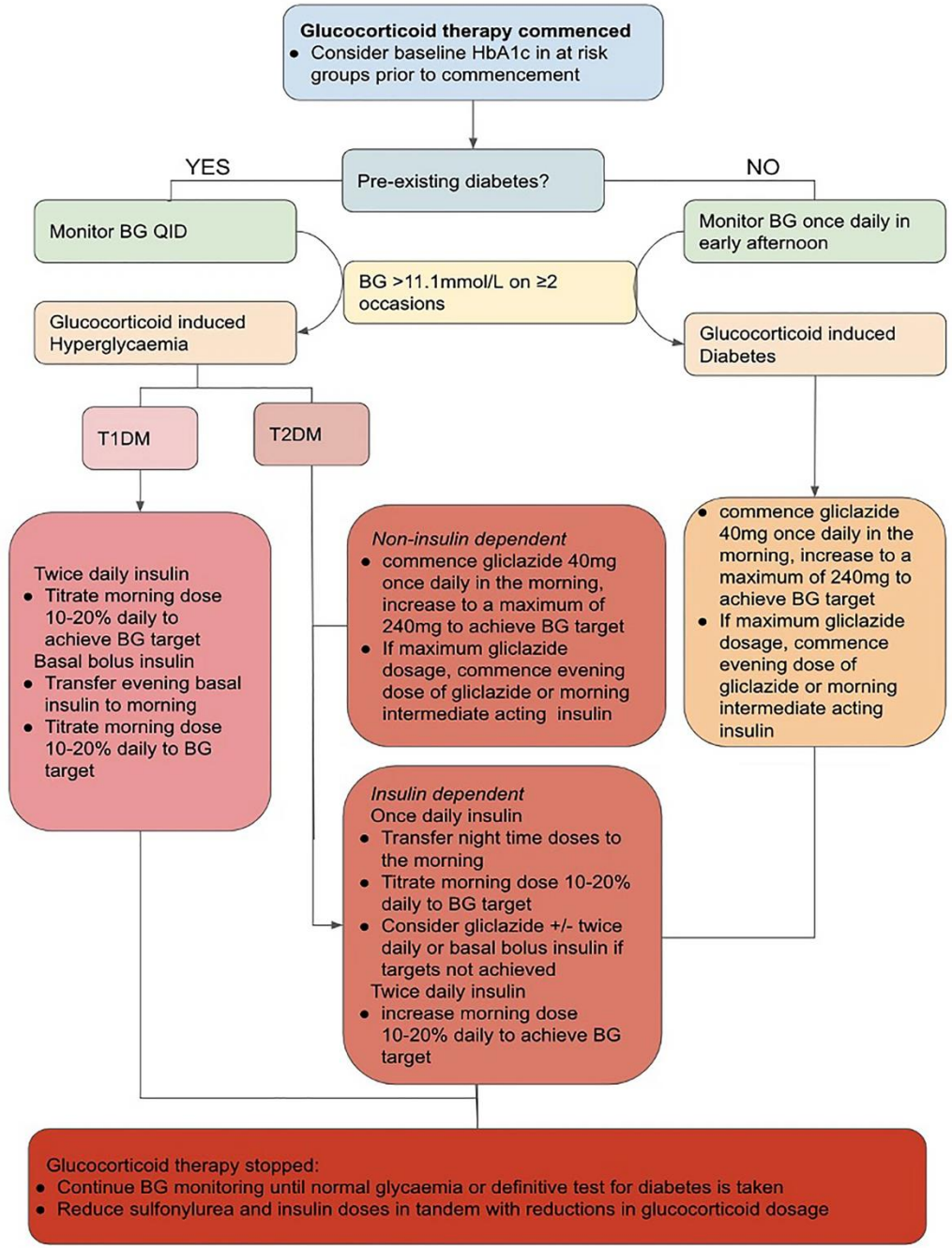
Abstract

Glucocorticoids, also known as steroids, are a class of anti-inflammatory drugs utilised


Glucocorticoid therapy commenced
• Consider baseline HbA1c in at risk groups prior to commencement
Pre-existing diabetes?
YES
NO
Monitor BG QID
Monitor BG once daily in early afternoon
BG >11.1mmol/L on ≥2 occasions
Glucocorticoid induced Hyperglycaemia
Glucocorticoid induced Diabetes
T1DM
T2DM
Twice daily insulin
• Titrate morning dose 10-20% daily to achieve BG target
Basal bolus insulin
• Transfer evening basal insulin to morning
• Titrate morning dose 10-20% daily to BG target
Non-insulin dependent
• commence gliclazide 40mg once daily in the morning, increase to a maximum of 240mg to achieve BG target
• If maximum gliclazide dosage, commence evening dose of gliclazide or morning intermediate acting insulin
• commence gliclazide 40mg once daily in the morning, increase to a maximum of 240mg to achieve BG target
• If maximum gliclazide dosage, commence evening dose of gliclazide or morning intermediate acting insulin
Insulin dependent
Once daily insulin
• Transfer night time doses to the morning
• Titrate morning dose 10-20% daily to BG target
• Consider gliclazide +/- twice daily or basal bolus insulin if targets not achieved
Twice daily insulin
• increase morning dose 10-20% daily to achieve BG target
Glucocorticoid therapy stopped:
• Continue BG monitoring until normal glycaemia or definitive test for diabetes is taken
• Reduce sulfonylurea and insulin doses in tandem with reductions in glucocorticoid dosage

Glucocorticoid-induced hyperglycaemia

- Gliclazide 40 mg once daily in the morning is recommended and titrating as required until glycaemic control is achieved

- If at maximal dose of morning gliclazide, commence an additional evening dose of gliclazide or consider insulin therapy

- Consider SMBG or CGM

Glucocorticoid-induced hyperglycaemia – follow-up

- Up to a third of people with steroid-induced diabetes may go on to develop persistent diabetes

- Long-term use of steroids can lead to adverse cardiometabolic effects; >50% of individuals taking long-term steroids develop features of the metabolic syndrome

Identifying People at High Risk of Type 2 Diabetes

Medscape UK X Guidelines
Primary Care Hacks

Authors: Dr Kevin Fernando, Portfolio GP, East Lothian; Content Advisor, Medscape Global and UK (email: kfernando@webmd.net); **Dr Eimear Darcy**, GP Partner, Grange Family Practice, Omagh

What Is Prediabetes?

- Prediabetes refers to raised blood glucose levels above normal but not above the diagnostic threshold for T2D. **HbA_{1c} values of 42–47 mmol/mol indicate prediabetes**[1] and a **single test** is sufficient. People living with prediabetes have an increased risk of developing T2D
- Depending on what test is used, prediabetes can also be referred to as:[2]
  - **nondiabetic hyperglycaemia** (HbA_{1c} 42–47 mmol/mol[3])
  - **impaired fasting glucose** (FPG ≥6.1 and <6.9 mmol/l[4])
  - **impaired glucose tolerance** (2-hour oral glucose tolerance test ≥7.8 and <11.1 mmol/l[4])
- **Prediabetes is associated with an increased risk of all-cause mortality and CVD in the general population and in those with atherosclerotic CVD.**[5] This has implications for the screening and management of prediabetes in the primary and secondary prevention of CVD[6]
- **Prediabetes is more than just dysglycaemia.** A recent prospective cohort study found that reversion to normoglycaemia in those with prediabetes was only associated with lower risks of death and a longer life expectancy when accompanied by significant lifestyle change such as high levels of physical activity, not smoking, and maintaining a healthy bodyweight.[6]

Identifying Those at High Risk of T2D

NICE PH38 recommends a **two-stage strategy to identify people at high risk of T2D** (and those with undiagnosed T2D)[4]:

1. A **risk assessment** should be offered using a validated computer-based risk assessment tool that can use routinely available data from individuals' electronic health records, such as QDiabetes-2018
2. For those with high risk scores for developing T2D (e.g., QDiabetes score ≥10%), a **blood test for HbA_{1c}** should be offered

Additionally, if aged ≥25 years and of South Asian or Chinese descent with BMI >23 kg/m², there is no need to use a risk assessment tool; instead, directly offer an HbA_{1c} blood test.

Matching Interventions to Risk in People with Prediabetes[4,7,8]

Risk factors for developing T2D

- Obesity
- Family history of T2D
- GDM
- MASLD (formerly NAFLD; see also the Primary Care Hack on MASLD/MASH)
- CVD
- OSAHS
- Hypertension requiring treatment (see also the Primary Care Hack on lifestyle changes for managing hypertension)
- PCOS
- Learning disabilities
- SMI, e.g., bipolar disorder or schizophrenia
- Certain medications including regular steroids, statins, and atypical antipsychotics
- People in highly deprived socioeconomic situations

- People aged 25–39 years of South Asian, Chinese, Black African, African–Caribbean descent or other high-risk Black and minority ethnic groups
- A recent retrospective cross-sectional US study suggested the need for screening for T2D among high-risk Asian groups even at healthy BMI levels[7]

- People aged ≥40 years (except pregnant women)
- NICE PH38 stresses that nobody should be excluded from assessment on the basis of age, as everyone can reduce their risk, including those aged ≥75 years

Stage 1
- Use a risk assessment tool such as **QDiabetes-2018**
- If aged ≥25 years and of South Asian or Chinese descent with BMI >23 kg/m², omit the risk assessment tool and instead directly offer an HbA_{1c} blood test

If low or intermediate risk score, e.g. **QDiabetes-2018 <10%**, no HbA_{1c} blood test is required

Give brief advice on the risks of developing T2D and offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g. Diabetes UK's *Information prescriptions for people with diabetes*

Reassess risk at least every 5 years

If high risk score, e.g. **QDiabetes-2018 ≥10%**, offer HbA_{1c} blood test

If HbA_{1c} <42 mmol/mol, the individual is at **moderate risk** of developing T2D

Discuss brief advice on the risks of developing T2D

Offer a brief intervention to help them change their lifestyle, e.g. structured weight-loss programmes

Offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g. Diabetes UK's *Information prescriptions for people with diabetes*

Reassess risk at least every 3 years

If HbA_{1c} 42–47 mmol/mol, the individual is at **high risk** of developing T2D

If HbA_{1c} ≥48 mmol/mol, this is **suggestive of T2D**

Repeat HbA_{1c} blood test within 4 weeks to confirm diagnosis. If repeat HbA_{1c} ≥48 mmol/mol, a diagnosis of T2D is confirmed and should be managed as usual

If repeat HbA_{1c} <48 mmol/mol, follow recommendations below

Discuss brief advice on the risks of developing T2D

Offer referral to a local, evidence-based, quality-assured intensive lifestyle change programme to increase physical activity and achieve and maintain weight loss

Offer verbal and written information about culturally appropriate resources that could help them change their lifestyle, e.g Diabetes UK's *Information prescriptions for people with diabetes*

Offer an HbA_{1c} blood test and reassess weight at least annually

Special Populations of Note

People Living with an Eating Disorder

- The prevalence of T2D is higher in people with binge eating disorder than the general population[9]
- Additional caution should be taken discussing prediabetes and weight loss with people who are living with or suspected to have an eating disorder, as weight-loss interventions may be contraindicated and may exacerbate the condition.[9]

Gestational Diabetes

- **Women with a history of GDM are almost 10 times more likely to develop T2D** over their lifetime than women without a history of GDM[10]
- For women previously diagnosed with GDM and whose blood glucose levels return to normal after birth, NICE and SIGN both recommend:[11,12]
  - lifestyle advice (including weight management, diet, and exercise)
  - **offer an FPG 6–13 weeks after delivery** to exclude T2D (HbA_{1c} should not be used until 3 months postpartum but can be used if an FPG has not been carried out by 13 weeks). Practically, this can be part of the 6-week postnatal check
    - **if FPG <6.0 mmol/l** (HbA_{1c} <39 mmol/mol), there is a low probability of T2D. Lifestyle advice should be reinforced; ensure they are under recall for **lifelong annual HbA_{1c}** to check for progression to T2D
    - **if FPG 6.0–6.9 mmol/l** (HbA_{1c} 39–47 mmol/mol), the individual is at high risk of developing T2D and the *Matching Interventions to Risk* flowchart should be followed
    - **if FPG ≥7.0 mmol/l** (HbA_{1c} ≥48 mmol/mol), a diagnosis of T2D is likely and the *Matching Interventions to Risk* flowchart should be followed.

Polycystic Ovary Syndrome

- **Women living with PCOS are 1.4 times more likely to develop T2D** over their lifetime than women without PCOS[13]
- This increased risk is **independent of baseline bodyweight**;[13] NICE recommends assessing glycaemic status with an HbA_{1c} blood test at baseline in **all** women living with PCOS. Thereafter, glycaemic assessment should take place **every 1–3 years lifelong**, depending on the presence of other risk factors for developing T2D.[14]

People Living with Severe Mental Illness

- **People living with SMI are 1.3 times more likely to develop T2D** over their lifetime than people without SMI[15]
- The *Lester UK adaptation: positive cardiometabolic health resource* 2023 update gives recommendations relating to monitoring physical health in people living with SMI such as psychosis and schizophrenia.[15] The aim of this resource is to help reduce the **health inequality of a 15–20-year mortality gap** in people living with SMI[16]
- For all people in the 'red zone' as depicted in the *Lester UK adaptation* intervention framework for people experiencing psychosis and schizophrenia, including those with HbA_{1c} ≥42 mmol/mol: **don't just screen, intervene!**
- Care should always be person-centred, tailoring discussion to the needs of the person to enable shared decision-making. Refer for investigation, diagnosis, and treatment as appropriate
- For those at high risk of T2D (HbA_{1c} of 42–47 mmol/mol), offer referral to an evidence-based lifestyle change programme. If ineffective, offer metformin modified release if safe and appropriate. Aim for HbA_{1c} <42 mmol/mol.

Metformin

- NICE recommends using clinical judgement on whether (and when) to offer metformin to support lifestyle changes in people at risk of T2D with rising HbA_{1c} blood tests. Consider metformin if:[4]
  - HbA_{1c} continues to rise despite participation in an intensive lifestyle change programme
  - the individual is unable to participate in a lifestyle change programme, particularly if BMI is >35 kg/m²
- If commencing metformin, **start low and go slow**, e.g. 500 mg once daily and increase gradually as tolerated to 2000 mg daily. If the individual is intolerant of standard-release metformin, consider using modified-release metformin[4]
- Prescribe metformin for 6–12 months initially. Check HbA_{1c} at 3-month intervals and stop metformin if no benefit is seen.[4]

Managing Prediabetes—Key Interventions

- By making changes to diet, increasing physical activity, and losing weight, **around half of cases of T2D can be prevented or delayed**[17]
- Review coexisting risk factors such as blood pressure, lipids, and smoking status
- Pharmacological interventions, most notably incretin therapies, may be appropriate as an adjunct to a reduced-calorie diet and increased physical activity for weight management in adults with overweight or obesity[18]—see also the Primary Care Hack on liraglutide, semaglutide, and tirzepatide for managing overweight and obesity in primary care
- Bariatric and metabolic surgery may also be appropriate for certain individuals; referral for MDT assessment is recommended if a person has prediabetes, has received optimal nonsurgical weight-management treatment, has a BMI >35 kg/m² (or 32.5 kg/m² in people with a South Asian, Chinese, other Asian, Middle Eastern, Black African, African–Caribbean, or Arab family background), and agrees to adhere to the requirements for long-term follow up[19]
- Also see *Metformin*, above
- In the SURMOUNT-1 trial, 3 years of treatment with tirzepatide in people living with obesity and prediabetes resulted in significant and sustained weight reduction (nearly 20% with tirzepatide 15 mg) and 90% fewer new diagnoses of T2D compared to placebo.[20]

Clinical Coding

- SIGN recommends a more uniform approach to coding in primary care of those at high risk of T2D:[8]
  - consider maintaining a register of people at high risk of developing T2D and offering then an annual review. This annual review should also cover any coexisting cardiometabolic long-term conditions
  - a single read code (**C11y500—'pre-diabetes'**) is recommended for all cases of prediabetes, including impaired glucose tolerance, impaired fasting glucose, and nondiabetic hyperglycaemia
  - the additional recall code is recommended to ensure that these individuals are properly followed up (**66Az—'high risk of diabetes annual review'**).

Useful Resources

For Patients

- Diabetes UK: *Prediabetes*
- Diabetes UK: *Weight loss and diabetes*
- Diabetes UK: *Type 2 diabetes—know your risk*
- QDiabetes-2018 risk calculator
- Diabetes Research Centre: *Could you have type 2 diabetes?*
- Diabetes Scotland: *Your guide to type 2 diabetes*
- NHS Lose Weight website.

For Healthcare Professionals

- Diabetes UK: *Information prescriptions for healthcare professionals*
- *UK Chief Medical Officers' physical activity guidelines*
- Gardner M, Wang J, Hazlehurt J et al. Risk of progression from prediabetes to type 2 diabetes in a large UK adult cohort. *Diabet Med* 2023; **40**(3): e14996.
- Public Health Scotland: *Challenging weight stigma learning hub*
- Babysteps online programme for GDM.

Abbreviations
BMI=body mass index; **CVD**=cardiovascular disease; **FPG**=fasting plasma glucose; **GDM**=gestational diabetes mellitus; **HbA_{1c}**=glycated haemoglobin; **MASH**=metabolic dysfunction-associated steatohepatitis; **MASLD**=metabolic dysfunction-associated steatotic liver disease; **MDT**=multidisciplinary team; **NAFLD**=nonalcoholic fatty liver disease; **OSAHS**=obstructive sleep apnoea/hypopnoea syndrome; **PCOS**=polycystic ovary syndrome; **PH**=Public Health Guideline; **SIGN**=Scottish Intercollegiate Guidelines Network; **SMI**=severe mental illness; **T2D**=type 2 diabetes.

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@GLNS_Medscape @drkevinfernando medscape.co.uk/guidelines

For references and to view this Primary Care Hack online, go to: medscape-uk.co/Hack-prediabetes

Last updated: April 2025.

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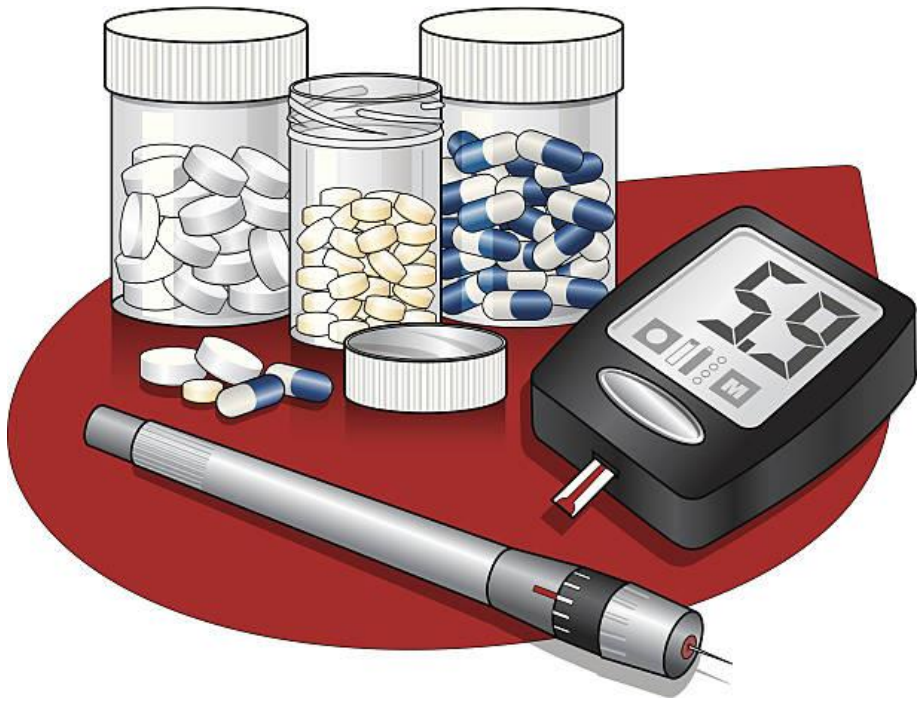
LADA



Latent Autoimmune Diabetes in Adults

- **LADA is essentially a "slow-onset" T1D**
- Often mistaken for T2D
  - Can have features of both T1D & T2D
- **Accurate diagnosis is crucial to prevent DKA**

Latent Autoimmune Diabetes in Adults

- More than 40% of patients with T1D presenting after age 30 are initially misclassified and treated as patients living with T2D
- Are typically younger and leaner and require insulin sooner in their treatment course than patients with T2D
- Have a higher risk of microvascular complications than patients with T2D, due to differences in glycaemic control

The Diagnosis and Classification of Diabetes in Primary Care

Medscape UK X Guidelines
Primary Care Hacks

Author: Dr Kevin Fernando, GP Partner, North Berwick Health Centre; Content Advisor, Medscape Global and UK. Email: kfernando@webmd.net

	T1D	LADA	T2D	Monogenic Diabetes	GDM	T3cD (Pancreatogenic)
Pathophysiology	Autoimmune destruction of pancreatic beta cells Clinical diagnosis ± PG and ketone levels. Urgent specialist discussion required It is increasingly challenging to differentiate T1D from T2D, partly due to the obesity epidemic. Often the safest strategy is to presume T1D until proven otherwise See this BMJ article on new advances in T1D	LADA is essentially 'slow-onset' T1D Gradual autoimmune destruction of pancreatic beta cells. Diagnosis and management similar to T1D See this international consensus statement on the management of LADA and this Cardi-OH resource on the diagnosis and treatment of LADA See also this article on differentiating LADA from other forms of diabetes	R with relative insulin deficiency T2D is usually diagnosed when HbA$_{1c}$ ≥48 mmol/mol. If use of HbA$_{1c}$ is inappropriate (e.g. pregnant women, genetic variants [HbS or HbC trait], acute or chronic blood loss, end-stage kidney disease) then T2D is diagnosed by an FPG ≥7 mmol/l If asymptomatic, the diagnosis should never be based on a single abnormal HbA$_{1c}$ or PG level; at least one additional abnormal test is essential See this Lancet article on T2D	Genetic mutation leading to diabetes. The most common is MODY See diabetesgenes.org for diagnosis guidance	Impaired glucose tolerance in pregnancy due to pancreatic beta-cell dysfunction on background of IR NICE NG3[1] diagnostic criteria: FPG ≥5.6 mmol/l or 2-hour PG post-75-g OGTT ≥7.8 mmol/l, i.e. much lower than the diagnostic criteria for non-pregnant individuals Some areas use FPG levels ≥5.1 mmol/l, as any degree of hyperglycaemia in pregnancy increases the risk of both adverse fetal and maternal outcomes	Diabetes associated with disease, trauma, or surgery of the exocrine pancreas Causes include acute and chronic pancreatitis, pancreatic surgery, CF, haemochromatosis, and pancreatic cancer See Pancreatic Cancer Action's information on T3cD and this factsheet on the recognition and management of T3cD Often misdiagnosed as T2D
Age at Diagnosis	Usually <25 years bu can occur at any age	Can occur at any adult age Often initially mistaken for T2D	Both adults and children at any age	MODY onset often during 2nd to 5th decades and usually <45 years	Can occur in any women of childbearing age Women with GDM have a nearly 10-fold higher risk of developing T2D[2] Follow up after delivery: women require lifelong annual HbA$_{1c}$ (NICE NG3)[1]	Both adults and children at any age Exclude pancreatic cancer in those >60 years (NICE NG12)[3] or >55 years (*Scottish referral guidelines for suspected cancer*)[4] with new-onset diabetes and unexplained weight loss
Weight at Diagnosis	Usually underweight but can occur at any weight Marked weight loss common	Variable	Usually overweight	Variable	RFs for GDM include overweight/obesity but baseline weight can be variable	Variable
Family History of Diabetes	Infrequent (5–10%)	Variable	Frequent (75–90%)	Multigenerational MODY is AD Strong FH of diabetes (any type) involving two or three consecutive generations may point towards a diagnosis of MODY	FH of diabetes is an important RF for GDM	Variable Haemochromatosis and CF are AR

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Family History of Diabetes	Infrequent (5–10%)	Variable	Frequent (75–90%)	Multigenerational MODY is AD Strong FH of diabetes (any type) involving two or three consecutive generations may point towards a diagnosis of MODY	FH of diabetes is an important RF for GDM	Variable Haemochromatosis and CF are AR
History of Autoimmune Disease	Often personal or FH, e.g. thyroid and coeliac disease	Variable	Variable	Variable	Variable	Variable but often PEI present, e.g. diarrhoea and steatorrhoea, abdominal discomfort, flatulence, and bloating Check stool sample for faecal elastase-1. Low levels suggestive of PEI
Pancreatic Autoantibodies	Present	Present	Absent	Absent	Absent	Absent
C-peptide Levels	Low/absent	Initially normal then low/absent	Normal to high	Normal	Normal to high	Low
Insulin Sensitivity	Normal when treated	Normal when treated	Reduced	Normal (maybe reduced if obese)	Reduced	Compensatory increase in peripheral insulin sensitivity
Insulin Requirements	Immediate; specialist input urgently required	Latent; months to years	Variable	Variable	Variable	Variable Much more likely to need insulin within 5 years of diagnosis
Risk of DKA	High	Low initially but high once insulin-deficient	Low but euglycaemic DKA is a rare side effect of SGLT2is. See the *Guidelines* Primary Care Hack, *What Next After Metformin? Part 2*	Low	Low	Low but hypoglycaemia is common and can be prolonged

Table based on the author's clinical experience and appraisal of the literature.

Commonly Used Drugs That Can Induce Hyperglycaemia or Cause Diabetes

- Corticosteroids e.g. prednisolone, dexamethasone (see Useful Resources for more information)
- Thiazide diuretics e.g. bendroflumethiazide, indapamide
- Beta-blockers e.g. atenolol, propranolol
- Antipsychotics e.g. olanzapine, quetiapine, risperidone
- Statins—especially higher-potency statins.

Useful Resources

- Barker et al: *Practical guide to glucocorticoid induced hyperglycaemia and diabetes*
- Joint British Diabetes Societies for Inpatient Care: *Management of hyperglycaemia and steroid (glucocorticoid) therapy*
- Diabetes UK: *Steroid-induced diabetes*
- The *Guidelines* Primary Care Hack, *Identifying People at High Risk of Type 2 Diabetes* and other Primary Care Hacks.

Abbreviations
AD=autosomal dominant; **AR**=autosomal recessive; ***BMJ***=*British Medical Journal*; **CF**=cystic fibrosis; **DKA**=diabetic ketoacidosis; **FH**=family history; **FPG**=fasting plasma glucose; **GDM**=gestational diabetes mellitus; **HbA_{1c}**=haemoglobin A_{1c}; **HbC**=haemoglobin C; **HbS**=haemoglobin S; **IR**=insulin resistance; **LADA**=latent autoimmune diabetes in adults; **MODY**=maturity onset diabetes of the young; **NG**=NICE Guideline; **OGTT**=oral glucose tolerance test; **PEI**=pancreatic exocrine insufficiency; **PG**=plasma glucose; **RF**=risk factor; **SGLT2i**=sodium–glucose co-transporter-2 inhibitor; **T1D**=type 1 diabetes; **T2D**=type 2 diabetes; **T3cD**=type 3c diabetes.

For references and to see the latest updates, view this Primary Care Hack online at medscape-uk.co/Hack-diabetes

Last updated: November 2023 (reviewed November 2024).

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Monogenic Diabetes

Monogenic diabetes

- A cluster of genetic mutations characterised by beta-cell dysfunction & diabetes
  - 1-2% of those with diabetes

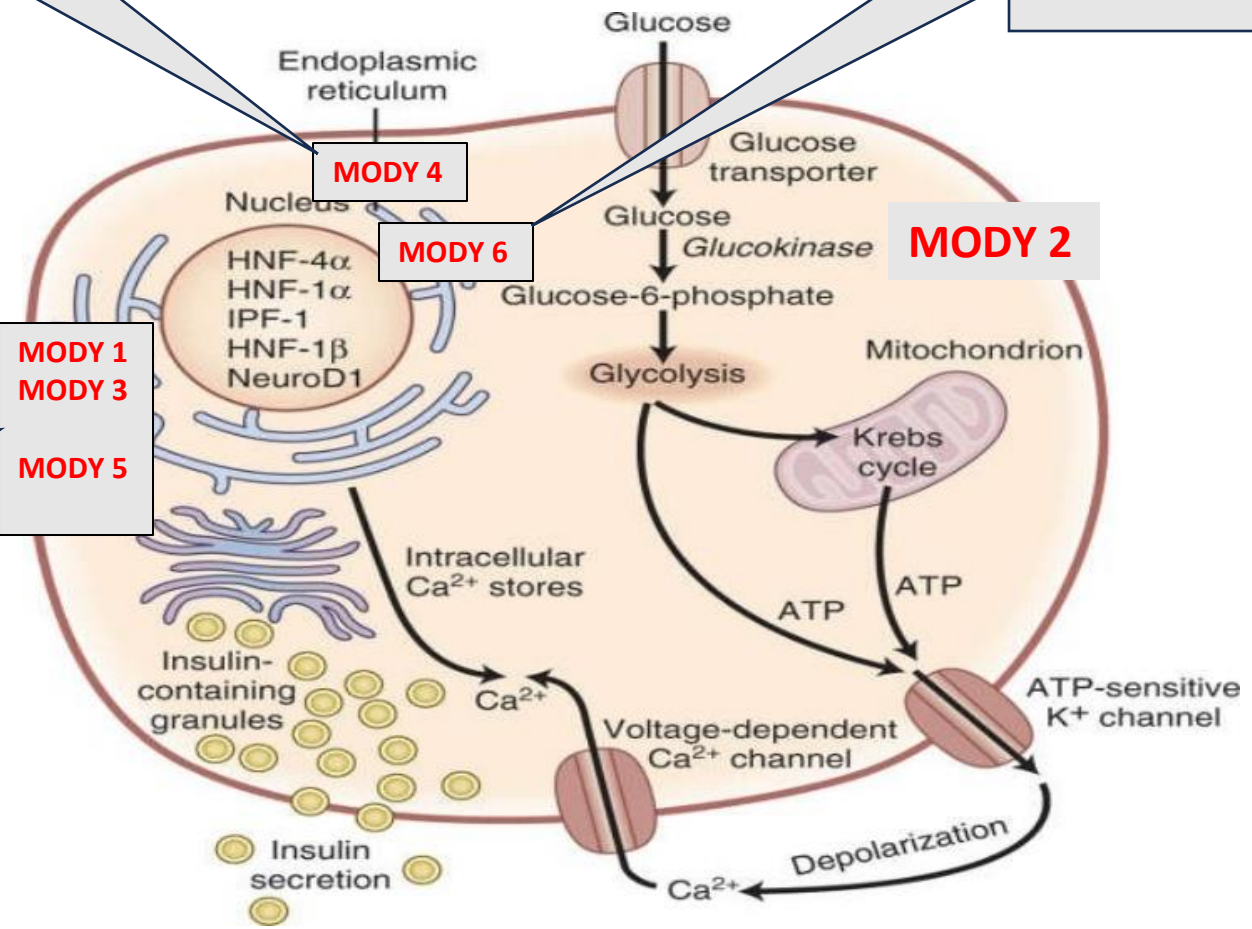
- Commonest form is maturity onset diabetes of the young (MODY)
  - Over 6 subtypes identified & most **autosomal dominant**

MODY types

glucose-induced stimulation of insulin gene transcription

Activates transcription of insulin gene

Mutations result in defects of insulin secretion response to glucose



Monogenic diabetes

- Many forms of MODY can be treated with either oral medication or simply diet alone

Monogenic diabetes

- Features that may point towards a diagnosis of MODY:
  - A strong FH of diabetes (any type) involving 2, or ideally 3 consecutive generations i.e. multigenerational
  - Age of onset 2nd-5th decades, usually <45y
  - Absence of features of insulin resistance
  - Pancreatic antibodies absent & c-peptide levels normal
  - T1D: hyperglycaemia initially easy to control & no history of DKA

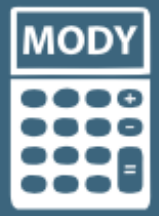
- Useful resources:
  - www.diabetesgenes.org
  - BMJ 2011 algorithm

Other Rare Types of Diabetes

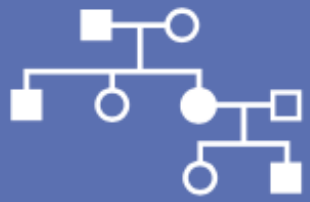
DiabetesGenes

Search...

Providing information for patients and professionals on research and clinical care in genetic types of diabetes



What Type Of Diabetes?



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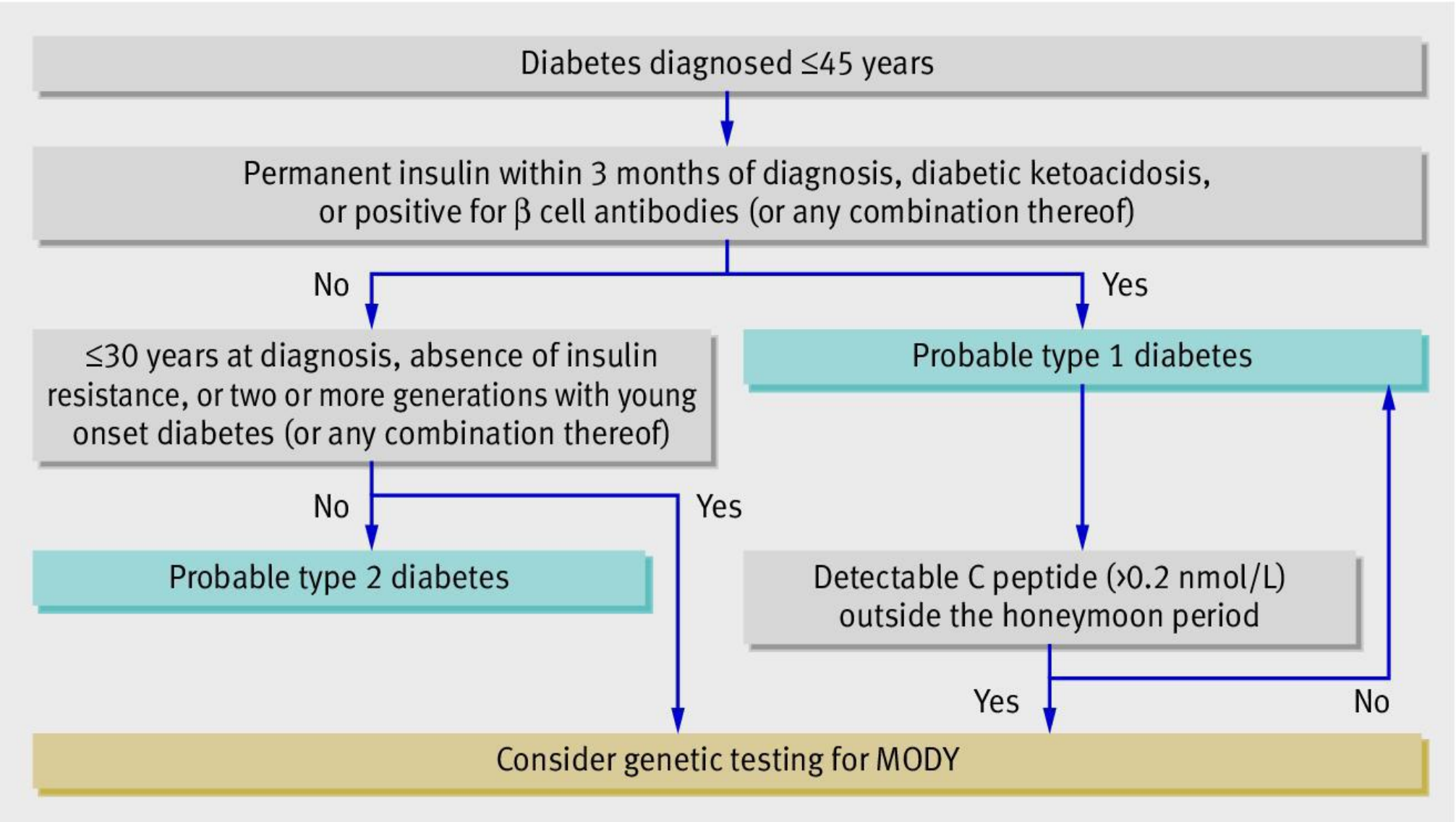
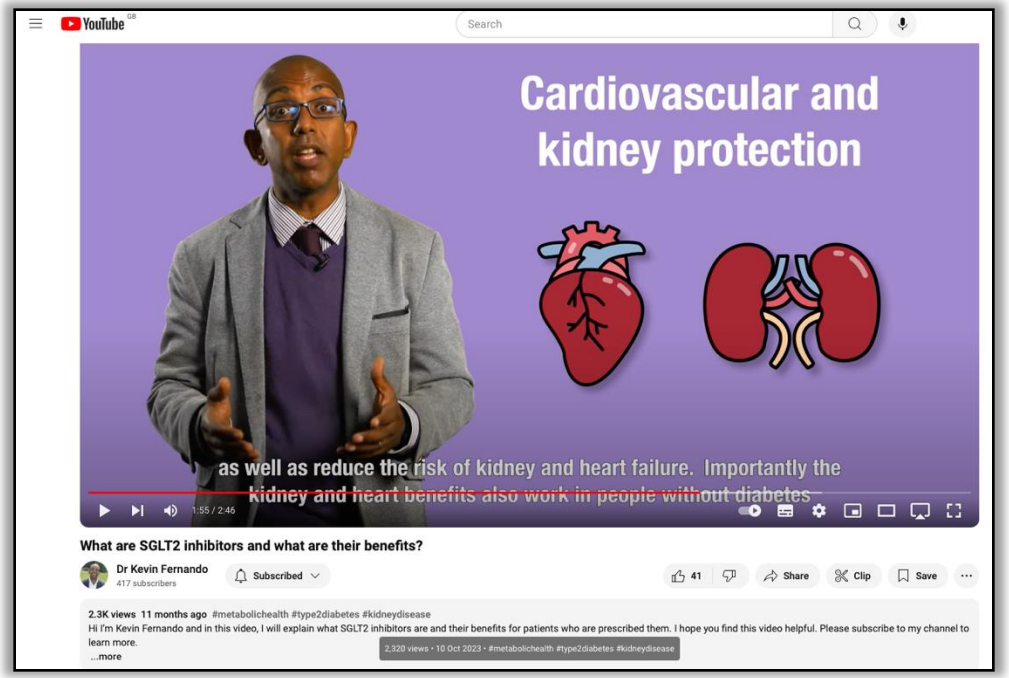
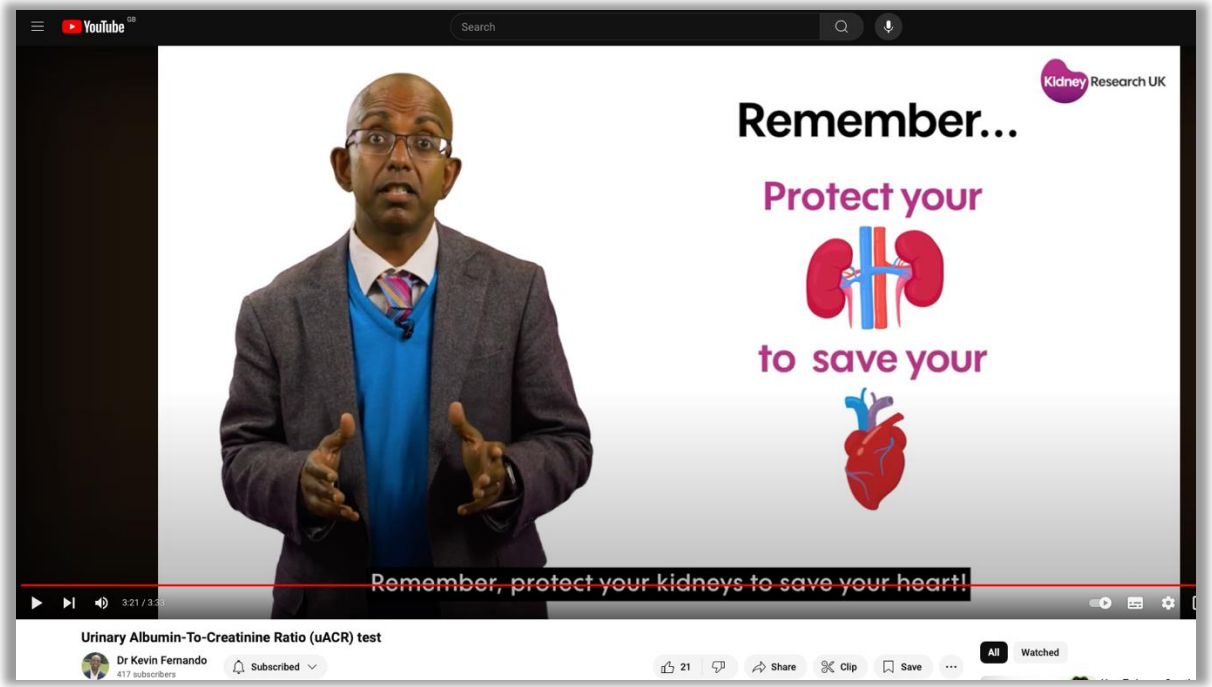
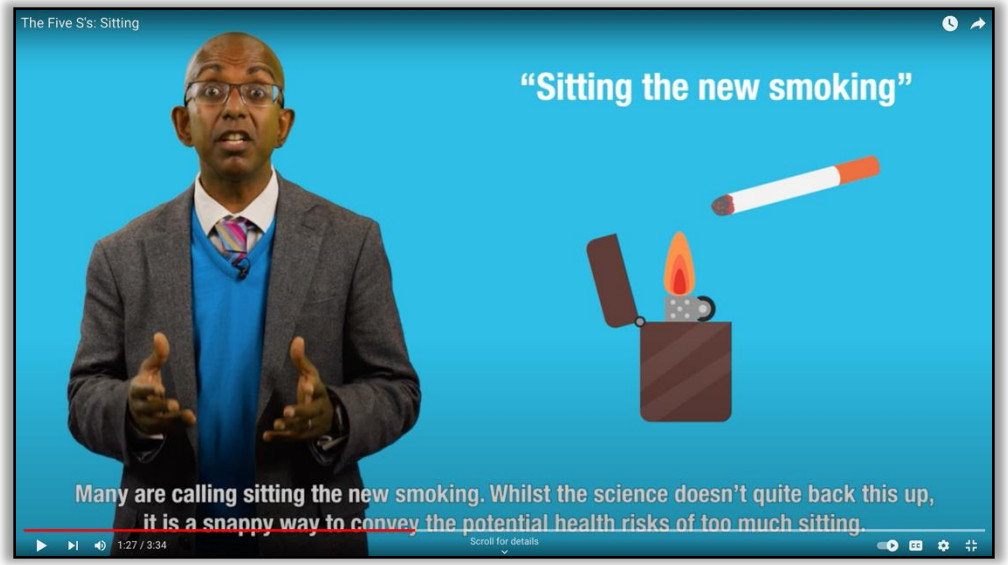


Gaya Thanabalasingham, and Katharine R Owen BMJ 2011;343:bmj.d6044







YouTube @DrKevinFernando

Use of Liraglutide, Semaglutide, and Tirzepatide for Adults Living With Overweight and Obesity

Medscape UK X Guidelines
Primary Care Hacks

Authors: Dr Kevin Fernando, GP Partner, North Berwick Health Centre and Content Advisor, Medscape Global and UK (email: kfernando@webmd.net); Dr Eimear Darcy, GP Partner, Grange Family Practice Omagh

Incretin Therapy	Indication	Standard Dose Escalation Schedule (in Weeks)								Further Considerations (see also *Prescribing Considerations and Special Precautions for Use*)
		1	2	3	4	5–8	9–12	13–16	17–20	21–24	
Liraglutide (Saxenda®)[3,4]	Weight management, as an adjunct to a reduced-calorie diet and increased physical activity in adults with an initial BMI of: • ≥30 kg/m², or • 27–30 kg/m² in the presence of ≥1 weight-related comorbidity.[A,B]	0.6 mg (od)[C]	1.2 mg (od)[C]	1.8 mg (od)[C]	2.4 mg (od)[C]	3.0 mg (od)[C]					• No dose adjustment is required according to age, but therapeutic experience is limited in patients aged ≥75 years and use is not recommended in these patients • No dose adjustment is required in mild/moderate renal impairment (CrCl ≥30 ml/min) or mild/moderate hepatic impairment • Avoid in severe renal impairment (CrCl <30 ml/min), including ESRD • Not recommended in patients with severe hepatic impairment; should be used cautiously in mild/moderate hepatic impairment.
Semaglutide (Wegovy®▼)[5–8]	Weight management, as an adjunct to a reduced-calorie diet and increased physical activity in adults with an initial BMI of: • ≥30 kg/m², or • 27–30 kg/m² in the presence of ≥1 weight-related comorbidity.[A,D,E] To reduce the risk of major adverse CV events in adults with established CVD and BMI ≥27 kg/m²,[A] as an adjunct to a reduced-calorie diet and increased physical activity.	0.25 mg (once weekly)				0.5 mg (once weekly)	1.0 mg (once weekly)	1.7 mg (once weekly)	2.4 mg (once weekly)[D]		• No dose adjustment is required according to age, but there is limited therapeutic experience in patients aged ≥85 years • No dose adjustment is required in mild/moderate/severe renal impairment; avoid in ESRD (eGFR <15 ml/min/1.73 m²) • No dose adjustment is required in hepatic impairment; exercise caution when prescribing in severe hepatic impairment.
Tirzepatide (Mounjaro®▼)[9,10]	Weight management, as an adjunct to a reduced-calorie diet and increased physical activity in adults with an initial BMI of: • ≥30 kg/m², or • 27–30 kg/m² in the presence of ≥1 weight-related comorbidity.[A,F]	2.5 mg (once weekly)				5 mg (once weekly)	7.5 mg (once weekly)[D]	10 mg (once weekly)[D]	12.5 mg (once weekly)[D]	15 mg (once weekly)[D]	• No dose adjustment is required according to age, but there are limited data available for patients aged ≥85 years • No dose adjustment is required in renal impairment (including ESRD) • No dose adjustment is required in hepatic impairment; exercise caution when prescribing in severe hepatic impairment.

Footnotes
[A] **NICE recommends lower BMI thresholds (usually, reduced by 2.5 kg/m²) for people of South Asian, Chinese, other Asian, Middle Eastern, Black African, or African–Caribbean family backgrounds**[1,7,18]
[B] NICE TA664[A] recommends liraglutide for overweight or obesity if it is prescribed by a specialist, multidisciplinary, tier-3 weight-management service and is provided according to the commercial arrangement for the drug. NICE recommends provision in patients with all of the following: a BMI of ≥35 kg/m²; nondiabetic hyperglycaemia (HbA$_{1c}$ of 42–47 mmol/mol or fasting plasma glucose of 5.5–6.9 mmol/l); and high risk of CVD, based on risk factors.[4] After 12 weeks of treatment with the 3.0 mg/day dose, treatment should be discontinued if patients have not lost ≥5% of their initial bodyweight[3]
[C] If escalation to the next dose is not tolerated for 2 weeks consecutively, consider discontinuing treatment[C]
[D] NICE TA875[F] recommends semaglutide if it is used for a maximum of 2 years, is prescribed within a specialist weight-management service providing multidisciplinary management, and is provided according to the commercial arrangement for the drug; NICE recommends provision in patients with ≥1 weight-related comorbidity and either a BMI ≥35 kg/m² or a BMI of 30–34.9 kg/m² if the patient meets the criteria for referral to specialist weight-management services in NICE NG246;[7,13A] if weight loss is <5% of initial weight after 6 months of treatment, consider stopping semaglutide;[7] as the SELECT trial has demonstrated CV benefits of semaglutide irrespective of weight loss, it may be worth considering continuation independent of weight loss when used for CV indications[8]
[E] If semaglutide is not tolerated at 2.4 mg, maintain at 1.7 mg for 4 more weeks then re-escalate afterwards[D]
[F] NICE TA1026[10] recommends prescribing tirzepatide for adults with a BMI of ≥35 kg/m² and ≥1 weight-related comorbidity;[A] if weight loss is <5% of initial weight after 6 months of treatment, consider stopping tirzepatide
[G] Individualise tirzepatide above 5 mg depending on individual treatment goals, increasing dose by 2.5 mg after ≥4 weeks at current dose; 5 mg, 10 mg, and 15 mg are the recommended maintenance doses.[9]

This table is based on the authors' interpretation of summaries of product characteristics and relevant guidance. HCPs are asked to report all suspected adverse drug reactions to products with a Black Triangle symbol (▼) through the Yellow Card Scheme: yellowcard.mhra.gov.uk.

Brand Names of Incretin Therapies for Different Indications[3,5,9,12–15]

Drug	Brand Name (Maximum Dose) for Weight Management	Brand Name (Maximum Dose) for T2D	Notes
Liraglutide	Saxenda® (up to 3.0 mg daily)	Victoza® (up to 1.8 mg daily)	• Liraglutide is also now available as an authorised generic in US markets (for T2D).[13]
Semaglutide	Wegovy®▼ (up to 2.4 mg weekly)	Ozempic® (up to 2.0 mg weekly)	—
Tirzepatide	Mounjaro®▼ (up to 15 mg weekly)		• In the UK, tirzepatide is currently only branded as Mounjaro®▼ • In the US, the FDA has approved Mounjaro®▼ for T2D and Zepbound® for weight management.[15]

Practical Considerations—Injection, Storage, Driving[3,5,9]

- Incretin therapies are injected **subcutaneously** in the **abdomen, thigh, or upper arm**
- Needles must be prescribed separately for liraglutide and tirzepatide when used for weight management; 4 mm needles will usually be suitable
- **Injection sites should be rotated**
  - if the individual also injects insulin, they should inject the incretin therapy into a different site
- Do not forget to issue a **sharps bin**—a 1.8-litre bin is usually adequate
- Store incretin therapies in a refrigerator at 2–8°C, away from the cooling element; do not freeze incretin therapies
  - **liraglutide:** after first use, store at <30°C (preferably, at 2–8°C in a refrigerator); pens should be discarded after 30 days, even if they still contain medication
  - **semaglutide:** after first use, store at <30°C (preferably, at 2–8°C in a refrigerator) for up to 6 weeks
  - **tirzepatide:** may be stored unrefrigerated for ≤30 days at <30°C
- **Incretin therapies have a negligible impact on the ability to drive or use machines**
  - however, if using incretin therapies alongside insulin or SUs, the usual advice and precautions should be given to avoid hypoglycaemia when driving or operating machinery. Ensure adherence with DVLA requirements.

Behavioural Modifications and Interventions[3,5,9,11,16–25]

- **Consider recommending behavioural modifications to all people with overweight or obesity**
  - offer a brief intervention to people living with overweight or obesity, using ASK, ASSESS, ADVISE, AGREE, and ASSIST;[16] see also PHE guidance
  - be aware of weight bias and stigma during these discussions
- Adequate support of behavioural modifications, as well as mental health care, needs to be considered **during** and **before** incretin therapy initiation
- Consider **multicomponent interventions**, involving behaviour modification strategies and motivational interviewing; key areas to support include:
  - nutrition (including eating behaviours and diet content)
  - **increased** physical activity (including maintenance of muscle mass)—discuss the importance of resistance training to aid preservation of muscle mass and function
  - **stress management**
  - **sleep health**
- Set **personalised goals** that are realistic and achievable
  - use a SMART goal-setting framework[25]
- Behavioural modifications should focus on **whole health gain**, not just weight loss, as this approach has been shown to improve long-term weight and behavioural outcomes[24]
- **Be aware that mental illness can impact obesity management efforts;** screen patients for potential mental illnesses that need to be addressed.[20]

Women's Health and Incretin Therapies[3,5,9]

- **Incretin therapies are not recommended during breastfeeding and pregnancy**
  - **women of childbearing potential should use contraception**
- For women planning pregnancy:
  - liraglutide: discontinue before attempting to conceive
  - semaglutide: discontinue ≥2 months before attempting to conceive
  - tirzepatide: discontinue ≥1 month before attempting to conceive
- **Specific OCP advice for tirzepatide:**
  - **women with a normal BMI:** no dose adjustment of OCP is required
  - **women with obesity or overweight:** switch to a non-oral contraceptive method, or add a barrier method of contraception upon initiation or dose escalation of tirzepatide (for 4 weeks).

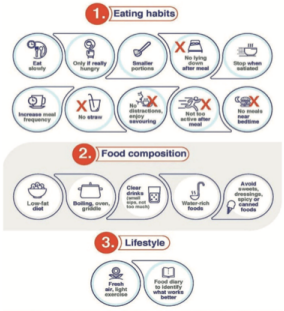
Side Effects[3,5,6,9,26–31]

- The side effects of incretin therapies can lead to nonadherence and discontinuation—in one study of GLP-1 RA use, 21.2% of people had discontinued therapy by 12 months and only 48.6% were adherent[26]
- **The most common adverse effects (prevalence ≥10%) are mostly GI in nature.** GI side effects mostly occur during dose escalation, usually fade with time, and are typically mild/moderate in severity
  - examples include nausea, vomiting, diarrhoea, constipation, abdominal pain, abdominal distension, dyspepsia, flatulence, and belching
- Hair loss (likely due to telogen effluvium; usually transient and reversible),[27,28] fatigue, headache, dizziness, and a small increase in resting HR (around 3 bpm on average, and not clinically significant) can also commonly occur.

Managing GI Side Effects

- **Incretin therapies should be used with caution in people with severe GI disease**, e.g. severe gastroparesis
- **GI side effects are dose-dependent, so consider slower dose escalation or drug holidays** (temporary cessation of incretin therapy) for those who are struggling with GI side effects in the early weeks of therapy
  - a lower maintenance dose can be considered for individuals unable to tolerate the usual maintenance dose
- Advise patients reporting GI side effects to adopt the following mitigating strategies:
  - eat slowly, stop eating as soon as you start to feel full, and avoid eating when not feeling hungry
  - eat smaller portion sizes and eat more frequently during the day, but avoid eating late in the day
  - maintain good hydration, aiming for ≥2–3 litres of fluids daily (not including alcohol)
    - limit intake of alcohol and fizzy drinks, especially if experiencing nausea or dyspepsia
  - avoid eating high-fat, ultra-processed, and spicy foods
  - increase fibre and water intake if experiencing constipation
  - consider short-term use of PPIs, antiemetics, laxatives, and antidiarrhoeal medications for those with disabling side effects
- Consider alternative causes of GI symptoms if persistent despite mitigation strategies, or if red-flag features are present.

Minimising Occurrence/Severity of GI Adverse Effects: General Guidance[29]



Gorgojo-Martínez J, Mezquita-Raya P, Carretero-Gómez J et al. Clinical recommendations to manage gastrointestinal adverse events in patients treated with glp-1 receptor agonists: a multidisciplinary expert consensus. *J Clin Med* 2022; **12** (1): 145.

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Advice for Missed Doses[3,5,9,31]

	Day of Usual Administration	Number of Days After Missed Dose					
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Semaglutide	Missed dose	Administer catch-up dose as soon as possible (within 5 days)				Skip dose and administer next dose on usual day	
Tirzepatide	Missed dose	Administer catch-up dose as soon as possible (within 4 days)				Skip dose and administer next dose on usual day	

After a dose of semaglutide or tirzepatide is missed (regardless of whether a catch-up dose is taken), individuals can then resume their regular once-weekly dosing schedule.
Note: the time between any two doses must always be ≥72 hours.

	0–12 hours after a missed dose	12–24 hours after a missed dose
Liraglutide	Administer catch-up dose as soon as possible	Skip dose and administer next dose on usual day

If >3 days have elapsed since the last dose, reinitiate liraglutide at 0.6 mg daily and follow the usual dose escalation schedule.[31]

Special Considerations for People With T2D and Overweight/Obesity[3,5,9,12,14,37–41]

- Incretin therapies are **not** currently licensed for use in people with T1D and overweight/obesity
- Based on the findings of a systematic review and meta-analysis, people **without** T2D may achieve significantly greater mean weight loss with GLP-1 RAs than people **with** T2D[39]
- **Risk of hypoglycaemia is low if the incretin therapy is not used alongside insulin or SUs**
  - people with T2D taking insulin or SUs may need to lower the dosage of these medications initially when starting incretin therapies, to reduce the risk of hypoglycaemia
  - SMBG is necessary when adjusting the dose of SU or insulin, and a stepwise approach to insulin reduction is recommended
- **DKA risk**
  - the MHRA (2019)[38] warns of reports of DKA when insulin is rapidly reduced or discontinued alongside GLP-1 RAs
  - any dose reduction of insulin should be done in a stepwise manner, with careful SMBG
- **Retinopathy—be aware that pre-existing DR may be worsened if HbA$_{1c}$ is rapidly lowered on initiation or escalation of incretin therapy**
  - use all incretin therapies with caution in patients who have DR requiring active ophthalmology follow up, suboptimal glycaemic control (HbA$_{1c}$ ≥86 mmol/mol), and are currently being treated with insulin[39–41]
  - ensure that all people living with T2D being considered for incretin therapies are up to date with retinal screening.

Prescribing Considerations[3,5,9,31–36]

- Incretin therapies can be administered at any time of the day, with or without meals
  - injections of semaglutide and tirzepatide should be scheduled on the same day each week, but the time can be varied
  - if a change of day is required for semaglutide or tirzepatide, **the time between the two doses during transition must be ≥3 days (≥72 hours)**
- **All incretin therapies delay gastric emptying and therefore have the potential to impact the absorption of coadministered oral medications;** however, no dose adjustments are required for most oral medications
  - if individuals are taking oral medications with a **narrow therapeutic index** (e.g. digoxin, lithium, warfarin), closer monitoring may be warranted according to clinical judgement
  - **specific OCP advice is required for tirzepatide** (see *Women's Health and Incretin Therapies*)
- **Sick day guidance** may be required:[32,33] during any intercurrent dehydrating illness (e.g. diarrhoea or vomiting), a temporary pause of incretin therapy may be required to avoid worsening of any GI or other symptoms
  - the incretin therapy can be restarted when the patient is eating and drinking as normal and recovered from illness
- Incretin therapies can be used as adjunctive treatment after bariatric surgery for those with suboptimal weight loss or weight regain, offering a viable alternative to revision surgery.[34] However, this approach should be discussed with a specialist in bariatric surgery and medicine
- **Contraindications:**
  - hypersensitivity to the active substance or any of the excipients present in the incretin therapy
  - according to the US SPCs, all incretin therapies are contraindicated in individuals with MEN2 or with a personal or family history of MTC[35]
    - however, a 2023 systematic review and meta-analysis found that **semaglutide use in RCTs and real-world studies was not associated with an increased risk of any types of cancer (including pancreatic and thyroid cancer).**[36]

Special Precautions for Use[3,5,9,42]

Adverse Effect	Frequency	Notes
Acute pancreatitis	≤1% (uncommon)	• Use with caution in people with a history of pancreatitis • Discontinue if pancreatitis is suspected.
Acute gallbladder disease (cholelithiasis, cholecystitis)	≤1% (uncommon)[A]	• Significant or rapid weight loss can increase the risk of gallstones[42] • If gallbladder disease is suspected, consider gallbladder imaging and appropriate clinical follow up as indicated.[42]
Pulmonary aspiration	—	• Cases of pulmonary aspiration have been reported in people undergoing GA or deep sedation who are receiving incretin therapies • Before such procedures, the increased risk of residual gastric content (due to delayed gastric emptying) should be considered.

[A] Cholelithiasis is listed as a common (≤10%) adverse effect of semaglutide[42] and liraglutide.[3]

Follow Up[3,7,10,11,17,43–48]

- **Provide long-term, multicomponent, multimodal, multidisciplinary follow up to all people living with overweight or obesity**
- **Set personalised goals that:**
  - emphasise long-term, realistic, sustained weight loss
  - promote weight maintenance and prevention, improvement, and resolution of obesity-related complications
- Consider agreeing a realistic 'best weight' (i.e. a weight that a person can achieve and maintain in the context of their life circumstances)[43]
- **Evaluation of response to incretin therapies is crucial:**
  - consider intensification of therapy or additional therapeutic options (e.g. metabolic surgery) if individualised goals are not achieved
  - consider stopping incretin therapies if <5% of the initial weight has been lost after 6 months of the highest tolerated dose of tirzepatide or semaglutide, or after 12 weeks of the highest tolerated dose of liraglutide[3,7,10]
  - ensure appropriate/optimal prescribing; consider deprescribing medications that may no longer be indicated due to the health benefits of weight loss (e.g. antihypertensives)
  - consider reassessing goals of therapy during treatment course
  - long-term use of pharmacotherapy is recommended
- **Explain that regular physical activity is beneficial for weight maintenance** and improves cardiometabolic risk factors, health-related quality of life, and mood disorders[44]
  - in weight management interventions, aerobic and resistance exercise supports improvements in cardiorespiratory fitness, mobility, strength, and **muscle mass**; support strategies to minimise muscle loss
  - resistance training in particular can promote weight maintenance and modest increases in muscle mass
- **Set a defined timescale for follow up**
  - consider regular monitoring, as clinically indicated, to assess obesity and its related complications (consider using the *Type 2 Diabetes CVRM Review Checklist*)
  - remember that managing obesity-related complications is part of obesity management
- **Be aware of the risks of weight cycling on cardiometabolic health and adopt strategies that focus on sustained changes that maintain healthy habits over time**[44,47]
- Be aware that incretin therapies **may increase the risk of mental health disorders and suicidal behaviours.**[48] Assess mental health in all individuals on incretin therapies and manage as clinically indicated.

Abbreviations
BMI=body mass index; **bpm**=beats per minute; **CrCl**=creatinine clearance; **CV**=cardiovascular; **CVD**=cardiovascular disease; **CVRM**=cardiovascular-renal-metabolic; **DKA**=diabetic ketoacidosis; **DR**=diabetic retinopathy; **DVLA**=Driver & Vehicle Licensing Agency; **eGFR**=estimated glomerular filtration rate; **ESRD**=end-stage renal disease; **FDA**=Food and Drug Administration; **GA**=general anaesthesia; **GI**=gastrointestinal; **GIP**=glucose-dependent insulinotropic polypeptide; **GLP-1**=glucagon-like peptide-1; **HbA$_{1c}$**=glycated haemoglobin; **HCP**=healthcare professional; **HR**=heart rate; **LTC**=long-term condition; **MEN2**=multiple endocrine neoplasia type-2; **MHRA**=Medicines and Healthcare products Regulatory Agency; **MTC**=medullary thyroid carcinoma; **NG**=NICE Guideline; **OCP**=oral contraceptive pill; **od**=once daily; **PHE**=Public Health England; **PPI**=proton pump inhibitor; **RA**=receptor agonist; **RCT**=randomised controlled trial; **SMART**=Specific, Measurable, Achievable, Rewarding, Timely; **SMBG**=self-monitoring of blood glucose; **SPC**=summary of product characteristics; **SU**=sulfonylurea; **TA**=Technology Appraisal; **T1D**=type 1 diabetes; **T2D**=type 2 diabetes.

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Thank-you for listening. Any questions?

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 Kevin Fernando