

DIABETES MELLITUS

National Standard Treatment Guideline

DIABETES MELLITUS TYPE 1 DIABETES MELLITUS TYPE 2
GESTATIONAL DIABETES MELLITUS



Ministry of Health
Republic of Maldives



JFPR
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World Health
Organization
Maldives

National Standard Treatment Guidelines

- Acid Peptic Disease
- Acute Anxiety
- Acute Pancreatitis
- Acute Psychosis
- Acute kidney Injury
- Arrhythmia
- Chronic Liver Disease
- Chronic Pancreatitis
- Chronic kidney disease
- Congenital Heart Diseases
- Dementia
- Depression
- Diabetes Mellitus Type 1
- Diabetes Mellitus Type 2
- Gestational Diabetes
- Epilepsy
- Heart Failure
- Hyponatremia
- Hypernatremia
- Hypokalemia
- Hyperkalemia
- Interstitial Lung Disease
- Liver Failure
- Obesity
- Obstructive Sleep Apnoea
- Osteoarthritis
- Ovarian Cancer
- Pneumonia
- Stroke
- Upper Gastrointestinal bleed
- Unstable Angina

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GUIDELINES DEVELOPMENT METHODOLOGY

The development of the Maldives Standard Treatment Guidelines (STGs) followed a structured, evidence-informed, and consensus-driven methodology adapted from internationally accepted guideline-development standards and the Delhi Society for Promotion of Rational Use of Drugs (DSPRUD) model. The process combined systematic evidence retrieval, critical appraisal, contextual adaptation, and multidisciplinary expert review to ensure feasibility, clinical relevance, and national ownership.

1. Determining Scope and Priority Conditions

Priority clinical conditions were identified through consultation with national programme managers, specialty clinicians, and health-system stakeholders. Selection criteria included: (i) major causes of morbidity and mortality, (ii) observed variation in clinical practice or prescribing patterns, (iii) potential to improve patient outcomes, and (iv) the feasibility of implementation across health-facility levels in Maldives. The final list of diseases reflected national epidemiology, service-delivery capacity, and essential-medicine availability.

2. Identification of Existing Evidence and Source Guidelines

A targeted search strategy was used to identify high-quality existing clinical guidelines. Searches were conducted across international guideline repositories (e.g., WHO, NICE, SIGN and other intergovernmental bodies, international and national guideline repositories, specialty societies and professional associations).

3. Quality Appraisal of Source Guidelines

Retrieved guidelines were screened for transparency of development, methodological rigour, clarity of recommendations, applicability to health-system reality, editorial independence. Guidelines were included if they met the Institute of Medicine (IOM) definition of a clinical guideline and addressed treatment or management of priority conditions. Guidelines that did not meet minimum quality standards, review articles, diagnostic criteria, or technical standards were excluded.

4. Adoption, Adaptation, and Contextualization

The guideline-development team employed an adopt–adapt–contextualize model:

- **Adoption:** High-quality recommendations that aligned with Maldivian health-system realities were retained without modification.
- **Adaptation:** Recommendations were modified when local considerations such as diagnostic capacity, medicine availability, workforce skills, referral pathways, or cost constraints affected feasibility.

- **Contextualization:** Where evidence was absent or inconclusive, conditional recommendations were formulated based on expert consensus, with explicit consideration of pragmatism, safety, and local workflows.

Medicines were selected in alignment with the Maldives National Essential Medicines List (NEML), based on suitability, efficacy, safety, and availability.

5. Expert Consensus and Multidisciplinary Input

Draft recommendations were initially prepared by experts from the DSPRUD, India, providing a strong methodological foundation for the process. Building on this, a collaborative and participatory process brought together clinicians from internal medicine, paediatrics, obstetrics-gynaecology, surgery, emergency medicine, endocrinology, cardiology, general practitioners, and public health representing different levels of healthcare. Consensus was achieved through moderated discussions, iterative revisions, and resolution of divergent views. For topics lacking strong evidence, recommendations were derived from expert clinical judgment grounded in extensive practice experience.

6. Drafting, Peer Review, and Validation

Each guideline section was organized in a standard format including key clinical features, essential investigations, non-pharmacological management, pharmacological therapy (with step-up/step-down options where relevant), referral criteria, paediatric considerations, and follow-up requirements. Drafts were peer-reviewed by senior clinicians and national experts. Reviewer comments were systematically integrated to strengthen clarity, accuracy, and applicability.

7. Addressing Conflicts of Interest

All contributors declared the absence of conflicts of interest. Individuals with potential or perceived conflicts were excluded from authorship or decision-making roles.

8. Updating and Future Revisions

The STGs were conceptualized as a living document. Future updates will incorporate new scientific evidence, changes in essential-medicine availability, national programme priorities, and user feedback from clinicians. Periodic review cycles will ensure the continued relevance and reliability of recommendations.

9. Distinctive Features of the Guidelines

Developed through a collaborative process involving a large group of multidisciplinary experts from different levels of healthcare, the guidelines incorporate the following distinctive features:

- **Diagnostic Assumption and Confirmation:** While assuming that an initial diagnosis has been established by the healthcare provider, the guidelines provide essential information for confirming diagnoses. This includes a comprehensive overview of major signs and symptoms, descriptions of confirmatory tests, and clear guidance on practices that are prohibited, discouraged, or unreliable—promoting evidence-based medicine supported by relevant references.
- **Comprehensive Treatment Approach:** The guidelines offer a systematic, up-to-date framework for managing medical conditions across the continuum of care. They begin at the primary care level and extend to secondary and tertiary care, incorporating protocols for treatment response assessment and referral criteria as integral components.
- **Diverse Treatment Modalities:** Recommendations encompass both non-pharmacological and pharmacological interventions and surgical intervention where applicable, providing flexibility for individualized treatment plans. Cautionary notes are included where necessary to ensure safe and effective use of therapies.
- **Assessment and Referral Criteria:** Clear criteria and goals for evaluating patient response to treatment are provided, along with guidance on when referral to higher levels of care is warranted ensuring continuity and comprehensiveness in patient management.

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The Government of the Republic of Maldives is committed to ensuring universal access to quality health services for all citizens. The Constitution of Maldives mandates the progressive realization of rights, including the right to good standards of health care for the population. In line with this national commitment, standardized quality health services are regarded as the foundation of a strong and equitable healthcare system.

This important work would not have been possible without the cooperation and support of many individuals and institutions. We express our sincere appreciation to the Honourable Minister of Health, Abdullah Nazim Ibrahim, for his leadership, commitment, and continuous guidance throughout the development process. We are grateful to WHO and ADB for their significant contribution, support, and technical assistance.

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It is important to acknowledge the immense efforts, involvement, timely coordination, collaboration, and dedication of the Quality Assurance and Regulation Division team who made it possible for these Clinical Treatment Guidelines to come into existence.

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DIABETES MELLITUS

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QUICK REFERENCE GUIDE

Clinical features

Diabetes mellitus (DM) is a chronic metabolic disorder marked by persistent hyperglycemia due to impaired insulin secretion, action, or both. Globally and regionally, diabetes is a major public health challenge associated with significant morbidity and mortality from complications like retinopathy, nephropathy, neuropathy, and cardiovascular disease. Recent estimates show prevalence rates of 10–

12% among adults in the Maldives. Type 1 diabetes typically occurs in childhood or adolescence, though it can develop at any age. Type 2 diabetes is most common in adults over 40 years, but its onset is increasingly seen in younger adults and even adolescents due to rising obesity and sedentary lifestyles. Gestational diabetes affects women during pregnancy, usually in the second or third trimester.

Condition	Typical features	Red flags/urgent referral
T1DM	Polyuria, polydipsia, weight loss, fatigue; lean/normal BMI; recent illness; possible other autoimmune disease	Suspected DKA: vomiting, abdominal pain, Kussmaul breathing, dehydration, ketonemia/ketonuria, altered mental status
T2DM	Often asymptomatic; overweight/central obesity; blurred vision; recurrent infections (skin, genital, UTI); acanthosis nigricans; neuropathic symptoms	Suspected HHS: very high glucose, profound dehydration, confusion; severe hyperglycemia with ketones
Gestational DM	Usually asymptomatic; detected on screening; risk factors: prior GDM/macrosomia, obesity, family history, PCOS	FPG ≥ 126 mg/dL or random ≥ 200 mg/dL at booking (consider overt diabetes in pregnancy); reduced fetal movements, severe hypertension/preeclampsia signs

Prediabetes/Intermediate Hyperglycemia (IH)

Category	Thresholds	Progression risk	What to do
Impaired fasting glucose (IFG)	FPG 100–125 mg/dL (5.6–6.9 mmol/L)	~5–10% per year (higher with obesity/family history)	Structured lifestyle program: ≥ 150 min/week activity, calorie-aware meal plan, weight loss 5–7% if overweight
Impaired glucose tolerance (IGT)	2-h OGTT 140–199 mg/dL (7.8–11.0 mmol/L)	As above (often higher than IFG alone)	As above; consider dietitian referral
Elevated HbA1c	5.7–6.4% (39–47 mmol/mol)	Higher A1c $\rightarrow$ higher risk	Recheck yearly; consider metformin if very high risk: age < 60 , BMI ≥ 35 kg/m ² , history of GDM, rising A1c despite lifestyle

Screening for diabetes

Population	Who to screen	Start age / triggers	Tests	Frequency if normal
Adults (general)	All adults by age 40 prioritized; earlier at any age if overweight/obese (BMI ≥ 25 ; ≥ 23 for Asians) + ≥ 1 risk factor (family history, high-risk ethnicity, HTN, dyslipidemia, PCOS, inactivity, CVD, MASLD, OSA)	35 years or earlier with risks	FPG, A1c, or 75-g OGTT	Every 3 years; yearly if prediabetes/IH
Youth	Overweight/obese children/adolescents with ≥ 1 risk factor (family history, maternal diabetes/GDM, high-risk ethnicity, signs of insulin resistance)	After puberty or age 10 (whichever earlier)	FPG, A1c, or OGTT	Every 3 years (or sooner if weight/risk worsens)
Pregnancy (GDM)	Universal screening	24–28 weeks (earlier if prior GDM or very high risk)	One-step 75-g OGTT: F ≥ 92 , 1-h ≥ 180 , 2-h ≥ 153 mg/dL $\rightarrow$ any one abnormal = GDM	As per antenatal schedule
Post-GDM	All women with prior GDM	6–12 weeks postpartum	75-g OGTT preferred	If normal, q1–3 years thereafter
High-risk clinical settings	People with CVD, CKD, HIV on ART, long-term steroids/antipsychotics	At diagnosis of the condition/therapy	As above	Per risk and treatment changes

1. TYPE 1 DIABETES (T1DM)

Diagnosis & initial steps

- Hyperglycemia with ketonemia/ketonuria or DKA; low/normal BMI; possible weight loss.
- Start regular insulin promptly; provide sick-day rules and hypo management.
- Consider islet autoantibodies (GAD65 $\pm$ IA-2/ZnT8).

Glycemic targets (non-pregnant adults)

Metric	Target
HbA1c	< 7% (individualize)
Fasting/Pre-meal	80–130 mg/dL (4.4–7.2 mmol/L)
1–2 h post meal	< 180 mg/dL (< 10.0 mmol/L)
Time-in-Range (CGM)	> 70% (70–180 mg/dL)

Insulin regimens (start & titrate)

Regimen	How to start	Titration pearls
Basal -bolus (MDI)	0.4–0.6 U/kg/day total; ~50% basal + 50% bolus split across meals	Use carb ratio ~500/TDD; correction ~1800/TDD (rapid-acting). Adjust every 2–3 days to targets.
CSII (pump)	Set basal profile; ICR and ISF as above	Review downloads weekly initially; adjust for dawn phenomenon/exercise.

Monitoring & education

- **SMBG/CGM:** pre-meal, bedtime; add 1–2 h post-meal while titrating.
- **Ketones:** check if glucose > 250 mg/dL, during illness, or vomiting.
- **Hypoglycemia: “15-15 rule”** (15 g fast carb, recheck 15 min). Keep glucagon (nasal/injectable).

Comorbidity screening (from/soon after diagnosis)

- Lipids, BP, Urine Albumin-to-Creatinine Ratio (uACR) & Estimated Glomerular Filtration Rate (eGFR), retina exam (within 5 years for T1; earlier if symptoms), and foot exam annually.
- Autoimmune: TSH at diagnosis and periodically; consider celiac screen if symptomatic.

2. TYPE 2 DIABETES (T2DM)

Who needs urgent insulin?

- Catabolic symptoms, A1c $\geq 10\%$, glucose ≥ 300 mg/dL (16.7 mmol/L), ketosis, or acute illness.

Glycemic targets

Metric	Target
HbA1c	< 7% ($\leq 6.5\%$ if achievable without hypo; 7.5–8% if frail/comorbid)
Fasting/Pre-meal	80–130 mg/dL
1–2 h post-meal	< 180 mg/dL

First-line and add-on therapy (choose by comorbidity & access)

Situation	Preferred options	Remarks
No ASCVD/HF/CKD; cost a concern	Metformin → add SU (glimepiride MR/ glimepiride) or DPP-4i	Educate on hypo with SUs.

Established ASCVD or high risk	GLP-1 RA (semaglutide/liraglutide) or SGLT2i (empagliflozin/dapagliflozin)	Use regardless of baseline A1c or metformin.
Heart failure (HFrEF or HFpEF)	SGLT2i	Symptom and hospitalization benefit.
CKD (uACR↑ and/or eGFR↓)	SGLT2i (renal/CV protection); add GLP-1 RA if further control needed	Follow agent-specific eGFR cut-offs.
Need to minimize weight gain	GLP-1 RA or SGLT2i	Favor when obesity present.
Cost-sensitive escalation	Add SU, pioglitazone, or human insulin	Avoid pioglitazone in HF/edema; watch weight.

Common drug doses

Class	Typical starting dose → up-titrate	Key cautions
Metformin	500 mg with meal → 1000 mg bid	Avoid if eGFR < 30; reduce dose if 30–45, GI upset common.
SGLT2i	Empagliflozin 10–25 mg once daily Or Dapagliflozin 10 mg once daily	Genital infections; dehydration; hold in prolonged fasting/illness; avoid in pregnancy/T1DM.
GLP-1 RA	Semaglutide 0.25 mg sc weekly → 1 mg+; Liraglutide 0.6 → 1.2–1.8 mg once daily	GI effects; avoid in pregnancy.
DPP-4i	Sitagliptin 100 mg once daily (renal dose); Linagliptin 5 mg once daily (no renal dose)	Generally, weight-neutral, low hypoglycemia risk.
SU (secretagogues)	Gliclazide MR 30 mg once daily → 60–120 mg; Glimepiride 1 mg OD → 4–8 mg	Hypoglycemia risk; caution elderly/CKD.
Pioglitazone	15–30 mg once daily → 45 mg	Edema, weight gain; avoid in HF.
Basal insulin	10 U at bedtime or 0.2 U/kg	↑ by 2 U every 3 days to fasting target; add prandial if A1c above goal.

Insulin intensification (if not at goal)

1. Basal first → titrate.
2. If A1c remains high:
 - Add 1 mealtime bolus (largest meal) → expand to basal-plus or full basal-bolus, or
 - Switch to premix (e.g., 70/30 before breakfast ± dinner).

Monitoring & prevention

- A1c q3 months until at goal, then q6 months.
- BP, lipids (statin for most adults 40+), uACR & eGFR annually, retina at dx then q1–2y, foot annually.
- B12 periodically on metformin.
- Vaccines, smoking cessation, Metabolic dysfunction-associated steatotic liver disease (MASLD; formerly known as NAFLD – Non-Alcoholic Fatty Liver Disease) screening by risk.

3. GESTATIONAL DIABETES (GDM)

Screening & diagnosis (single 75-g OGTT)

- Universal testing at 24–28 weeks (earlier if high risk or previous GDM).
- Any one abnormal = GDM: Fasting $\geq$ 92 mg/dL (5.1), 1-h $\geq$ 180 (10.0), 2-h $\geq$ 153 (8.5).

Glycemic targets (capillary)

Metric	Target
Fasting	< 95 mg/dL (5.3 mmol/L)
1-h post-meal	< 140 mg/dL (7.8 mmol/L)
2-h post-meal	< 120 mg/dL (6.7 mmol/L)

Management pathway

1. Medical nutrition therapy + activity (walking after meals, unless obstetric contraindication).
2. Self-monitoring: fasting + 1-/2-h post-meals (per clinic protocol).
3. Start pharmacotherapy if $\geq$ 20–30% readings above target after 1–2 weeks:
 - Insulin is first choice (safe, flexible).
 - Metformin can be used when acceptable locally and patient consents; may need supplemental insulin.
4. Antenatal care: fetal growth surveillance, BP and preeclampsia watch.
5. Intrapartum: aim maternal glucose ~ 72–127 mg/dL (4–7 mmol/L).
6. Postpartum: 75-g OGTT at 6–12 weeks, breastfeeding encouraged, lifestyle advice; screen every 1–3 years thereafter.

Acute complications (all patients)

Problem	Recognition	Immediate actions
Hypoglycemia	Glucose < 70 mg/dL or symptoms	15 g fast carb → recheck 15 min → repeat if needed → snack when stable. If unconscious: glucagon and emergency care.
Diabetic ketoacidosis DKA (more T1DM, can occur in T2DM/GDM)	Polyuria, vomiting, abdominal pain, Kussmaul breathing, ketones + high glucose	Urgent referral/Emergency Department (ED). IV fluids, insulin, electrolytes per protocol.
Hyperosmolar hyperglycemic State (HHS in T2DM)	Very high glucose, dehydration, altered sensorium, minimal ketones	Urgent referral/ED. Aggressive fluids, insulin, electrolytes.

Follow-up

T1DM: reviews every 1–3 months initially; technology training; annual full screen.

- **T2DM:** 1–3 months while adjusting therapy; then every 3–6 months.
- **GDM:** every 1–2 weeks until stable; postpartum OGTT at 6–12 weeks.

Quick prescribing cautions

- **Metformin:** avoid eGFR < 30; reduce dose 30–45.

- **SGLT2i:** avoid in pregnancy/T1DM; hold if dehydrated or before major surgery.
- **GLP-1 RA:** avoid in pregnancy; GI side effects common.
- **SU:** risk of hypoglycemia; caution in CKD/elderly.
- **Pioglitazone:** avoid in HF, edema, or high fracture risk.
- **Insulin:** teach hypo prevention, safe driving, sharps disposal.

System	Complication	When to start screening	How often	What to do quickly
Eyes	Diabetic retinopathy	T2DM: at diagnosis. T1DM: 5 years after onset	Every 1–2 years if normal, more often if disease	Refer to ophthalmology; optimize glycemia/BP/lipids
Kidneys	Diabetic kidney disease	T2DM: at diagnosis. T1DM: 5 years after onset	Annually: uACR + eGFR	Start ACEi/ARB if albuminuria and HTN; consider SGLT2i if eGFR allows
Nerves/Feet	Peripheral neuropathy, foot ulcers	T2DM: at diagnosis. T1DM: 5 years after onset	Annually foot risk exam; at every visit inspect feet if high risk	Educate foot care; offload, refer promptly for ulcers/infection
Cardio-cerebro-vascular	CAD, stroke, PAD	At diagnosis	BP each visit, fasting lipids yearly (or per therapy), ASCVD risk	Treat BP, statin for most adults 40+; antiplatelet by risk; smoking cessation
Pregnancy (GDM history)	Future T2DM, metabolic syndrome	6–12 weeks postpartum	q1–3 years lifetime	Lifestyle program; consider metformin if high risk
Liver	MASLD/MASH	At diagnosis if overweight	Periodic ALT; risk-based fibrosis assessment	Weight loss, cardio-metabolic risk control
Oral/periodontal, infections, sexual dysfunction	Gingivitis/periodontitis, recurrent infections, Erectile Dysfunction/Female Sexual Dysfunction	At diagnosis if symptomatic or high risk	Periodic dental review; targeted history	Treat infection promptly; address sexual health

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycaemia due to impaired insulin secretion, action, or both. It primarily includes Type 1 diabetes, where autoimmune destruction of pancreatic β -cells causes absolute insulin deficiency, and Type 2 diabetes, which results from insulin resistance combined with relative insulin deficiency. Diabetes poses a major public health challenge globally and is of increasing concern in the Maldives. Recent estimates indicate that diabetes affects nearly 10–12% of the adult population in the Maldives, reflecting the broader regional and global trend of rising prevalence due to urbanization, dietary shifts, sedentary lifestyles, and increasing obesity. The disease is a leading contributor to morbidity and mortality in the country, causing significant disability through complications such as retinopathy, nephropathy, neuropathy, cardiovascular disease, and stroke. Furthermore, diabetes places a growing burden on the healthcare system, contributing to increased healthcare costs and loss of productivity.

While diabetes is not curable, it is highly controllable. Type 1 diabetes requires lifelong insulin therapy, whereas Type 2 diabetes can be effectively managed through timely diagnosis, lifestyle modifications, pharmacotherapy, and in select cases bariatric or metabolic surgery. Early detection and intervention are critical to preventing complications that result in disability and premature death. Standardization of diabetes care is essential given the variability in access to healthcare services across atolls, the reliance on external referral systems for complex care, and the challenges posed by geographical dispersion. Without standardized, evidence-based treatment protocols, there is a risk of inconsistent management, leading to avoidable complications such as amputations, vision loss, kidney failure, and cardiovascular events. Standard treatment guidelines are necessary to ensure equitable, cost-effective, and high-quality diabetes care for all individuals across the Maldives, regardless of location or socioeconomic status.

SCOPE OF THE GUIDELINES

This guideline covers the prevention, diagnosis, treatment, and follow-up of Type 1 diabetes mellitus, Type 2 diabetes mellitus, and gestational diabetes mellitus, along with the recognition and management of early and late diabetes-related complications. Early complications addressed include hypoglycemia, diabetic ketoacidosis, hyperosmolar hyperglycemic state, hypertension, dyslipidemia, and early manifestations of nephropathy, retinopathy, and neuropathy. Late complications include end-stage renal disease, advanced retinopathy leading to blindness, severe neuropathy, diabetic foot ulcers and amputations, and cardiovascular diseases such as coronary artery disease, stroke, and peripheral artery disease.

INTENDED USERS

primary care providers; endocrinology/diabetology, obstetrics, ophthalmology, nephrology; diabetes educators, dietitians, nurses, pharmacists; public-health managers, policymakers, community health workers.

Where it applies: all levels of care.

- **Primary care:** screen and diagnose, start lifestyle counseling and first-line therapy, screen for complications, refer early when needed.
- **Secondary care:** confirm diagnosis, initiate or adjust complex regimens, manage acute complications, perform advanced micro- and macrovascular screening.
- **Tertiary care:** multidisciplinary management, advanced diagnostics, interventions for severe or refractory disease.

Purpose and approach: standardize care across levels and close access gaps. Use simplified algorithms suitable for limited-resource settings. Emphasize early detection and timely referral. Align with local resources and the essential medicines list. Prioritize point-of-care testing, minimal dependence on advanced labs for initial decisions, practical clinical criteria when tests are delayed, and cost-effective screening schedules.

TYPES OF DIABETES MELLITUS

Diabetes mellitus (DM) is a heterogeneous group of metabolic disorders characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. The main types of diabetes and their key features are described below.

Table 1. Different types of diabetes mellitus, age at onset and diagnostic criteria and its management.

Type	Key Features	Usual Age at Onset	Management	Diagnostic Criteria
Type 1 Diabetes Mellitus	Autoimmune β -cell destruction → absolute insulin deficiency	Childhood, adolescence (can occur at any age)	Lifelong insulin therapy	■ Classic symptoms + random glucose ≥ 200 mg/dL (11.1 mmol/L) ■ *Fasting glucose ≥ 126 mg/dL (7.0 mmol/L) ■ 2-h OGTT glucose ≥ 200 mg/dL (11.1 mmol/L) ■ HbA1C $\geq 6.5\%$ ■ Positive islet auto-antibodies confirm autoimmune etiology

Type 2 Diabetes Mellitus	Insulin resistance + relative insulin deficiency	>40 years (increasingly younger)	Lifestyle changes, oral agents ± insulin	■ Same glucose thresholds as Type 1 DM ■ Often asymptomatic at diagnosis ■ No autoantibodies ■ Often associated with obesity, metabolic syndrome
Prediabetes/ Intermediate hyperglycemia	Intermediate hyperglycaemia; high risk of progression to diabetes	Any age, common in adults with risk factors	Lifestyle intervention (diet, exercise, weight loss); sometimes metformin	■ Fasting glucose 100–125 mg/dL (5.6–6.9 mmol/L) = Impaired fasting glucose (IFG) ■ 2-h OGTT glucose 140–199 mg/dL (7.8–11.0 mmol/L) = Impaired glucose tolerance (IGT) ■ HbA1C 5.7–6.4%
Gestational Diabetes Mellitus (GDM)	Glucose intolerance first detected in pregnancy	Pregnancy (2nd/3rd trimester)	Diet, exercise ± insulin/oral agents (where approved)	■ 75-g OGTT: Fasting ≥92 mg/dL (5.1 mmol/L) OR 1-h ≥180 mg/dL (10.0 mmol/L) OR 2-h ≥153 mg/dL (8.5 mmol/L) ■ Any one abnormal value confirms diagnosis
Monogenic Diabetes (e.g., MODY)	Single gene mutation affecting insulin production/secretion	Childhood or early adulthood	Depends on subtype (often oral agents)	■ Mild fasting hyperglycaemia ■ Strong family history (autosomal dominant) ■ Onset <25 years ■ Genetic testing confirms specific mutation (e.g., HNF1A, GCK)
Secondary Diabetes	Diabetes secondary to another condition (pancreatic disease, endocrine disorders, drugs)	Variable	Treat underlying cause + diabetes care	■ History of causative condition (e.g. pancreatitis, Cushing's) ■ Meets standard glucose criteria
LADA (Latent Autoimmune Diabetes in Adults)	Autoimmune diabetes in adults with slow insulin dependence	>30 years	Initially oral agents → insulin over time	■ Same glucose thresholds as Type 1 DM ■ Positive islet autoantibodies (commonly GAD) ■ Slow progression to insulin requirement

Note: *Random/casual is defined as any time of day without regard to last meal.

**Fasting is defined as no caloric intake for at least 8 hours.

Clinical Features & Diagnostic Threshold for Diabetes

Situation / Test	Threshold	Details
Classic hyperglycemia symptoms (polyuria, polydipsia, polyphagia, weight loss) or hyperglycemic crisis + Random plasma glucose	≥ 200 mg/dL (≥ 11.1 mmol/L)	Random = any time of day, irrespective of meals
Fasting plasma glucose (FPG)	≥ 126 mg/dL (≥ 7.0 mmol/L)	Fasting = no caloric intake for ≥ 8 h
2-h plasma glucose on 75-g OGTT	≥ 200 mg/dL (≥ 11.1 mmol/L)	Venous plasma glucose at 2 hours after 75-g load
HbA1c	$\geq 6.5\%$ (48 mmol/mol)	Use NGSP-certified, DCCT-standardized method

Note: Confirmation rule: If unequivocal hyperglycemia is not present, confirm diagnosis with two abnormal results, either two different tests on the same sample/day (e.g., A1C + FPG) or the same test repeated on a different day.

Laboratory assessment of co-existing morbidities at diabetes diagnosis

Morbidity / Risk	What to order (baseline)	Why / action cues	Re-test cadence*
Chronic kidney disease (CKD)	Serum creatinine + eGFR, urine albumin-creatinine ratio (uACR)	Stage CKD, dose-adjust drugs; start ACEi/ARB if albuminuria with HTN; consider SGLT2i if eGFR allows	At least yearly (T2DM from dx; T1DM after 5y)
Dyslipidemia / ASCVD risk	Fasting lipid panel (TC, LDL-C, HDL-C, TG)	Statin decision and intensity; repeat 4–12 weeks after statin change	Yearly (and 4–12 weeks post-change)
Metabolic dysfunction-associated steatotic liver disease (MASLD)	ALT, AST ($\pm$ GGT if indicated)	Identify hepatic disease before statins/ other meds; persistent elevation $\rightarrow$ fibrosis risk workup	Per clinical course
Thyroid disease	TSH (routine in T1DM; in T2DM if symptoms/goitre/dyslipidemia)	Hypo/Hyperthyroidism alters lipids, weight, glucose control	Periodically in T1DM; PRN in T2DM
Anemia / B12 deficiency	CBC; Vitamin B12 if risk or before long-term metformin	Baseline anemia; metformin-related B12 fall over time	B12 periodically once on metformin; CBC PRN
Celiac disease (T1DM)	tTG-IgA + total IgA (if GI symptoms, anemia, or growth issues)	Autoimmune clustering; malabsorption worsens control	If symptomatic / high suspicion
Electrolytes / ketosis risk	Na, K, HCO_3^- , serum/urine ketones if symptomatic or very high glucose	Exclude DKA/HHS at presentation	As clinically indicated

Infection/other secondary causes	Tests guided by history (e.g., HbSAg, anti-HCV, HIV, TB work-up)	Treat contributors to hyperglycemia; drug choices	Per national program/risk
Baseline cardiovascular status	Not a lab per se, but labs inform ASCVD risk calculator (lipids, BP, smoking)	Guides statin, BP targets, antiplatelet decisions	Recalculate with new labs/age

* Adjust frequency for abnormal results, CKD progression, med changes, pregnancy, or intercurrent illness.

PREDIABETES (INTERMEDIATE HYPERGLYCAEMIA)

Category	Threshold	Notes
Impaired fasting glucose (IFG)	FPG 100–125 mg/dL (5.6–6.9 mmol/L)	Fasting = ≥ 8 h without calories
Impaired glucose tolerance (IGT)	2-h OGTT 140–199 mg/dL (7.8–11.0 mmol/L)	After 75-g glucose load
*HbA1c (elevated risk)	5.7–6.4% (39–47 mmol/mol)	≥ 6.5% = diabetes; < 5.7% generally normal

*Use NGSP-certified, DCCT-standardized method.

Note on HbA1c: Do not use as the sole diagnostic test when accuracy may be affected (anemia, hemoglobin variants, CKD, recent transfusion, biological/ethnic variability). Prefer to pair HbA1c with FPG or OGTT for a reliable diagnosis.

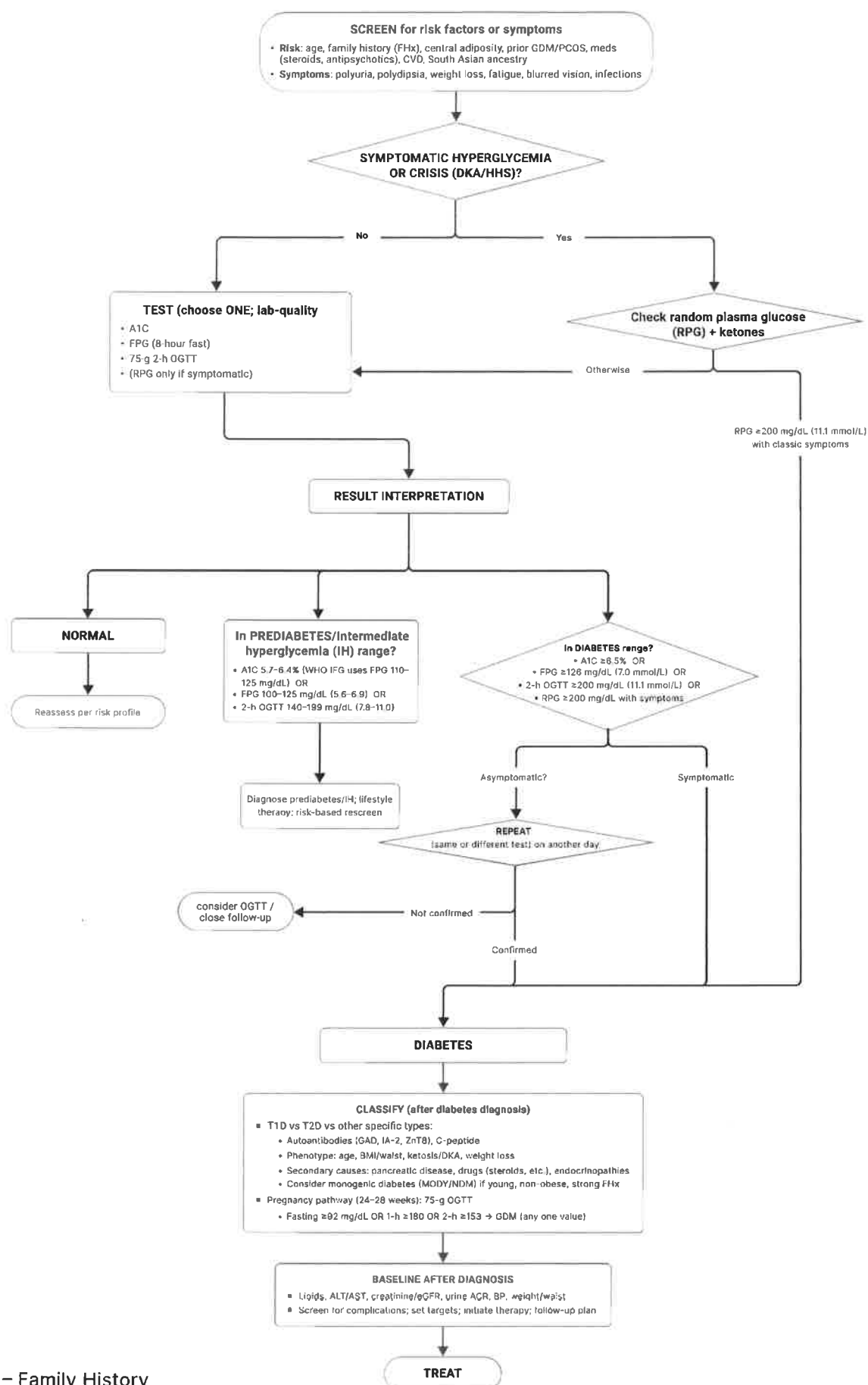
Screening recommendations:

- There are significant risk factors for future type 2 diabetes and cardiovascular disease (CVD). Opportunistic screening for undiagnosed diabetes and prediabetes/IH is advised in asymptomatic adults and adolescents who are overweight or obese and have two or more additional risk factors, such as:
 - ▢ Hypertension
 - ▢ History of CVD
 - ▢ Abnormal lipid profile
 - ▢ Physical inactivity
 - ▢ Women with a history of gestational diabetes or polycystic ovary syndrome (PCOS)
 - ▢ Clinical signs of insulin resistance (e.g., severe obesity, acanthosis nigricans)
 - ▢ Family history of diabetes

- Screening can also be integrated into antenatal care, dental care visits, and community screening programmes where feasible.

Testing intervals:

- Screen **all adults from 35 years**. Screen earlier at any age if overweight/obese (BMI ≥ 25 ; ≥ 23 for Asians) with ≥ 1 risk factor (family history, high-risk ethnicity, HTN, dyslipidemia, PCOS, inactivity, etc.). If results are normal, repeat at least every 3 years or more frequently depending on the initial results, risk status or prediabetes/IH present (ADA 2025). However, the age-based screening is ≥ 40 years prioritized for annual screening under the National Multi-sectoral Action Plan; NCD Maldives clinics assess FBS/PPBS and use 10-yr CVD risk (age 40–70) to guide care. always confirm abnormal screens with diagnostic tests
- People who were diagnosed with GDM should have testing at least every 1–3 year.
- People with high blood glucose during screening need further diagnostic testing to confirm diabetes while those with screen-negative for diabetes should be retested as advised by the physicians.
- Individuals with prediabetes/IH or those at high risk should undergo annual testing.
- Individuals in the high-risk groups (e.g., people with HIV, exposure to high-risk medicines, evidence of periodontal disease, history of pancreatitis) should also be closely monitored.



FHx – Family History

PRE-DIABETES: MANAGEMENT AND PREVENTION

- Lifestyle modification is the cornerstone of preventing or delaying the progression from pre-diabetes to type 2 diabetes. It is recommended for all individuals with pre-diabetes, regardless of body weight.
- Concurrent risk factor management: Screening for and managing modifiable cardiovascular disease (CVD) risk factors—such as hypertension, dyslipidaemia, smoking, and excessive alcohol consumption—should be part of the care plan.

■ Lifestyle recommendations:

- Aim for 5–10% weight loss in individuals who are overweight or obese.
- Engage in moderate-intensity physical activity (e.g., brisk walking, cycling, or swimming for at least 150 minutes per week to enhance insulin sensitivity and supports weight management.):
- Ensure 6 to 8 hours of quality sleep per day.
- Promote healthy lifestyle practices, including balanced diet and regular physical activity, even in non-obese individuals with pre-diabetes.
- Stress reduction through mindfulness, yoga, or relaxation techniques helps stabilize blood glucose levels.
- Smoking cessation and moderation of alcohol intake are essential to reduce complications.

■ Nutritional guidance:

- Adopt a reduced-calorie meal plan focused on the quality of food intake.
- Emphasize whole grains, legumes, nuts, fruits, and vegetables while minimizing refined and processed foods.
- Children with pre-diabetes should consume a well-balanced diet that provides adequate macro- and micronutrients to support normal growth and development.

Note: Healthy lifestyle measures including diet and physical activity are equally important for non-obese patients with prediabetes/intermediate hyperglycemia.

■ Pharmacological interventions:

- Metformin may be considered for diabetes prevention in all individuals with pre-diabetes who have:
 - A BMI ≥ 35 kg/m²
 - Higher fasting plasma glucose (e.g., ≥ 110 mg/dL [≥ 6.1 mmol/L]), and higher A1C (e.g., $\geq 6.0\%$ [≥ 42 mmol/mol])
 - A history of gestational diabetes mellitus (GDM)
 - PCOS

Note: Prolonged use of metformin may lead to vitamin B12 deficiency. Periodic monitoring of B12 levels is recommended, particularly in individuals with anemia or peripheral neuropathy.

- Alpha-glucosidase inhibitors (AGIs) (e.g., acarbose or voglibose) can be considered as alternatives if metformin is not tolerated.

Note: Other pharmacological interventions with pioglitazones, orlistat, vitamin D, or bariatric surgery are not recommended.

People with prediabetes often have additional cardiovascular risk factors, such as hypertension and dyslipidemia, increasing their risk for cardiovascular disease. Routine care should include tobacco use evaluation and cessation support. The years soon after quitting smoking may temporarily elevate diabetes risk, warranting close monitoring and lifestyle-based prevention strategies.

PATIENT EDUCATION

- **Healthy Eating:** Choose a balanced diet rich in whole grains, fruits, vegetables, lean proteins, and healthy fats. Limit sugary foods, refined carbs, and processed snacks.
- **Physical Activity:** Aim for at least 150 minutes of moderate exercise per week, such as brisk walking, cycling, or swimming.
- **Weight Management:** Losing even 5–10% of body weight can significantly reduce diabetes risk.
- **Avoid Harmful Substances:** Minimize or avoid alcohol and quit tobacco use.
- **Stress Control:** Practice stress-reducing techniques such as yoga, deep breathing, or mindfulness.
- **Monitoring & Follow-up:** Routine annual screening of blood glucose and HbA1C levels. Periodic evaluation for blood pressure, cholesterol, and BMI and to consult the doctor about possible medications if lifestyle changes aren't enough.

TREATMENT OF DM TYPE 1

Goals of Management

Type 1 diabetes is an autoimmune condition characterized by absolute insulin deficiency. Its management requires a lifelong, patient-centered, and multidisciplinary approach. The management of T1DM is centred on life-long insulin therapy, individualized to maintain blood glucose within target ranges while preventing both short-term and long-term complications. The primary goals are to:

- Achieve near-normal blood glucose levels (glycemic targets as per age)
- Prevent acute complications (hypoglycemia, diabetic ketoacidosis (DKA))
- Prevent or delay long-term complications (retinopathy, nephropathy, neuropathy, cardiovascular disease)
- Promote normal growth and development (in children)
- Ensure good quality of life through patient empowerment, education, and psychosocial support.

PHARMACOLOGICAL THERAPY

Insulin Therapy

Essential in all cases of T1DM: Type 1 DM always requires lifelong insulin therapy in addition to dietary management (see below for insulin therapy).

- **Basal-bolus regimen (preferred):** The basal-bolus regimen is the preferred approach for Type 1 Diabetes Mellitus as it best mimics natural insulin secretion. It combines basal insulin (long-acting: glargine, detemir, or degludec) for steady, 24-hour background coverage. This regimen provides flexible, tighter glycemic control but requires regular glucose monitoring and patient education.

Manage all patients with type 1 diabetes preferentially with combined intermediate/long-acting (basal) and short-acting insulin (bolus).

- Basal: long-acting insulin (glargine, detemir, degludec)
- Bolus: rapid-acting insulin (aspart, lispro, glulisine) before meals

Various types of insulins available and their pharmacokinetics are shown in Table 2.

Table 2 . Insulin types and preparations available and their pharmacokinetics.

Type of Insulin	Examples	Onset	Peak	Duration	Key Use
Rapid-acting	Aspart, Lispro, Glulisine	10–20 min	1–3 hours	3–5 hours	Pre-meal bolus
Short-acting	Regular insulin	30–60 min	2–4 hours	6–8 hours	Pre-meal bolus (older regimens)
Intermediate-acting	NPH insulin	1–2 hours	4–8 hours	12–16 hours	Basal coverage
Long-acting	Glargine, Detemir	1–2 hours	Minimal/no peak	~20–24 hours	Basal insulin
Ultra-long-acting	Degludec	1–2 hours	Flat profile	>24 hours	Basal insulin (greater flexibility)
Premixed (fixed ratio)	30/70, 50/50 mixes (short + NPH or rapid + NPH)	10–60 min*	Dual (based on components)	Up to 16 hours	Simplified basal + bolus (twice daily)

- **Twice-daily pre-mixed insulin regimens** (for resource-limited settings): premixed 30/70 insulin (less physiological, more hypoglycemia risk)

Pre-mixed insulin combines fixed proportions of short- or rapid-acting and intermediate-acting insulin (commonly 30/70). It is not the preferred regimen for Type 1 Diabetes Mellitus, as it offers less flexibility and does not closely mimic physiological insulin secretion. However, it may be used in resource-limited settings, or in patients unable to manage multiple daily injections (e.g., very young children, the elderly, or those with poor healthcare access).

The schedule is twice-daily dosing: before breakfast (about two-thirds of the total daily dose) and before the evening meal (one-third). Injections should be given 15–30 minutes before meals if using short-acting components, or immediately before meals if using rapid-acting components.

While simpler, pre-mixed insulin carries a higher risk of hypoglycemia and less precise control compared to basal-bolus regimens. It is best used as a temporary or compromise solution with plans to transition to basal-bolus when feasible.

Continuous subcutaneous insulin infusion (CSII) via insulin pumps for selected patients.

Insulin doses

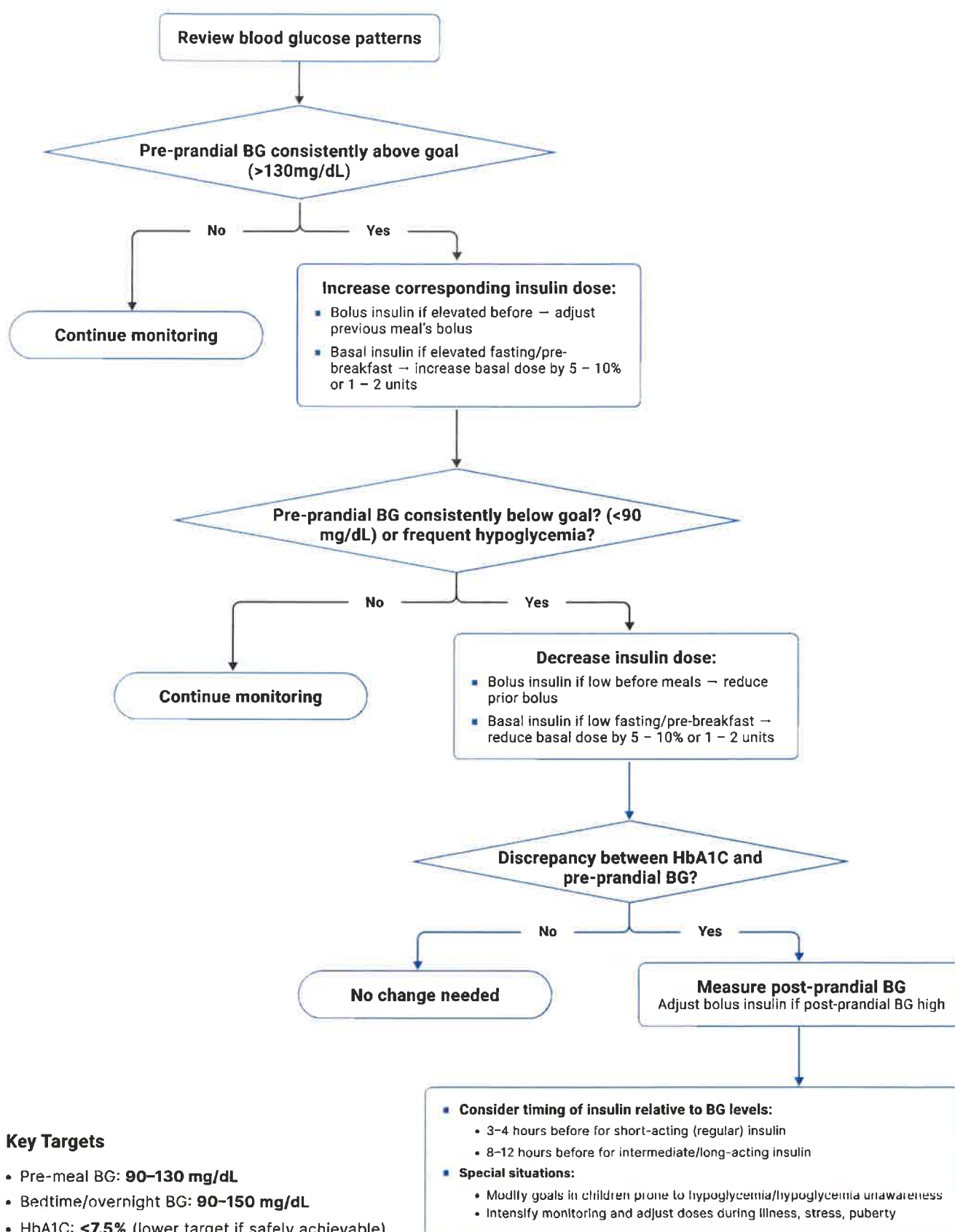
- **Children/adolescents:** 0.3–0.5 unit/kg/day subcutaneously 30 minutes before meals

- **Adults:** ~0.5 units/kg/day (adjust individually)
- 50% basal + 50% bolus (divided among meals)

Insulin Dose Adjustment Rules

The dose, type, and timing of insulin should be adjusted on an individual basis, guided by frequent monitoring of pre- and post-prandial blood glucose levels, dietary intake, physical activity, and overall glycemic trends. Targets should be personalized based on the patient's age, risk of hypoglycemia, and overall clinical context, with dosing decisions reflecting patterns over time rather than isolated readings (see Figure 1).

- The general BG goal before meals is 90–130 mg/dL, while the target at bedtime or overnight is 90–150 mg/dL. The recommended HbA1C target is <7.5%, though a lower goal, such as 7.0%, may be reasonable if it can be achieved safely without excessive hypoglycemia. In children with frequent hypoglycemia or hypoglycemia unawareness, these glycemic goals should be modified to prioritize safety.
- Post-prandial blood glucose monitoring is useful when there is a discrepancy between pre-prandial BG levels and HbA1C, or when assessing the adequacy of pre-meal insulin doses in patients on basal-bolus regimens. Post-prandial measurements help identify the need for adjustment of bolus insulin doses and improve overall control. The interpretation of blood glucose levels should consider the type of insulin previously administered: levels measured 3–4 hours after a dose of short-acting (regular) insulin or 8–12 hours after intermediate- or long-acting insulin provide the most meaningful information regarding the insulin's effect.
- In general, dose adjustments are made gradually—by 5% to 10% of the total daily dose—to avoid overtreatment and hypoglycemia. Basal insulin adjustments are based on fasting and pre-meal glucose levels, while bolus insulin doses are modified in response to postprandial glucose readings and carbohydrate intake patterns.
- If fasting blood glucose remains consistently above target (e.g., >130 mg/dL), basal insulin may be increased by 1–2 units at a time, whereas bolus doses are adjusted based on pre- and post-meal readings and meal composition. Dose changes should ideally be made no more frequently than every 2–3 days unless clearly warranted.
- In cases of persistent hyperglycemia despite appropriate adjustments, review of injection technique, insulin storage, site rotation, adherence, and lifestyle factors is essential before further dose escalation.
- During periods of illness, stress, or puberty, insulin requirements may increase significantly, and closer monitoring with timely dose titration is required.

Figure 1. Insulin Dose Adjustment Flowchart**Key Targets**

- Pre-meal BG: **90–130 mg/dL**
- Bedtime/overnight BG: **90–150 mg/dL**
- HbA1C: **<7.5%** (lower target if safely achievable)

Note: Regular review of glucose data and dose adjustments based on patterns, rather than isolated values, is essential for safe and effective diabetes management.

Monitoring

Explain diabetes self-management and adjustment of insulin, dose based on self-monitoring of glucose and carbohydrate count.

- **Self-monitoring of blood glucose (SMBG):** ≥ 4 times/day (pre-meal, bedtime; more often during illness, exercise, suspected hypoglycemia)
- **HbA1C:** every 3 months (target $< 7\%$ in most cases)
- **Ketone testing** during illness or persistent hyperglycemia

Insulin Injection Site, Technique, Storage, and Precautions

- Insulin should be injected into the subcutaneous tissue at sites such as the abdomen (preferred for consistent absorption), thighs, upper arms, and buttocks.
- Rotate injection sites within the same region to prevent lipodystrophy and ensure reliable absorption. The correct injection technique involves injecting at a 90-degree angle using an insulin syringe or pen (or 45 degrees in very lean individuals). Do not pinch.
- Insulin must be stored in a refrigerator at 2–8°C (in the middle shelf of the refrigerator) but should not be frozen. When in use, it can be kept at room temperature (below 25–30°C) for up to 28 days, depending on the product. Insulin vials and pens should be protected from direct sunlight and heat.

Precautions to Prevent Insulin Errors (High-Alert Medicine)

Insulin is classified as a high-alert medication because errors in its prescribing, dispensing, or administration can result in serious harm, including severe hypoglycemia or hyperglycemia. As insulin is a high-alert medication, strict adherence to safe practices is essential to prevent serious dosing errors that can lead to hypoglycemia or hyperglycemia (Table). To minimize risks:

- **Use clear, unambiguous prescriptions** — always specify the type (e.g., glargine, lispro), dose, timing, and device (pen, syringe). Avoid using only brand names when possible.
- **Double-check insulin type and dose** before administration, especially when switching between different preparations (e.g., from U-100 to U-500 concentrations or between short-acting and rapid-acting insulin).
- **Label insulin clearly** in hospital settings and segregate storage of different types to prevent mix-ups.

- **Standardize insulin delivery devices** (e.g., pens vs. syringes) as far as possible to reduce errors.
- **Educate patients and caregivers** on insulin names, appearance, timing, and correct administration techniques. They should know not to interchange long-acting and short-acting insulin, and to check the label each time.
- **Storage and handling:** Since insulin is a high-alert medicine, careful storage and handling, especially during travel, is critical to maintain its efficacy and prevent dangerous dosing errors.
- **Monitor regularly** to detect errors early — through review of blood glucose logs, injection technique checks, and clinical review.

Proper training, standardized protocols, and use of technology (such as barcode scanning or smart pens in hospital settings) can further reduce the risk of insulin-related errors.

Table 3 summarizes the Do's and Don'ts of insulin injections, handling and storage.

Table 3. Do's and Don'ts of Insulin injection handling, and storage

Do's	Don'ts
■ Always check insulin type, dose, and expiry date before injection. ■ Use a new, sterile needle or pen tip for each injection. ■ Allow cold insulin to reach room temperature before injecting to minimize discomfort. ■ Record injection sites and rotate systematically to avoid repeated use of the same spot. ■ Double-check insulin dose, especially when switching between types or strengths (e.g., U-100 vs. U-500).	■ Do not freeze insulin or expose it to direct heat or sunlight. ■ Do not reuse needles or pen tips, as this increases the risk of infection and lipodystrophy. ■ Do not shake insulin pens or vials (except cloudy insulins, which should be gently rolled). ■ Do not inject into areas with lipodystrophy, scars, or inflammation. ■ Do not mix different insulins in the same syringe unless specifically instructed.
Storage of insulin while traveling	
■ Keep insulin in a cool bag or insulated pouch while traveling. ■ Carry insulin in hand luggage, not in checked baggage (risk of freezing in aircraft hold). ■ Always bring extra insulin, needles, and supplies in case of delays or overstay. ■ Carry a prescription or doctor's note for airport security checks. ■ Use ice packs or cooling wallets for long journeys but ensure insulin does not freeze.	■ Do not leave insulin in a parked car, especially in hot or cold weather. ■ Do not place insulin next to ice packs directly (risk of freezing). ■ Do not store insulin in direct sunlight or near heat sources (e.g., on dashboards or near stoves). ■ Do not pack all insulin supplies in one place—distribute in separate bags, if possible, for safety.

NUTRITION GUIDELINES FOR DM T1DM

Caloric requirements

In T1DM, caloric requirements are based on age, sex, growth stage, physical activity, and nutritional status, with the goal of supporting normal growth and development in children and maintaining a healthy weight in adults. Energy needs in children and adolescents range from 35–60 kcal/kg/day, depending on activity and pubertal stage.

In T2DM, caloric requirements are individualized to achieve and maintain ideal body weight, promote weight loss if overweight/obese, and improve insulin sensitivity. A modest caloric deficit of 500–1000 kcal/day is usually recommended for weight reduction in adults, targeting a gradual loss of about 0.5–1 kg per week. Energy needs range between 20–30 kcal/kg/day depending on age, sex, activity level, and metabolic goals.

Table 4 depicts the caloric requirements in T1DM and T2DM.

Table 4. Caloric Requirements in Type 1 and Type 2 Diabetes Mellitus

Group	Caloric requirement (kcal/kg/day)	Remarks
Type 1 DM: children (growth phase)	35–60	Adjust for age, growth spurts, puberty, and activity.
Type 1 DM: adults	30–35	For healthy weight maintenance.
Type 2 DM: overweight/obese adults	20–25	For weight loss. Aim for a 500–1000 kcal/day deficit.
Type 2 DM: normal-weight adults	25–30	For weight maintenance.
Type 2 DM: older adults (sedentary)	20–25	Lower metabolic rate; monitor function and nutrition risk.
Highly active (T1DM/T2DM)	Up to ~40	Scale to training load and glycemic control plan.

TDEE (total daily energy expenditure) = BMR × Activity factor (kcal/day)

- Estimate BMR with Mifflin–St Jeor: Men = $10 \times \text{wt} + 6.25 \times \text{ht} - 5 \times \text{age} + 5$; Women = $10 \times \text{wt} + 6.25 \times \text{ht} - 5 \times \text{age} - 161$.
- Activity factors: sedentary 1.2, light 1.375, moderate 1.55, vigorous 1.725, athlete 1.9.
- Use TDEE to set targets: maintenance $\approx$ TDEE; weight loss $\approx$ TDEE – 500 to –1000 kcal/day.

Note: adjust for CKD, frailty, pregnancy/lactation, or under-nutrition risk; review every 4–12 weeks with weight and glycemic data.

Nutrition:

- For individuals with Type 1 Diabetes on basal-bolus or insulin pump therapy, carbohydrate counting is key to matching insulin doses with carbohydrate intake, offering flexibility in food choices while ensuring better glycemic control. 1 unit of rapid-acting insulin covers about 10–15 grams of carbohydrate, but this ratio should be individualized. Patients and families should be educated by a dietitian or diabetes educator on estimating carbohydrate content using food labels, portion sizes, and apps. A balanced diet should provide age-appropriate calories to support normal growth in children and weight maintenance in adults.
- The recommended macronutrient distribution is 45–55% carbohydrates (preferably from whole grains, legumes, fruits, and vegetables), 15–20% protein, and 25–35% fats with an emphasis on unsaturated fats. Adequate intake of vitamins, minerals, calcium, and iron is essential.
- Sugar-sweetened beverages like sodas, juices, and energy drinks should be avoided to prevent glucose spikes, while water, unsweetened beverages, and milk are preferred.
- In children or those prone to hypoglycemia, small, frequent meals or snacks every 3–4 hours, including a mix of carbs with protein or fat, help stabilize glucose levels, especially during illness, exercise, or periods of erratic appetite.

Table 5. Key recommendations for non-pharmacological management.

Component	Key Points
Carbohydrate Counting	■ Learn to estimate grams of carbs in meals/snacks ■ Use insulin-to-carb ratio (ICR) to dose bolus insulin ■ ICR: 1 unit per 10–15 g carbs
Balanced Diet	■ 45–55% carbs (whole grains, fruits, vegetables) ■ 15–20% protein ■ 25–35% fat (prefer unsaturated fats) Age-appropriate calories for growth/weight maintenance
Avoid Sugar-Sweetened Drinks	■ No sodas, fruit juices, energy drinks ■ Choose water, milk (as per plan), unsweetened beverages
Small, Frequent Meals	■ Useful if hypoglycemia risk ■ Include protein/fat with carbs to slow glucose absorption
Meal Planning	■ Useful if hypoglycemia risk ■ Include protein/fat with carbs to slow glucose absorption

Physical Activity:

- Regular exercise is encouraged, with at least 60 minutes per day of moderate to vigorous activity for children and adolescents, and a minimum of 150 minutes per week of moderate activity for adults. This improves insulin sensitivity, cardiovascular health, and overall well-being. However, exercise carries a risk of hypoglycemia during or even several hours after activity, and hyperglycemia if pre-exercise blood glucose is high with ketones. It is important to monitor blood glucose levels before, during prolonged activity (every 30–60 minutes), and after exercise, and to avoid vigorous activity if blood glucose exceeds 250 mg/dL with positive ketones.
- Planned exercise may require reducing pre-exercise insulin by 20–50% or consuming 15–30 grams of carbohydrates per hour of moderate activity. For unplanned exercise, fast-acting carbohydrates should be taken before or during activity as needed.

Table 6. Physical activity guidelines

Aspect	Guidance
Exercise Targets	■ ≥60 min/day (children/adolescents) ■ ≥150 min/week moderate activity (adults)
Before Activity	■ Check blood glucose- If <100 mg/dL: eat 15–30 g carbs ■ If >250 mg/dL: check ketones
During Activity	■ For prolonged activity, check glucose every 30–60 min ■ Consume extra carbs as needed
After Activity	■ Monitor glucose levels (watch for delayed hypoglycemia, especially at night)
Adjustments	■ Reduce insulin dose pre-exercise (by 20–50% depending on intensity) ■ Add carbs if unplanned exercise
Carry Supplies	■ Always have fast-acting carbs (glucose tablets, juice) ■ Stay hydrated

Blood Glucose (BG) level (mg/dL)	Action
<100	■ Eat 15-30 g carbs before exercise
100-250	■ Usually safe to start activity
>250	Check Ketones: ■ Positive: avoid exercise ■ Negative: proceed with caution

Diet and exercise plans should be personalized by a diabetes care team (doctor, dietitian, educator) based on age, activity type, insulin regimen, and patient preferences.

Referral Criteria

Patients with Type 1 Diabetes Mellitus should be referred promptly to a higher-level healthcare facility or a diabetes specialist under specific circumstances as below to ensure timely and appropriate management:

1. Newly diagnosed patients presenting with diabetic ketoacidosis (DKA) require immediate referral to a hospital with facilities for intensive monitoring and management. DKA is a life-threatening emergency characterized by hyperglycemia, ketonemia, metabolic acidosis, dehydration, and electrolyte disturbances, necessitating intravenous fluids, insulin infusion, and electrolyte replacement under close supervision.
2. Recurrent severe hypoglycemia, defined as episodes requiring assistance from another person to administer carbohydrates, glucagon, or take other corrective actions, is another indication for referral. These patients need detailed evaluation to identify and address contributory factors such as inappropriate insulin dosing, missed meals, unrecognized hypoglycemia, or hormonal deficiencies, and may benefit from advanced therapies (e.g., insulin pump therapy, continuous glucose monitoring).
3. Growth retardation in children with T1DM should prompt referral for comprehensive assessment. Poor linear growth or delayed puberty in a child with diabetes may indicate chronic under-insulinization, frequent metabolic decompensation, associated autoimmune disorders (such as celiac disease or hypothyroidism), or psychosocial factors affecting diabetes management. Early intervention is crucial to support normal growth and development.
4. 'Difficult-to-control diabetes'—defined as persistently poor glycemic control (elevated HbA1C despite appropriate therapy and good adherence), frequent hospitalizations for hyperglycemia or hypoglycemia, or marked glycemic variability—warrants specialist referral. These patients require thorough reassessment of insulin regimens, lifestyle factors, psychosocial issues, and screening for comorbidities or complications that may contribute to poor control. Access to multidisciplinary care, including endocrinologists, diabetes educators, dietitians, and mental health professionals, is essential in these complex cases.

Assessment of Response & Follow-up Schedule

Regular and structured follow-up is essential in the management of Type 1 Diabetes Mellitus to ensure optimal glycemic control, early detection of complications, and overall well-being of the patient.

Focus	When	What to cover	Decision points / notes
Routine follow-up — initial phase	Every 1–3 months after diagnosis (tailor to age, control, needs)	Review glucose records, HbA1c, insulin regimen and injection technique, hypoglycemia/ketone sick-day plan, diet, physical activity, psychosocial issues	Shorten interval if poor control, recurrent hypoglycemia/DKA, or psychosocial concerns
Routine follow-up — stable phase	Extend once good control and self-management competence achieved; do not exceed 3–6 months (per policy)	Ongoing review of SMBG/CGM trends, HbA1c, regimen adjustments, lifestyle, adherence, psychosocial check-in	Revert to 1–3 month visits if control deteriorates or life circumstances change
Annual complication screening	Yearly, starting after 2–5 years of diabetes or from age 11, whichever is later	Retinopathy: dilated fundus exam or retinal photography;	Early detection allows timely intervention to prevent or delay progression
Growth & puberty (children/adolescents)	Each visit for growth; annually for pubertal staging	Plot height, weight, BMI on standardized growth charts; document pubertal stage	Delayed growth or puberty → assess for chronic poor control or coexisting autoimmunity (e.g., thyroid, celiac) and address psychosocial challenges

Patient and Family Education

- **Insulin technique:** teach sites (abdomen, thighs, arms, buttocks), strict **site rotation**, correct pen/syringe/pump use, and **cold-chain storage**. Use teach-back at start and at follow-ups.
- **Hypoglycemia plan:** early signs (sweating, tremor, hunger, confusion/irritability). Treat **15–20 g fast carbs**, recheck in 15 min, repeat if needed, then a longer-acting carb. Train family/school on **glucagon** for severe lows.
- **Sick-day rules:** never stop insulin. Check glucose/ketones every **2–4 h**, drink fluids (small, frequent), and seek care for **moderate/large ketones, persistent vomiting, lethargy, confusion**.
- **Adherence:** take all doses on time, match mealtime insulin to carbs, monitor glucose as prescribed, keep supplies stocked, attend scheduled reviews.
- **Psychosocial support:** screen for distress, anxiety, depression, or burnout; connect to peer groups/mental-health support; set school plans.

Do's	Don'ts
■ Rotate injection/infusion every dose; avoid lipodystrophy areas.	■ Don't inject into lumps/scarred tissue.
■ Keep fast carbs and medical ID with you at all times.	■ Don't ignore early hypo symptoms or delay treatment.
■ Practice glucagon use; ensure caregivers/teachers know it.	■ Don't drive/exercise if <70 mg/dL (3.9 mmol/L) or symptomatic.
■ Follow sick-day checklist: insulin on board, frequent checks, fluids.	■ Don't stop insulin during illness—even if not eating.
■ Store insulin refrigerated (unopened); in-use pens at room temp as per label; check expiry.	■ Don't expose insulin to heat/freezing; don't use cloudy/discolored clear insulin.
■ Change pen needles/infusion sets as recommended; dispose safely.	■ Don't reuse needles/sets beyond guidance.
■ Log glucose, carbs, doses, activity; bring data to visits.	■ Don't make large dose changes outside an agreed plan.
■ Keep backup supplies (insulin, needles, strips/CGM sensors, ketone strips).	■ Don't run out of essentials; don't skip follow-ups.
■ Share an action plan with school/work; rehearse emergency steps.	■ Don't keep your plan to yourself—no one can help if they don't know it.

TREATMENT OF TYPE 2 DM

Goals of Management of Type 2 Diabetes Mellitus

The primary goals in managing Type 2 Diabetes Mellitus are to achieve optimal glycemic control, prevent or delay microvascular and macrovascular complications, reduce cardiovascular risk, and maintain quality of life. According to the ADA Standards of Care (2025), glycemic targets should be individualized based on patient age, comorbidities, duration of diabetes, hypoglycemia risk, and life expectancy. Lowering HbA1C has been associated with a reduction in microvascular complications of diabetes and possibly macrovascular disease. For most non-pregnant adults, the general targets are depicted in Table 7.

Table 7. Goals of Management of Type 2 Diabetes Mellitus

Parameter	Target	Remarks
HbA1C	<7.0%	<6.5% may be reasonable in selected individuals without hypoglycemia risk (7–7.5% in old patients with complication)
Fasting/pre-prandial BG	80–130 mg/dL	Adjust based on individual factors
Post-prandial BG (2 h)	<180 mg/dL	Particularly useful when HbA1C and pre-meal BG mismatch
Blood pressure	<140/90 mmHg	<130/80 mmHg for higher-risk patients
LDL cholesterol	<100 mg/dL	<70 mg/dL if ASCVD present

Triglycerides	<100 mg/dL
HDL cholesterol	>40 mg/dL (men); >50 mg/dL (women)

Note: HbA1C is the primary target for glycaemic control in Type 2 Diabetes Mellitus, but targets should always be individualized and periodically reassessed based on factors such as duration of diabetes, age, life expectancy, comorbidities, existing vascular complications, patient preferences, and available resources.

Special considerations are needed for children, pregnant women, and the elderly. Less intensive goals (e.g., HbA1C <8%) may be appropriate for patients with limited life expectancy, advanced complications, extensive comorbidities, long-standing diabetes, or where intensive therapy leads to unacceptable risks such as level 3 hypoglycemia. When pre-prandial glucose goals are achieved but HbA1C remains above target, post-prandial glucose should also be assessed and addressed.

NON-PHARMACOLOGICAL

Most patients with Type 2 Diabetes Mellitus (T2DM) are overweight or obese and should be encouraged to achieve weight reduction through dietary modification and physical activity (Table 8). Dietary and exercise recommendations should be individualized based on overall health status, lipid profile, and CVD risk.

- Follow meal planning, healthful eating and/or portion control and counting. A low-glycaemic-index diet may modestly improve hyperglycaemia.
- A low-carbohydrate-diet (<130 g/day) is not recommended for the management of overweight and obesity in individuals with type 2 diabetes, due to limited long-term evidence and concerns about nutritional adequacy.
- Routine supplementation with antioxidants (vitamins E, C and carotene) is not advised.
- For non-vegetarians, consumption of 100–200 g of fish/week is advised as good source of PUFA and for vegetarians vegetable oils (soybean/safflower/ sunflower), walnuts and flaxseeds are recommended.
- Lifestyle measures should also include complete tobacco cessation and aggressive control of cardiovascular risk factors such as blood pressure, dyslipidemia, and other co-morbidities.

Table 8. Non-pharmacological management recommendations for Type 2 DM.

Aspect	Recommendation			
Caloric intake (normal weight)	Kcal/day	Sedentary	Moderate	Heavy
	Male	1800–2000	1800–2200	2200–3200
	Female	1200–1500	1400–1600	1600–2400
Diet	A balanced diet rich in fruits, leafy vegetables, nuts, fibre, whole grains and unsaturated fat is preferred.			
Carbohydrates	Prefer complex carbs, whole grains, low-GI/low-GL foods; limit refined carbs and white rice (brown rice lower GI)			
Fats	MUFA/PUFA-rich oils; avoid saturated fats (<10% total calories; <7% if high triglycerides)			
	Avoid consumption of foods high in saturated fat (butter, coconut oil, margarine, ghee etc.).			
	Use of two or more vegetable oils in rotation			
	Avoid the use of partially hydrogenated vegetable oils as the cooking medium			
	Avoid reheating and refrying cooking oils			
Protein (non-vegetarians)	100–200 g fish/week (for PUFA source)			
Protein (vegetarians)	Use soybean/safflower/sunflower oils, walnuts, flaxseeds			
Fiber	20–35 g/day			
Sodium	≤3000 mg/day			
Sweeteners	Caloric sweeteners (e.g. sucrose) safe within FDA-recommended limits (≤10% of total daily calories)			
Antioxidants	Routine supplementation not advised			
Exercise (aerobic)	≥150 min/week moderate intensity (50–70% max HR) or ≥90 min/week vigorous intensity (>70% max HR); spread over ≥3 days/week			
Exercise (resistance)	At least 3 sessions/week			
Other lifestyle	Complete tobacco cessation; control BP, lipids, other CVD risk factors			

Note: Low glycaemic index (GI) and low glycaemic load (GL), Mono unsaturated fatty acid MUFA, Poly unsaturated fatty acid (PUFA)

It is possible to control mild type 2 DM with non-pharmacological therapy (dietary control and exercise); however, moderate and severe forms will require, in addition, one or more oral hypoglycaemics and occasionally insulin therapy.

PHARMACOLOGICAL

Metformin should be initiated in combination with lifestyle interventions at the time of diagnosis and should be continued as long as it is tolerated and not contraindicated; other OHAs, including insulin, should be added to Metformin. Metformin has the advantage of promoting mild weight loss in obese patients. Patients with fasting glucose 200–250 mg/dL respond well. Treatment may be started with the drugs as shown in Figure 3 and the dose individualized focusing on individualized target HbA1C for each patient based on: age, duration of diabetes, comorbidities, cost of therapy, hypoglycaemia risk, weight gain, durability and dose can be increased every 2–3 weeks as determined by BG response. Table 8 depicts the doses of the commonly used oral hypoglycemic agents. Doses of the commonly used oral hypoglycemic agents and their adverse drug reactions are depicted in Table 9.

Table 9. Doses of the commonly used oral hypoglycemic agents and their adverse drug reactions.

Class	Example drugs	Usual dose	Max dose	Cautions / ADRs
Biguanide	Metformin	500 mg once/ twice daily, titrate	2000–2500 mg/day (divided doses)	GI upset (nausea, diarrhea), lactic acidosis (rare) -Supplement vitamin B12 as needed in patients on long-term metformin -If eGFR is between 45–30 mL/min/1.73 m ² , reduce dose of metformin by 50% - stop metformin if eGFR <30 mL/min/1.73 m ² , - closely monitor renal function every 3 months
Sulfonylurea	Glimepiride, Gliclazide MR, Glipizide	Glimepiride 1–2 mg/day	Glimepiride 8 mg/day	Hypoglycemia, weight gain, caution in elderly & renal dysfunction
DPP-4 inhibitor	Sitagliptin, Linagliptin, Vildagliptin	Sitagliptin 100 mg daily	Sitagliptin 100 mg daily	Well tolerated, rare pancreatitis, adjust dose in renal impairment (except linagliptin)
SGLT2 inhibitor	Empagliflozin, Canagliflozin, Dapagliflozin	Empagliflozin 10 mg daily	Empagliflozin 25 mg daily	Genital infections, UTI, euglycemic ketoacidosis (rare), volume depletion

GLP-1 receptor agonist	Liraglutide, Semaglutide, Dulaglutide	Liraglutide 0.6 mg SC daily (start)	Liraglutide 1.8 mg SC daily	Nausea, vomiting, risk of pancreatitis, GI side effects, weight loss beneficial
Thiazolidinedione (TZD)	Pioglitazone	15–30 mg daily	45 mg daily	Edema, weight gain, risk of heart failure, fracture risk, bladder cancer (rare)
Alpha-glucosidase inhibitor	Acarbose, Voglibose	Acarbose 25 mg TID (with meals)	Acarbose 100 mg TID	Flatulence, diarrhea, abdominal discomfort
Basal insulin	Glargine, Detemir, Degludec	10 units/day or 0.1–0.2 units/kg	Titrate based on fasting BG	Hypoglycemia, weight gain, injection site reactions

Combination therapy: If goal is not achieved or maintained (HbA1C is >1.5 above the target) in 3 months with monotherapy at maximal tolerated doses. In some cases, dual therapy may be indicated initially if it is considered unlikely that single agent therapy will achieve glucose targets. The following combination can be given:

Common initial combinations include Metformin paired with either DPP-4 inhibitors (e.g., Vildagliptin, Sitagliptin, Teneligliptin, Linagliptin) or SGLT2 inhibitors (e.g., Canagliflozin, Dapagliflozin, Empagliflozin). Alternatively, Sulphonylurea with Metformin, Sulphonylurea with Thiazolidinediones (TZD) such as Pioglitazone or Rosiglitazone, and Sulphonylurea with Alpha-glucosidase inhibitors (AGI) like Acarbose.

If blood glucose targets are not achieved with two agents, a third oral agent—such as an AGI, DPP-4 inhibitor, SGLT2 inhibitor, or TZD—may be added depending on the prior treatment.

If glycemic control remains inadequate, insulin or glucagon-like peptide-1 (GLP-1) receptor agonists should be considered. In some cases, particularly when patients fail to achieve targets even with three oral agents, the addition of a fourth may be warranted. Thiazolidinediones may be considered when insulin resistance is present. For individuals with established atherosclerotic cardiovascular disease (ASCVD), heart failure, diabetic kidney disease (DKD), or those needing weight loss, SGLT2 inhibitors are preferable. If postprandial hypoglycemia is a concern, AGIs, glinides, or SGLT2 inhibitors may offer additional benefit.

If postprandial hypoglycaemia is the issue AGI, glinides or SGLT2 inhibitors may be considered.

In elderly patients with increased risk of hypoglycaemia, DPP-4 inhibitor is preferred over sulphonylurea.

Insulin: Add insulin or intensify insulin therapy in patients with primary (markedly ...

symptomatic and/or elevated BG levels or HbA1C >8%) or secondary failure to oral agents after 3 months, often as single dose of intermediate-acting insulin 0.3–0.4 unit/kg/day either before breakfast or at bedtime in combination with Tab. metformin. Insulin is also required in situations like pregnancy, surgery and infection.

Consider insulin as initial therapy in patients with:

- ▣ Fasting plasma glucose >250–300 mg/dL or HbA1C >10% since more rapid glycaemic control will reduce glucose toxicity to islet cells, improve insulin secretion and possibly make OHAs more effective
- ▣ Severe weight loss or lean patients
- ▣ Underlying renal or hepatic disease, or acutely ill or hospitalized patients.
- Therapeutic choice of regimen, preparation and delivery device should be made through a process of shared, informed decision making.
- Initiate with once-daily basal insulin, once-daily premixed/co-formulation insulin, or twice-daily premixed insulin, either alone or in combination with or other OHAs, based upon patient's age, clinical features, glucose profile, risk of hypoglycaemia and patient preference. Basal insulin may also be initiated in combination with GLP-1 analogues.
- Basal bolus insulin regimens may be needed in severe hyperglycaemia, and in life threatening or organ/limb threatening clinical situations.
- Analogue insulins may be used in preference to human insulins with possible lower risk of nocturnal and symptomatic hypoglycaemia; however, economic considerations must be considered.
- Match timing of insulin and meals.
- Counselling/education about SMBG and hypoglycaemia prevention, recognition and treatment are recommended to all patients initiating with insulin.
- Provide guidance for adjusting insulin dose adjustments, administration, storage and other practical aspects.
- Titration using a self-titration regimen (dose increases of 2–4 units every 3 days or biweekly) or with more frequent contact with a healthcare professional. Titration should be done at regular and short intervals to attain glycaemic goals without causing hypoglycaemia. Titration should be done to control FBG first, followed by prandial control of meal with highest glycaemic excursion in sequential order.
- Intensify insulin therapy if patients fail to achieve glycaemic goals even after optimal dose titration considering following options: In patients on basal insulin: Switch to premix insulin twice daily or premix analogues twice or thrice-daily.

- Switch to insulin co-formulation-based regimen
- Add prandial insulin (basal plus or basal bolus) with the largest meal of the day
- Add GLP-1 analogues

Individualize therapy: For patients who have been diagnosed with diabetes, consider a combination of metformin and one of the treatment options based on patients Age, BMI, CKD, duration of diabetes, established CVD, financial condition, glycaemic status and hypoglycaemia concern.

(For details, see section Insulin Therapy.)

If targets are not met and/or at the onset of diabetes complications, therapy should be intensified without delay, with reassessment of adherence, lifestyle, and comorbid conditions. **Note:** Ensure that the patient knows correct SMBG technique and assess understanding about adjusting therapy using SMBG data at every follow-up visit.

Figure 3. Stepwise Pharmacotherapy for Type 2 Diabetes Mellitus

Stepwise Pharmacotherapy for Type 2 Diabetes Mellitus

◆ Step 1: Lifestyle modification (all patients)

- Medical nutrition therapy
- Physical activity (≥ 150 min/week)
- Weight loss if overweight/obese
- Tobacco cessation, alcohol moderation

◆ Step 2: Initiate Oral hypoglycemic agents (OHA)

- Start Metformin: First-line drug (if not contraindicated: avoid in severe renal dysfunction or intolerance); Titrate slowly to minimize GI side effects
- Consider initial dual therapy if HbA1C ≥ 1.5 –2% above target
- Continue lifestyle therapy

◆ Step 3: Add second agent if HbA1C remains above target (usually after 3 months)

✓ If ASCVD or high CV risk or Obesity is a major concern:

- GLP-1 receptor agonists: Liraglutide, Semaglutide, Dulaglutide
- SGLT2 inhibitors: Empagliflozin, Canagliflozin, Dapagliflozin

✓ If heart failure or CKD:

- SGLT2 inhibitors: Empagliflozin, Dapagliflozin

✓ If no major comorbidity (cost or other factors to guide choice):

- DPP-4 inhibitors: Sitagliptin, Vildagliptin, Saxagliptin, Linagliptin
- Sulfonylureas: Glimepiride, Gliclazide MR, Glipizide
- Thiazolidinediones (TZDs): Pioglitazone
- GLP-1 receptor agonist or SGLT2 inhibitor (as above)

✓ Consider insulin if markedly elevated glucose or catabolic features

◆ Step 4: Add third agent if needed

- Choose based on individual factors (e.g., weight, hypoglycemia risk, cost, tolerability)

◆ Step 5: Consider basal insulin

- If HbA1C >9% with symptoms or if oral/injectable agents insufficient
- Start low-dose basal insulin (e.g., 10 units/day or 0.1–0.2 units/kg/day)
- Titrate gradually based on fasting glucose

✓ Key points

- Individualize HbA1C target (generally <7%)
- Monitor HbA1C every 3–6 months
- Intensify therapy as needed without delay
- Regularly reassess lifestyle measures, adherence, side effects

Role of Metabolic Surgery in Type 2 Diabetes Mellitus

Metabolic (bariatric) surgery is an effective option for selected patients with T2DM, offering significant and sustained weight loss, improved glycemic control, and potential remission. It is indicated for patients with BMI ≥ 40 kg/m², or BMI ≥ 35 kg/m² with uncontrolled diabetes despite optimal medical therapy. Some guidelines consider surgery in BMI 30–34.9 kg/m² with poorly controlled diabetes, particularly in Asian populations.

Common procedures include Roux-en-Y gastric bypass and sleeve gastrectomy. While effective, surgery has limitations: it is invasive, carries risks of complications and nutritional deficiencies, requires lifelong follow-up, and is costly (₹2–5 lakh or more in most centers, often with limited insurance coverage). Careful selection and long-term care are essential.

ASSESSMENT OF RESPONSE TO TREATMENT

Evaluate response

Component	What to check	Frequency	Targets / Red flags	Action
Glycemia	SMBG/CGM trends; HbA1c	HbA1c q3 months (sooner if off-target); CGM/SMBG each visit	A1c individualized (often <7%); CGM TIR $\geq 70\%$ (70–180 mg/dL), <4% <70 mg/dL	At target → continue; off-target → adjust therapy/lifestyle
BP & BMI	BP, weight, BMI, waist	Each visit	BP often <130/80 if safe; adverse weight trend	Titrate antihypertensives; reinforce/adjust weight plan
Symptoms	Polyuria/polydipsia, weight change, blurred vision, fatigue; hypos	Each visit	Recurrent hypos, DKA symptoms, marked variability	Review dosing/timing; add CGM; sick-day plan

Adherence & lifestyle	Diet pattern, activity, med timing/technique, logs	Each visit	Missed doses, poor carb matching, needle/site errors	Teach-back, simplify regimen, remove barriers
Complications screen	Feet, neuropathy s/s; UACR/eGFR; retinopathy; lipids	Per protocol (many annually) or sooner if abnormal	New retinopathy, UACR ≥ 30 mg/g, eGFR decline, foot lesions	Start/optimize ACEi/ARB; urgent referral when indicated
Psychosocial/economic	Distress, depression, costs, support	Each visit (brief)	Barriers that limit adherence	Connect to DSMES, social work, mental-health support

Follow-up & adjustment

Context	Visit frequency	Step-UP when	Step-DOWN when	Check before any change
GDM	Weekly–fortnightly until at target; then q1–2 weeks to delivery	Targets unmet despite adherence	Sustained control with low hypo risk	Monitoring accuracy, diet adherence, med timing/technique, illness/stress, weight trend, hypo/hyper episodes, renal/liver labs, A1c (if used), capacity/affordability/support
T1D / T2D	q1–3 months (based on control, regimen complexity, risk)	A1c/TIR off-target despite adherence; significant variability; complications evolving	Stable control with hypoglycemia or treatment burden; older/frail patients	Same checks as above (accuracy, adherence, technique, intercurrent illness, weight/BMI, events, labs), plus readiness for more complex regimens (skills, cost, support)

Step-UP options: add/increase oral/GLP-1/SGLT2; start basal insulin; advance to basal-plus/basal-bolus or AID (T1D).

Step-DOWN options: de-intensify insulin/sulfonylurea; simplify dosing; deprescribe where risks > benefits.

PROGNOSIS AND PROGRESSION

The long-term outcomes of diabetes mellitus vary by type, but all forms require continued monitoring, lifestyle management, and timely intervention to minimize complications. Prognosis depends on the degree of glycemic control, adherence to treatment, management of comorbidities, and access to healthcare services.

All diabetes types

- Outcomes hinge on glycemic control, treatment adherence, comorbidity management, and access to care.
- Ongoing monitoring + lifestyle changes prevent or delay complications.

GDM

- Usually resolves postpartum, but confers 50–70% lifetime risk of T2DM within 10–20 years; recurrence common in future pregnancies.
- Infant risks: macrosomia, birth trauma, neonatal hypoglycemia; later childhood obesity/glucose intolerance.
- Postpartum 75-g OGTT at 6–12 weeks; then annual–biennial screening. Lifelong weight management, diet, and activity.

T1DM

- Lifelong insulin-dependent; without insulin, fatal.
- Risks: hypoglycemia, DKA; long term retinopathy, nephropathy, neuropathy, CVD—risk rises with duration and poor control.
- With intensive insulin, education, and regular screening, most can live well and cut disability/mortality. Prioritize psychosocial support and smooth pediatric→adult transition.

T2DM

- Progressive: insulin resistance with declining β -cell function; most need step-up therapy over time (lifestyle → orals/GLP-1/SGLT2 → insulin).
- Poor control leads to microvascular (eye, kidney, nerve) and macrovascular disease (CAD, stroke, PAD); higher infection and some cancer risk.
- Best outcomes with early diagnosis, sustained glycemic control, CV risk reduction (BP, lipids, smoking), weight control, and regular monitoring.

REFERRAL TO SPECIALIST OR TERTIARY CARE

A structured, tiered referral pathway helps ensure patients with diabetes receive timely, appropriate care while making efficient use of available health system resources. Referral decisions should be guided by the patient's clinical status, treatment response, and the capacity of the current facility. In areas with limited diagnostic or therapeutic capacity, referral should follow the fastest available pathway to an equipped facility, ensuring that stabilization measures—such as fluid replacement, initiation of insulin in DKA, or management of hypoglycemia—are undertaken before transfer. The use of standardized referral notes and patient-held health records ensures continuity of care across levels, reduces duplication of investigations, and allows the receiving facility to act promptly on the patient's needs.

Referral trigger	Key criteria	Immediate actions before transfer	What higher-level care provides
Diabetic ketoacidosis at diagnosis	Hyperglycemia + ketonemia/ketonuria + acidosis, dehydration, electrolyte disturbance	Start IV fluids, draw labs, begin insulin infusion if trained, correct K ⁺ as indicated, monitor vitals; urgent transfer	ICU/HDU monitoring, protocolized insulin/electrolytes, precipitant work-up, post-stabilization education
Recurrent severe hypoglycemia	Episodes needing third-party help, LOC or seizures	Treat current hypo; review doses/meals/activity; provide glucagon kit; ensure safe escort	Regimen overhaul, CGM/pump/AID assessment or initiation, hypoglycemia unawareness work-up, structured education
Growth retardation / delayed puberty	Low height velocity, crossing percentiles, delayed Tanner staging	Plot growth; review insulin adequacy/nutrition; screen thyroid/celiac if possible	Endocrine + nutrition assessment, optimize insulin, manage autoimmunity, psychosocial support
Difficult-to-control diabetes	Persistently high A1C, frequent admissions, marked glycemic variability despite appropriate therapy	Check technique, timing, sites, carb counting; review meds/psycho-social barriers; rule out infection	Multidisciplinary care; advanced tech (CGM, pumps, AID); screen for complications/secondary causes
New-onset microvascular complications	First detection of retinopathy, albuminuria (UACR ≥ 30 mg/g, confirm), or neuropathy on exam/symptoms	Confirm abnormal test; reinforce glycemic/BP/lipid control; start ACEi/ARB if albuminuria and appropriate; foot-care advice	Ophthalmology (dilated exam, laser/anti-VEGF), nephrology (CKD staging, meds), neurology/podiatry (pain, foot protection)
Advanced micro/macrovascular disease	Proliferative retinopathy/macular edema, nephrotic-range proteinuria or rapid eGFR fall, severe neuropathy/ulcer; ACS, HF decompensation, TIA/stroke, limb ischemia	Stabilize per emergency protocols (ACS/Stroke/HF); wound care/off-loading; intensify risk-factor therapy; urgent referral	Ophthalmic procedures, nephrology CKD pathway, limb/vascular and cardiology interventions, coordinated secondary prevention
Complex insulin regimens / advanced adjustments	CSII/hybrid closed loop initiation, marked variability, recurrent hypos/unawareness, pregnancy planning, athletic needs, peri-operative plans	Interim regimen review; verify technique/sites; download SMBG/CGM; update hypo plan; ensure supplies; schedule referral	Endocrinology-led pump/CGM selection and onboarding, ICR/ISF tuning, TIR optimization, structured DSMES, psychosocial support

PREVENTION AND HEALTH PROMOTION

Primary prevention

- Type 2: balanced diet, regular physical activity, healthy weight, no tobacco, limit alcohol.
- Public awareness: teach symptoms and promote screening in high-risk groups.
- Type 1: cannot prevent onset; focus on early recognition and prompt insulin to avoid DKA.

- Gestational diabetes: healthy weight before pregnancy, stay active, early antenatal screening for at-risk women.

Secondary prevention (all types)

- Regular glucose monitoring (SMBG/CGM), medication adherence.
- Manage comorbidities early: blood pressure, lipids, vaccines.

Tertiary prevention

- Routine screening for eye, kidney, nerve, and foot complications.
- Foot care education and fast referral when problems appear.
- Rehab and function-focused care when needed.

Health promotion

- Provide diabetes self-management education and psychosocial support.
- Reduce stigma and empower self-care.
- Build supportive environments at home, work, and in the community with easy access to healthy food, activity spaces, and care.

PATIENT EDUCATION

The primary objective of patient education in diabetes is to equip individuals with the knowledge, skills, and confidence to manage their condition effectively and prevent complications. Education should help patients understand the nature of their disease, its potential short- and long-term effects, and the role they play in achieving good control. It should foster long-term self-management habits, provide psychosocial support, and empower patients to maintain a good quality of life while living with diabetes.

- Targets: A1C, fasting and post-meal glucose, time-in-range if using CGM.
- Self-monitoring: how often to check, how to log, what changes to make based on results.
- Food: regular, balanced meals; fiber, lean protein, healthy fats; spread carbs through the day.
- Activity: safe exercise plan and how to adjust food or meds around it.
- Medicines: names, timing, dosing, storage, and what to do if a dose is missed.

- Hypoglycemia: signs, 15–20 g quick sugar, recheck in 15 minutes, then longer-acting carb, when to use glucagon.
- Hyperglycemia: signs, when to test for ketones, when to call the clinic.
- Sick-day rules: never stop insulin, check glucose and ketones more often, hydrate, seek help if vomiting or ketones rise.
- Foot care: daily check, hygiene, proper footwear, early review of any wound.
- Screening and follow-up: eyes, kidneys, nerves, heart risk, vaccination schedule.
- Psychosocial support and shared decisions.
- Pregnancy path: attend antenatal visits and follow specific guidance.

Instructions to the patient: Do's and don'ts

Do	Don't
Know your diabetes type and why control matters.	Ignore how your type affects treatment or rely on myths.
Eat regular, balanced meals; include fiber, lean protein, healthy fats; spread carbs through the day.	Skip meals or load up on sugary drinks and refined carbs.
Be active most days (e.g., walking); plan food/meds around exercise to prevent lows.	Exercise when glucose is low, or very high with ketones; go out without quick sugar.
Check glucose as instructed, log results, and bring records to visits.	"Dose by feel," omit logs, or ignore frequent highs/lows.
Take insulin/oral meds exactly as prescribed; store insulin correctly.	Skip/double doses, change doses without advice, or use expired/heat-exposed insulin.
Treat lows fast: 15–20 g quick sugar, recheck in 15 min, then a longer-acting carb.	Drive or operate machinery during/after a hypo, or delay treatment.
For high sugars: check glucose (and ketones if unwell), follow your action plan.	Sit on persistent hyperglycemia or ketones without contacting your clinic.
Daily foot care: wash/dry, inspect, moisturize (not between toes), wear well-fitting shoes.	Walk barefoot; ignore cuts, redness, swelling, or slow-healing wounds.
Follow sick-day rules : never stop insulin, check glucose/ketones more often, hydrate, seek help if vomiting/ketones rise.	Stop insulin during illness or self-medicate without checking interactions.
Keep scheduled follow-ups for treatment adjustments and screening.	Miss appointments or vaccine updates.
If pregnant/planning: follow diet/med guidance; attend all antenatal visits.	Self-adjust therapy in pregnancy or skip antenatal care.
Maintain healthy habits and routine screening long-term.	Stop monitoring or screening once you "feel fine."

GESTATIONAL DIABETES MELLITUS (GDM) / DIABETES IN PREGNANCY

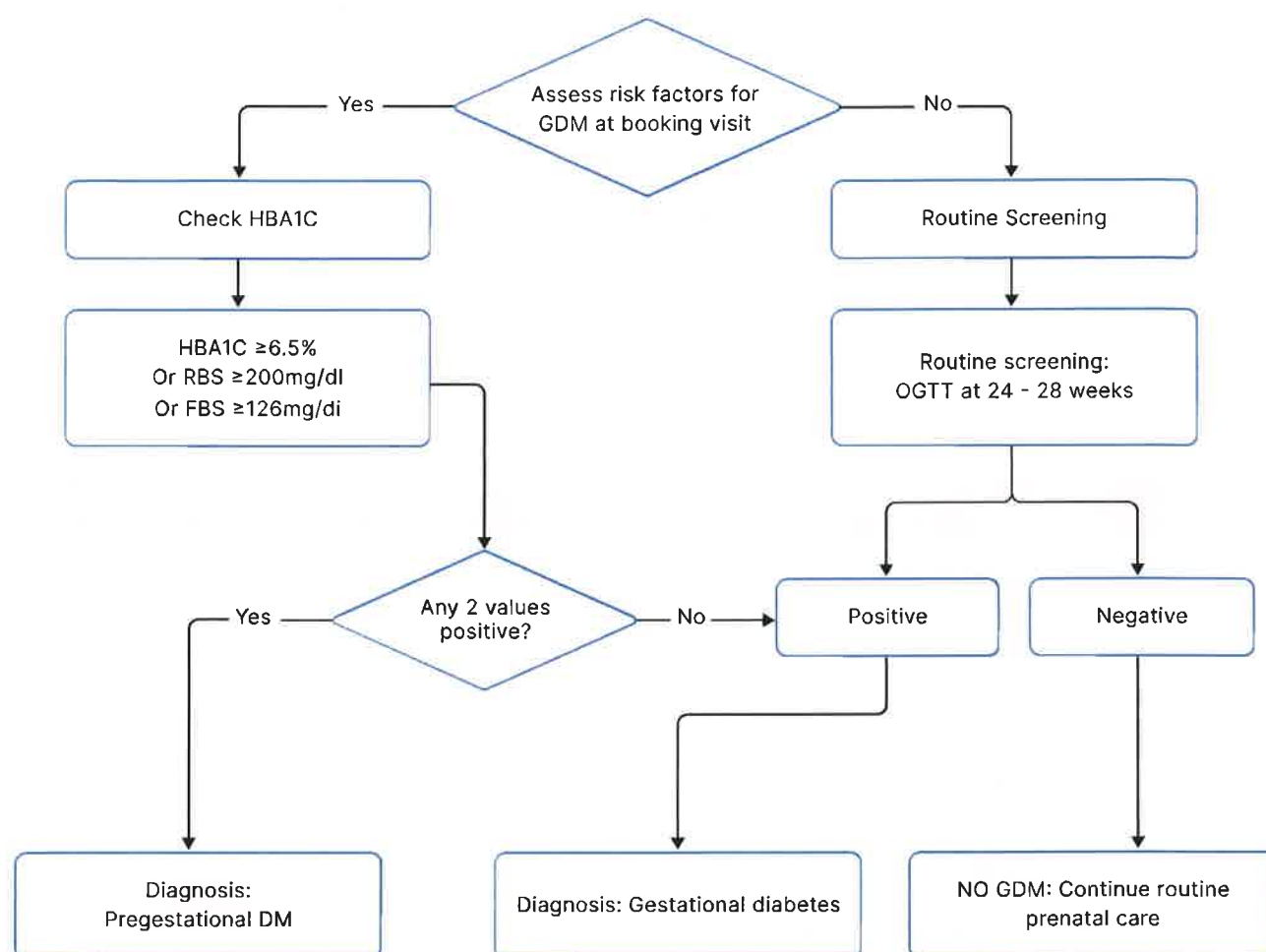
Gestational Diabetes Mellitus (GDM) is carbohydrate intolerance resulting in hyperglycaemia of varying severity with onset or first recognition during pregnancy (WHO).

This definition applies regardless of whether insulin is used or whether the condition persists postpartum. It reflects insufficient pancreatic β -cell function to meet insulin needs during pregnancy (ADA). It is recognized as a risk factor for developing type 2 diabetes later in life (MoH MV).

Difference between diabetes in pregnancy and gestational diabetes

Diabetes in pregnancy	Gestational diabetes mellitus
Pregnancy in previously known diabetes	Hyperglycemia during pregnancy that is not diabetes
OR	
Hyperglycemia diagnosed for the first time during pregnancy that meets WHO criteria for diabetes mellitus in the nonpregnant State	Hyperglycemia diagnosed for the first time during pregnancy
May occur anytime during pregnancy including the first trimester	May occur anytime during pregnancy but most likely after 24 weeks

Algorithm for diagnosis and management of pre-gestational and gestational diabetes in pregnancy.



Its early identification and appropriate management are vital because uncontrolled GDM is associated with maternal complications (such as preeclampsia, polyhydramnios, and increased cesarean deliveries) and fetal/neonatal risks (including macrosomia, birth trauma, neonatal hypoglycemia, respiratory distress, and future risk of obesity and type 2 diabetes).

GDM significantly increases the risk of developing T2DM, with affected women facing up to a sevenfold higher likelihood compared to those without GDM. These women are also more susceptible to metabolic syndrome and CVD. In addition, their children have a greater chance of developing T2DM later in life. In the Maldivian population, where GDM prevalence is high, timely diagnosis and appropriate management are essential to preventing pregnancy complications and ensuring a healthy postpartum outcome for both mother and child.

Risk factors (MoH MV):

- Pre-pregnancy overweight/obesity BMI >30kg/m² (Asian cut off. BMI > 25)
- Significant weight gain in between pregnancies, or excessive Gestational Weight Gain (GWG) during the first 18 to 24 weeks of pregnancy.
- Previous macrosomic baby 4kg or more or index pregnancy.
- Previous gestational diabetes (GDM in previous pregnancy has 40% risk of recurrence)
- Family history of diabetes (first degree relative with diabetes).
- Personal history of impaired glucose tolerance, HbA1C ≥6.5 percent, impaired fasting glucose,
- Older maternal age (especially >40 years of age)
- Medical condition/any other condition associated with development of diabetes, such as polycystic ovary syndrome (PCOS),
- Bad obstetric history - Recurrent miscarriages h/o unexplained intrauterine death, Congenital anomalies-neural tube defects, cardiac defects,
- Smoking /substance use disorder (SUD)

DIAGNOSTIC CRITERIA

Being South Asian and pregnant may pose Maldivian women at a higher risk for hyperglycemia in pregnancy. Therefore, universal screening should be done in the first antenatal visit and at 24–28 weeks of gestation in pregnant women not previously known to have diabetes. The diagnosis of GDM is made when any of the following is met or exceeded.

Screening (One Step Strategy)

The diagnostic criteria most used for universal screening include the one-step strategy: A 75-g oral glucose tolerance test (OGTT) performed at 24–28 weeks of gestation with plasma glucose measurement when an individual is fasting and at 1 and 2h, in individuals not previously diagnosed with diabetes.

Ensure woman has been fasted for at least 8 hours. Measure fasting blood glucose. Dilute 75g of glucose in 250ml of water and drink immediately. Repeat blood glucose level is checked 1st hour and 2nd hour. There is no need to check for glycosuria during the blood taking

GDM is diagnosed if any of the following plasma glucose values are met or exceeded (WHO, ADA, MoH Maldives):

- Fasting ≥ 92 mg/dL (5.1 mmol/L),
- 1-hour ≥ 180 mg/dL (10.0 mmol/L), or
- 2-hour ≥ 153 mg/dL (8.5 mmol/L).

If Single step: 75g OGTT (non-fasting) ≥ 140 mg/dL

Clinical presentation

- GDM is often asymptomatic and detected through routine screening during pregnancy.
- Most women do not report specific symptoms. In some cases, features may include excessive weight gain, polyuria, polydipsia, or fatigue. On clinical examination, there may be signs of larger-than-expected uterine size due to polyhydramnios or fetal macrosomia.
- "Relevant past obstetric history." Past obstetric history helps determine if the patient is at increased risk for GDM recurrence, associated complications such as macrosomia, preeclampsia, or progression to type 2 diabetes mellitus postpartum.
- Because GDM is usually silent, universal or targeted screening is essential to detect it early and prevent maternal and fetal complications.

Screening for Gestational Diabetes Mellitus in high-risk women

- For high-risk women (obesity, previous GDM, a history of macrosomia, polycystic ovarian syndrome (PCOS), or a strong family history of diabetes), to detect overt diabetes before 24 weeks.
- For all women 24–28 weeks gestation not previously diagnosed with diabetes.
- In high-risk women with normal early screening, repeat testing at 24–28 weeks is recommended. Early identification of GDM is crucial to reduce maternal and fetal complications.
- Measure HbA1c levels at the booking appointment for all pregnant women with pre-existing diabetes, to determine the level of risk for the pregnancy. Consider measuring HbA1c levels in the second and third trimesters of pregnancy for women with pre-existing diabetes, to assess the level of risk for the pregnancy. Level of risk for the pregnancy for women with pre-existing diabetes increases with an HbA1c level above 48 mmol/mol (6.5%). Note: Do not routinely use HbA1c levels to assess a woman's blood glucose control in the second and third trimesters of pregnancy.

Additional laboratory assessment GDM or pre-existing diabetes

Purpose	What to order (baseline)	Notes
Antenatal baseline	CBC, blood group/Rh & antibody screen, creatinine + eGFR, uACR or urine protein (per local protocol), ALT/AST, fasting glucose/A1c (classification at booking)	Follow national antenatal screening program
Infections (per program)	HIV, HBsAg, syphilis (RPR/VDRL ± TPHA), ± anti-HCV	Timing and repeats as per national policy
Thyroid (if indicated)	TSH	Screen if clinical suspicion or local policy
Preeclampsia risk	Baseline urine protein measure; repeat if BP rises/symptoms	Use correct cuff size; monitor BP each visit

Management

The primary aim in managing GDM is to maintain maternal blood glucose within target ranges to reduce the risk of complications for both the mother and the baby. Optimal management improves pregnancy outcomes, prevents acute metabolic complications, and reduces the long-term risk of Type 2 diabetes in the mother and metabolic disorders in the child.

Key goals

Achieve and maintain target glycemic control. Keep fasting, pre-meal, and post-meal blood glucose levels within recommended ranges to minimize fetal hyperinsulinemia and macrosomia.

Recommended **glycemic targets** are:

- Fasting: ≤95 mg/dL (5.3 mmol/L)
- 1-hour post-meal: ≤140 mg/dL (7.8 mmol/L)
- 2-hour post-meal: ≤120 mg/dL (6.7 mmol/L)

Other targets are to prevent fetal hyperinsulinemia, macrosomia, and related complications. Management aims to avoid maternal hypoglycemia and ketosis, support optimal fetal growth, and reduce maternal risks such as pre-eclampsia and operative delivery. Postpartum follow-up is essential to detect persistent hyperglycemia and reduce the mother's long-term risk of type 2 diabetes.

NON-PHARMACOLOGICAL

Non-pharmacological management is first-line and includes medical nutrition therapy (MNT) with individualized meal plans ensuring adequate maternal and fetal nutrition without excessive weight gain.

- Meals should be distributed across three moderate meals and two to four snacks to minimize postprandial glucose surges.
- Regular moderate physical activity (such as walking) is encouraged unless obstetrically contraindicated.

Nutritional therapy

- Diet plan with visit to dietician
 - 60: 20: 20 carbohydrate: protein: fat
 - Regular exercise for 30 minutes daily
- Blood glucose is reassessed for 2–3 days with checking of FBS, premeal and post meal monitoring (1–2 hours)
- If it fails, i.e. FBS ≥ 90 mg/dL and/ or postmeal ≥ 120 mg/dL → start insulin or oral hypoglycemic agents.
- If blood sugars are in range, wait for another 2 weeks and reassess

Recommended calorie intake:

- Underweight: 35–40 kcal/kg
- Normal weight: 30–35 kcal/kg
- Overweight: 25–30 kcal/kg

Recommended Weight Gain in Pregnancy

- Normal BMI (19.8–26.0 kg/m²) → 11.4–15.9 kg
- Overweight (BMI 26.1–29.0 kg/m²) → 6.8–11.4 kg
- Obese women (BMI >29 kg/m²) → upto 7 kg

Recommended Calorie Intake According to Trimester

- 1st trimester → no increase in calories
- 2nd trimester → an additional 340 kcal/day
- 3rd trimester → an additional 452 kcal/day

Ref (MoH MV)

PHARMACOLOGICAL

If targets are not met within about 1–2 weeks of lifestyle intervention, pharmacotherapy is indicated. Insulin is the preferred treatment first-line pharmacologic option, as it does not cross the placenta and allows precise dose titration. Basal-bolus regimens or premixed insulins can be used based on glucose profiles.

In select cases where insulin is not feasible due to non-availability, patient preference, resource limitations, or logistic barriers, metformin or glyburide may be considered (2nd and 3rd trimester), under close monitoring and shared decision making, as both cross placenta and long-term effects on the child are still under study.

Caution: Avoid or discontinue Metformin if fetal compromise (Placental insufficiency/IUGR) is suspected, in hypertension/preeclampsia; insulin preferred due to better titratability and placental safety profile. Avoid in significant hepatic disease. Contraindicated in renal impairment if eGFR <45, in acute illness or compromised perfusion (such as Hypoxia / Sepsis / Dehydration) as there is increased risk of lactic acidosis. Metformin may be considered only if benefits outweigh risks in case of fetal anomalies or high-risk pregnancy (ADA).

Low-dose aspirin at a dose of 81 mg/day (100-150 mg) for pregnant individuals with type 1 or type 2 diabetes starting between 12 and 28 weeks of gestation, optimally before 16 weeks and it should be continued till delivery. to reduce the risk of preeclampsia who are at high risk of developing preeclampsia when GDM coexists with other significant conditions such as chronic hypertension, renal disease, autoimmune disorders, or multifetal gestation. Aspirin may be considered in individuals with moderate-risk factors if two or more are present. These include being pregnant for the first time, maternal age of 35 years or older, a body mass index greater than 30, a family history of preeclampsia, and sociodemographic vulnerabilities. (ACOG, ADA).

Caution: Strictly avoid in individuals with a history of aspirin allergy, hypersensitivity to salicylates or NSAIDs, nasal polyps, or asthma with aspirin-induced bronchospasm due to the risk of anaphylaxis or life-threatening respiratory reactions. Relative contraindications include prior gastrointestinal bleeding, active peptic ulcer disease, other bleeding disorders, and severe hepatic dysfunction. Though rare, Reye syndrome has been reported in children under 18 recovering from viral illnesses when given aspirin. In cases of obstetric bleeding or elevated bleeding risk, continuation of aspirin should be evaluated individually.

Delivery timing and mode of delivery (as above). Timing of delivery 38 – 40 weeks in diet controlled or controlled on medication cases.

For type 1&2 DM in pregnancy screening for diabetic retinopathy in every trimester is recommended (ADA 2025)

Table 14. Screening and overview of management of gestational diabetes mellitus

Aspect	Details
Screening for GDM	Universal screening should be done in the first antenatal visit and at 24–28 weeks of gestation in pregnant women not previously known to have diabetes.: gestation using 75-g OGTT (one-step approach). For high-risk women, to detect overt diabetes before 24 weeks. For all women 24–28 weeks gestation not previously diagnosed with diabetes.
Diagnostic criteria (75-g OGTT)	Fasting ≥ 92 mg/dL 1-hour ≥ 180 mg/dL 2-hour ≥ 153 mg/dL
Glycemic targets	Fasting < 95 mg/dL 1-hour postprandial < 140 mg/dL 2-hour postprandial < 120 mg/dL
Non-pharmacological therapy	Medical nutrition therapy (individualized meal plan) Regular moderate exercise (e.g., walking) unless contraindicated
Pharmacological therapy	First-line: Insulin (preferred, does not cross placenta) Alternative (select cases): Metformin, glyburide
Monitoring	Daily self-monitoring of fasting + postprandial glucose Regular fetal growth ultrasound, amniotic fluid index
Assessment of response	Achieving target glucose levels without hypoglycemia Normal fetal growth and fluid levels
Delivery planning	Well-controlled GDM: deliver at 38–40 weeks Poorly controlled GDM / macrosomia / complications: consider earlier delivery Cesarean section if EFW > 4–4.5 kg

Note: EFW (Estimated Fetal Weight), is a approximation of the fetus's weight based on ultrasound measurements such as head circumference, abdominal circumference, and femur length.

Management of Pre-existing Diabetes in Pregnancy

Management of pre-existing diabetes (Type 1 or Type 2) in pregnancy focuses on achieving tight glycemic control before and throughout pregnancy to reduce risks of miscarriage, congenital anomalies, preeclampsia, preterm birth, macrosomia, stillbirth, and neonatal complications.

- Women should ideally receive preconception counseling emphasizing the importance of optimizing blood glucose (target HbA1C $< 6.5\%$ or as close to normal as possible without significant hypoglycemia) before conception.
- During pregnancy, insulin is the preferred therapy for glycemic control in both Type 1 and Type 2 diabetes. Most women require intensification of insulin therapy, through basal-bolus regimens or continuous subcutaneous insulin infusion (pump therapy) in Type 1 diabetes.
- Oral hypoglycemic agents like metformin or glyburide, if used pre-pregnancy, are generally switched to insulin, although metformin may be continued in selected Type 2 diabetes patients after shared decision-making (for details see above).

- Management includes medical nutrition therapy, appropriate weight gain, regular moderate physical activity unless contraindicated, and frequent glucose monitoring (fasting and postprandial). Monitoring of maternal glucose, HbA1C (each trimester), blood pressure, and fetal growth (serial ultrasounds) is essential. Aspirin (low dose) may be recommended from the late first trimester to reduce preeclampsia risk. Delivery planning should be individualized based on glycemic control, fetal size, and maternal condition, aiming for delivery at 38–39 weeks if stable.
- Postpartum, insulin needs often decline, and breastfeeding should be encouraged. Ongoing follow-up is critical for maternal and neonatal health.

Postpartum Management of Diabetes Mellitus

Immediate postpartum care in GDM is not different from women without GDM but women are at high risk to develop Type 2 Diabetes mellitus in future.

- Lifestyle interventions (healthy diet, regular exercise, weight management) should be reinforced to reduce future diabetes risk.
- In women with GDM, insulin and other glucose-lowering therapies are usually discontinued immediately after delivery, as insulin resistance rapidly decreases. However, these women remain at high risk for developing type 2 diabetes. Therefore, a 75-g oral glucose tolerance test (OGTT) is recommended 6 weeks postpartum to assess for persistent glucose intolerance, followed by regular lifelong screening every 1–3 years.
- In women with pre-existing diabetes, insulin requirements decrease after delivery — often to pre-pregnancy levels or lower — due to the loss of placental hormones that cause insulin resistance. Close monitoring of blood glucose is essential to adjust insulin doses and avoid hypoglycemia, especially in breastfeeding mothers.

Preconception planning and care

- Provide information, advice and support, to reduce the risks of adverse pregnancy outcomes for mother and baby.
- Explain to women with diabetes who are planning a pregnancy that if they have good blood glucose control before conception and throughout their pregnancy, this will reduce the risk of miscarriage, congenital malformation, stillbirth and neonatal death. But it should be explained that the risks can be reduced but not eliminated.
- When women with diabetes are planning a pregnancy, provide them and their families with information about how diabetes affects pregnancy and how pregnancy affects diabetes. The following information to be provided (MoH MV)

Antenatal care, Monitoring & Assessment of Response

Regarding the management of impaired glucose tolerance, the current approach is aggressive lifestyle modification. The aim is frequent follow up Antenatal care in collaboration with multidisciplinary team (Obstetrician, physician and dietician) and self-monitoring blood glucose for all pregnant women with diabetes.

Recommendation for Antenatal supervision with hyperglycemia in Pregnancy (HIP)

- GDM with well-controlled plasma sugar levels without any complications: routine antenatal care
- With uncontrolled plasma sugar levels or any complication of pregnancy: every 2 weekly visits in second trimester every week in third trimester
- NT Scan (12–13 weeks): Early screening for chromosomal anomalies
- Anomaly Scan with Cardiac Evaluation (22–24 weeks): Detailed fetal assessment
- Daily Fetal Movement Count: Advised due to increased risk of unexplained intrauterine fetal death
- Vitamin B12 Monitoring: Especially in women on long-term metformin therapy
- Vaccination & Smoking Cessation: As part of preventive care
- MASLD Screening: For metabolic dysfunction-associated steatotic liver disease high-risk cases
- Refer to higher center for ANC checkup and delivery.
- Periodic clinical and sonographic growth assessments from diagnosis until term.
- Use CTG and /or BPP or kick-count chart as indicated accordingly.
- Monitoring for maternal complications.
- Follow recommendations for mode and time of delivery as below.

[1] <https://health.gov.mv/storage/uploads/QEoAk1Y9/2idslx56.pdf>

Glucose monitoring in women with GDM:

- Self-monitoring of blood glucose is recommended for all pregnant women with diabetes, 3-4 times a day:
- Fasting: once daily, following at least 8 hours of overnight fasting
- Postprandial: 2-3 times daily, 1 or 2 hours after the onset of meals, rotating meals on different days of the week.

- Self- monitoring of blood glucose is recommended for all pregnant women with diabetes at least once daily, with documented relation to timing of meal.

Note: HbA1C is not routinely used for monitoring due to physiological changes in pregnancy. The assessment of response is based on achieving glycemic targets, absence of hypoglycemia, and normal fetal growth.

Delivery planning & Mode of Delivery

The mode and timing of delivery in GDM should be individualized based on glycemic control, fetal growth, maternal and obstetric factors (See above).

- In women with well-controlled GDM on diet or medication, spontaneous vaginal delivery at 39–40 weeks gestation is generally appropriate. Due to delay in lung maturity of fetus, routine delivery prior to 39 weeks is not recommended. Early delivery (before 38 weeks) may be considered if there are maternal or fetal complications, such as poor glycemic control, preeclampsia, or abnormal fetal growth or well-being.
- Cesarean section may be recommended if the estimated fetal weight exceeds 4,000–4,500 g due to the risk of shoulder dystocia.
- Continuous fetal monitoring during labor is advisable, and blood glucose levels should be maintained between 70–110 mg/dL during labor with insulin and dextrose infusions as needed.

Timing and mode of delivery in women with HIP

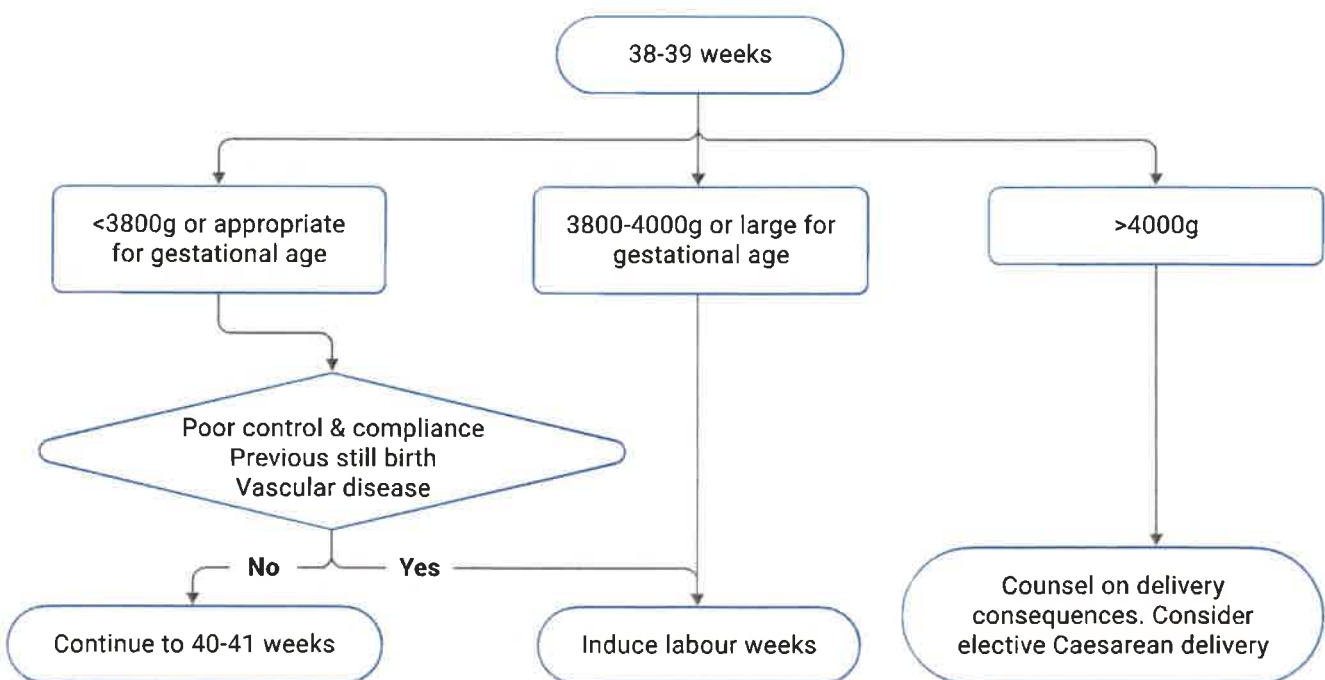


Figure 7: Recommendations for timing and mode of delivery in women in HIP (as per hospital protocol or as suggested below) Source: FIGO initiative 2017

Immediate neonatal care

- Early breast feeding.
- Monitor for hypoglycemia (capillary blood glucose < 44mg/dl).
- Evaluate for other neonatal complications like respiratory distress, convulsions and hyper-bilirubinemia

Patient education (GDM)

Patient education in GDM aims to equip women with the knowledge, skills, and confidence to manage their condition effectively during pregnancy and reduce risks for both mother and baby. The key objectives are:

- Help the patient understand what GDM is, why it occurs, and how it can affect maternal and fetal health if not well controlled.
- Explain target blood glucose ranges, the importance of maintaining them, and the role of diet, physical activity, and medication in achieving control.
- Train in accurate use of glucometers, timing of checks (fasting and post-meal), and recording results for review.
- Provide individualized dietary guidance, including portion control, carbohydrate distribution, and healthy food choices that meet pregnancy requirements.
- Advise on safe, pregnancy-appropriate exercise to improve insulin sensitivity and glycemic control.
- Educate on correct insulin injection or oral medication use, dose timing, storage, and the importance of adherence.
- Teach signs, symptoms, and immediate management strategies for both low and high blood glucose levels.
- Discuss delivery planning, newborn monitoring, and the importance of postpartum glucose testing to detect persistent diabetes or future risk.
- Emphasize healthy lifestyle continuation after pregnancy to lower the risk of developing type 2 diabetes in the future.
- Breastfeeding is encouraged as it provides metabolic benefits for both mother and infant.
- Women should receive contraceptive counseling and be advised about planning future pregnancies with preconception glycemic optimization
- Women should undergo a 75-g OGTT 6–12 weeks postpartum to check for persistent glucose intolerance and be counseled on long-term diabetes prevention strategies.

INSTRUCTIONS TO PATIENTS

Do	Don't
■ Eat balanced meals at regular intervals, avoiding large gaps between meals. Distribute carbohydrates evenly through the day.	■ Skip meals or bunch most carbs into one meal.
■ Choose whole grains, vegetables, pulses, lean protein, nuts, and healthy oils.	■ Rely on sweets, sugary drinks, juices, refined carbs, or deep-fried snacks.
■ Walk or do other moderate, pregnancy-safe activity most days.	■ Do activities with fall risk, abdominal impact, or that exhaust you.
■ Check glucose fasting and after meals exactly as instructed. Recognize Warning Signs: Low blood sugar: shakiness, sweating, dizziness – take quick sugar (e.g., glucose tablets or juice). High blood sugar: excessive thirst, frequent urination, blurred vision – check your glucose and inform your provider.	■ Guess glucose control or check “when you remember.”
■ Log every reading and bring the log (or app) to each visit.	■ Rely on memory or incomplete notes.
■ Take insulin/medicines on time; learn injection technique; rotate sites.	■ Change doses on your own, skip doses, reuse blunt needles, or share devices.
■ Store insulin per label (cool, not frozen; protect from heat and sunlight).	■ Keep insulin in a hot car, near a freezer compartment, or use expired vials/pens.
■ Treat low sugar fast: 15 g quick carb (glucose tabs/juice), recheck in 15 min.	■ Ignore symptoms of shakiness, sweating, or dizziness, or overcorrect with heavy meals.
■ Check for high sugar if unwell; follow sick-day advice and hydrate.	■ Stop insulin during illness or ignore persistent high readings.
■ Keep quick sugar and your meter with you when outside.	■ Leave home without emergency carbs or testing supplies.
■ Attend all antenatal visits; discuss timing and mode of delivery.	■ Delay check-ups or last-minute delivery planning.
■ Breastfeed if possible; it helps your and baby's metabolism.	■ Assume medicines automatically prevent breastfeeding—ask first.
■ Do the 75-g OGTT at 6–12 weeks postpartum; then screen every 1–3 years.	■ Skip postpartum testing or future screening.
■ Use contraception and plan future pregnancies with preconception glucose review.	■ Conceive without optimizing sugars or stopping unsafe meds.
■ Ask your care team when unsure.	■ Take advice from non-medical sources or self-
■ Maintain healthy eating and activity to reduce your future diabetes risk.	

COMPLICATIONS OF DIABETES MELLITUS

Immediate Metabolic Complications

1. Hypoglycemia

Definition

Hypoglycemia is defined as blood glucose <70 mg/dL (3.9 mmol/L). Severe (level 3) hypoglycemia is associated with cognitive impairment requiring assistance (Table 10)

Causes

- Excess insulin or oral hypoglycemic agent dose (e.g., sulfonylureas)
- Skipped or delayed meals
- Excessive or unplanned physical activity without dose/food adjustment
- Alcohol intake (especially on an empty stomach)
- Renal or hepatic dysfunction (impaired insulin clearance)
- Drug interactions (e.g., beta-blockers masking symptoms)

Clinical Presentation

- Autonomic symptoms: sweating, tremors, palpitations, hunger, anxiety
- Neuroglycopenic symptoms: confusion, blurred vision, dizziness, difficulty concentrating, seizures, loss of consciousness
- In elderly or long-standing diabetes, hypoglycemia unawareness is common.

It is classified into three levels: Level 1 to 3 depending on the BG levels (Table 10). This classification helps tailor clinical responses, ranging from dietary adjustments and medication review to emergency support, ensuring timely and appropriate management to prevent complications.

Table 10. Levels of Hypoglycemia

Level	Blood glucose	Description
Level 1	<70 mg/dL but ≥54 mg/dL	Alert level (requires action to prevent worsening) national antenatal screening program
Level 2	<54 mg/dL	Clinically significant hypoglycemia
Level 3	Any glucose, with severe cognitive impairment needing assistance	Severe hypoglycemia

Management

At Home

If patient is conscious and able to swallow:

- Give 15–20 g fast-acting carbohydrate (e.g., glucose tablets, 3 teaspoons sugar, 1/2 glass juice)
- Recheck glucose after 15 minutes
- Repeat treatment if glucose still <70 mg/dL
- Once >70 mg/dL, follow with longer-acting carbohydrate (e.g., biscuit, bread)

If patient is unconscious / unable to swallow:

- Family member gives glucagon injection (1 mg IM/SC) if available
- Seek immediate hospital care

In Hospital

If patient is conscious:

- As above

If patient is unconscious

- Give 25–50 mL of 25% dextrose IV bolus (or 50% dextrose 20–30 mL slowly), followed by 5–10% dextrose infusion until stable
- Monitor glucose every 15–30 minutes initially

Prevention

- Regular meal timings; avoid meal skipping
- Dose adjustments during increased activity or reduced intake
- Frequent glucose monitoring during therapy changes or illness
- Avoid excessive alcohol consumption
- Routine education about hypoglycemia risks and management

Patient Education

- Recognize early symptoms: sweating, trembling, hunger, irritability, confusion
- Always carry a source of fast-acting carbohydrate (e.g., glucose tablets, fruit juice, candy)

- Instruct family and friends on how to administer glucagon during severe episodes
- Follow a consistent meal plan and take medications at scheduled times
- Monitor blood glucose regularly to detect drops early
- Wear a medical ID bracelet or tag to alert others in case of emergencies
- Adjust medications during illness, travel, or changes in daily routine
- Emphasize reporting any hypoglycemic episodes to your healthcare provider for dose review and future prevention
- Discuss the need for adjusting therapy during changes in daily routine, illness, or travel

Table 11. Do's and Don'ts in the management of hypoglycemia

Do's	Don'ts
■ Always carry glucose tablets or sugar sachets ■ Educate family on hypoglycemia signs and emergency treatment ■ Wear medical ID indicating diabetes ■ Adjust insulin/oral medication dose before exercise or fasting	■ Don't delay treatment when symptoms occur ■ Don't give oral intake to unconscious patients ■ Don't over-treat (can cause rebound hyperglycemia)

2. DIABETIC KETOACIDOSIS

Definition

Diabetic ketoacidosis (DKA) is an acute, life-threatening metabolic complication of diabetes mellitus characterized by the triad:

- **Hyperglycemia:** blood glucose >250 mg/dL
- **Ketosis:** presence of ketones in blood or urine
- **Metabolic acidosis:** arterial pH <7.3 and/or serum bicarbonate <18 mEq/L

Causes

- Missed or inadequate insulin doses (poor adherence, interrupted therapy)
- First presentation of Type 1 Diabetes Mellitus (especially in children/adolescents)
- Infections (pneumonia, urinary tract infection, skin infections — most common precipitant)
- Acute illnesses: myocardial infarction, stroke, pancreatitis

- Surgery, trauma, burns
- Drugs: corticosteroids, thiazides, sympathomimetics

Salient Features

- Clinically, DKA presents polyuria, polydipsia, weight loss, nausea, vomiting, abdominal pain, weakness, dehydration, tachycardia, hypotension, Kussmaul respiration (deep, rapid breathing), fruity breath odor (due to acetone), and, in severe cases, altered mental status (confusion, drowsiness), or coma.
- Signs: Diabetic ketoacidosis presents with a characteristic set of signs reflecting severe dehydration, metabolic acidosis, and the underlying hyperglycemic state. Patients often show signs of dehydration, such as dry mucous membranes, poor skin turgor, sunken eyes, dry tongue, and reduced urine output. Tachycardia is common as a compensatory response to hypovolemia, and hypotension may develop in moderate to severe dehydration. Respiratory signs include Kussmaul breathing—deep, rapid, labored respirations—as the body attempts to compensate for metabolic acidosis by blowing off carbon dioxide. A distinctive fruity or acetone odor on the breath is frequently noted due to exhaled ketones.
- Neurological signs can vary depending on severity; patients may appear drowsy, lethargic, or confused, and in severe cases, coma may occur. Other findings include hypothermia (particularly in severe DKA or in children), weak peripheral pulses, and occasionally abdominal tenderness that can mimic an acute abdomen. These signs, when observed in a diabetic or undiagnosed patient with hyperglycemia, should prompt immediate evaluation for DKA and initiation of appropriate management.

Management of DKA

Non-Pharmacological Management

- Admit to ICU or high-dependency unit for severe DKA (pH <7.0, altered sensorium, hypotension)
- Ensure airway protection and adequate breathing/circulation
- Start continuous monitoring: vitals, input-output chart, mental status
- Insert large-bore IV line, urinary catheter (if indicated)

Pharmacological Management

1. Fluid resuscitation (priority to restore intravascular volume):

- **0.9% normal saline:** 15–20 mL/kg (1–1.5 liters) over the first hour

- Continue 250–500 mL/hour depending on hydration, cardiac status, and sodium level
- Once corrected sodium is normal/high switch to 0.45% saline
- When BG falls to 200 mg/dL, add 5% dextrose with saline to prevent hypoglycemia while continuing insulin

2. Insulin therapy:

- Start regular insulin IV infusion: 0.1 unit/kg/hour
- Optional: initial IV bolus of 0.1 unit/kg
- Goal: reduce blood glucose by 50–75 mg/dL per hour
- When BG reaches 200 mg/dL: reduce insulin infusion to 0.02–0.05 unit/kg/hour; maintain glucose between 150–200 mg/dL until acidosis resolves

3. Potassium replacement:

- **Before insulin initiation:**
 - If $K^+ < 3.3$ mEq/L: hold insulin, give 20–40 mEq KCl/hour until > 3.3 mEq/L
 - If $K^+ 3.3$ – 5.2 mEq/L: give 20–30 mEq KCl/L IV fluid
 - If $K^+ > 5.2$ mEq/L: monitor K^+ every 2 hours, no immediate supplementation

Note: For precautions to be taken while administering Potassium Chloride (KCl) see Table 12.

4. Bicarbonate therapy:

- Rarely required; consider if **pH < 6.9**
- Dose: 50 mEq sodium bicarbonate in 400 mL sterile water + 20 mEq KCl infused over 2 hours

Monitoring of response to therapy

- Blood glucose: hourly until stable
- Serum electrolytes, urea, creatinine, venous blood gas: every 2–4 hours
- Urine ketones or serum beta-hydroxybutyrate: every 4–6 hours
- Fluid balance: strict input-output chart
- Vitals, neurological status: frequently (hourly initially)

Assessment of Response to Treatment

- Blood glucose falling by 50–75 mg/dL/hour
- Acidosis correction: pH >7.3, bicarbonate >18 mEq/L
- Anion gap closure
- Ketones negative or decreasing
- Improved hydration, normalization of vitals, mental status recovery

Once DKA resolves:

- Transition to subcutaneous insulin regimen
- Overlap IV insulin and SC insulin by 1–2 hours when switching

Key points in DKA management

Throughout, it is vital to identify and treat underlying triggers, avoid rapid fluid or osmolality shifts (to prevent cerebral edema, particularly in children), and ensure safe potassium replacement.

- Address the underlying cause (e.g., infection: start antibiotics if needed)
- Avoid rapid shifts in osmolality (risk of cerebral edema, especially in children)
- Never withhold potassium replacement when indicated
- Continue glucose monitoring after DKA resolution to avoid hypoglycemia.

Management of Precipitating Causes of DKA

Successful treatment of diabetic ketoacidosis (DKA) requires not only correcting metabolic derangements but also identifying and managing underlying triggers.

- The most common precipitating cause is infection (e.g., pneumonia, urinary tract infection), which should be promptly diagnosed through clinical examination, appropriate cultures, and imaging if needed, and treated with targeted antibiotics.
- In cases of myocardial infarction, stroke, or other acute illnesses, supportive care and disease-specific management (e.g., anticoagulation, reperfusion therapy) must be initiated.
- Missed insulin doses should be addressed through patient education, reviewing injection techniques, and ensuring access to insulin and supplies.

Other causes like pancreatitis, trauma, or certain medications (e.g., corticosteroids) should be identified and appropriately managed. A thorough search for triggers is essential to prevent the recurrence of DKA.

Table 12. Precautions While Administering Potassium Chloride (KCl)

Potassium chloride (KCl) is a high-alert concentrated electrolyte solution, and errors in its administration can cause serious, potentially fatal complications, including cardiac arrhythmias and cardiac arrest. The following precautions must be strictly observed during its use in DKA management:

✓ **Dilution and administration:**

- Never give undiluted KCl directly as an IV bolus or push.
- KCl should always be diluted in an appropriate volume of IV fluids (e.g., saline or dextrose saline).
- The concentration should generally not exceed 40 mEq/L in peripheral lines; higher concentrations require central venous access.

✓ **Infusion rate:**

- Do not exceed **10 mEq/hour** via peripheral line.
- Up to **20 mEq/hour** may be used via central line in closely monitored settings (e.g., ICU) with continuous ECG monitoring.

✓ **Monitoring:**

- Continuous cardiac monitoring is mandatory for rates >10 mEq/hour or when given via central line.
- Check serum potassium levels at baseline and every 2–4 hours during replacement.
- Use pre-mixed, ready-to-use KCl solutions whenever available to reduce risk of dosing errors.

✓ **Storage and handling:**

- Clearly label KCl-containing solutions.
- Store concentrated KCl ampoules separately, ideally in a controlled-access area.
- Use pre-mixed, ready-to-use KCl solutions whenever available to reduce risk of dosing errors.

✓ **Staff education:**

- Ensure that all healthcare staff administering KCl are trained on its safe handling and administration protocols.

✗ **Do not:**

- Do not add KCl to a hanging IV bag already connected to a patient.
- Do not exceed recommended rates or concentrations.
- Do not administer without confirming serum potassium level

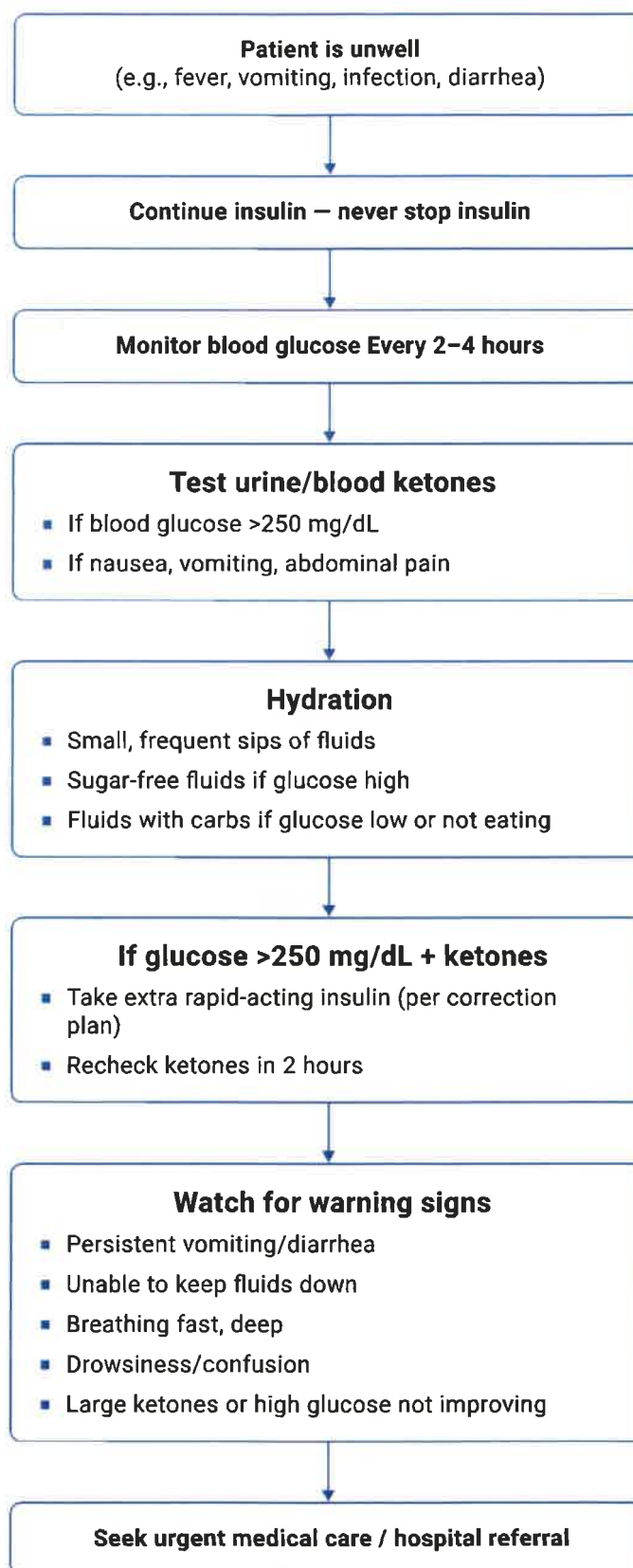
3. Sick Day Management

Sick day management is a critical component of care for individuals with Type 1 Diabetes Mellitus, as intercurrent illnesses—such as infections, fever, or gastrointestinal disturbances—can significantly disrupt glycemic control and increase the risk of diabetic ketoacidosis (DKA). During illness, stress hormones such as cortisol and catecholamines are elevated, leading to increased insulin resistance and hepatic glucose production. Therefore, it is essential to educate patients and caregivers about the following:

- 1. Insulin should never be stopped during illness**, even if food intake is reduced or appetite is poor. In most cases, the usual insulin dose should be continued, and sometimes additional insulin may be required to counteract hyperglycemia and ketone production.

2. Patients should be advised to **monitor blood glucose levels more frequently**, every 2 to 4 hours, including during the night if necessary. In addition, urine or blood ketone testing should be done at these intervals, especially if blood glucose levels exceed 250 mg/dL or if symptoms such as nausea, vomiting, or abdominal pain develop. Early detection of rising ketones allows for timely intervention to prevent progression to DKA.
3. **Hydration is of paramount importance** during sick days. Patients should be encouraged to take small, frequent sips of fluids—preferably sugar-free if blood glucose is high, and containing carbohydrates (e.g., clear soups, fruit juices) if hypoglycemia is a concern or if food intake is inadequate. The goal is to maintain adequate fluid intake to prevent dehydration and assist in flushing out ketones. If the patient is unable to tolerate solids, liquid carbohydrates should be given to meet energy needs and prevent hypoglycemia.
4. Clear criteria for seeking medical help should be communicated to patients and caregivers. **They should promptly contact their healthcare provider or report to a health facility if they experience persistent vomiting or diarrhea, inability to keep fluids down, rapid breathing, confusion or drowsiness, high blood glucose levels (>300 mg/dL) that are not responding to extra insulin, or moderate to large ketones despite corrective measures.**
5. Sick day guidelines should be reinforced at every clinic visit, with written instructions provided where feasible (Figure 2). Patients and families should have ready access to contact information for diabetes care providers and understand when hospitalization is indicated to manage dehydration, DKA, or severe hypoglycemia.

Sick Day Management Flowchart for T1DM



VACCINATION FOR DIABETIC PATIENTS

Vaccination for individuals with diabetes—both children and adults—should follow age-specific guidelines. Recommendations from the CDC’s Advisory Committee on Immunization Practices (ACIP) are summarized in Table 15 for select vaccines. [cdc.gov/vaccines](https://www.cdc.gov/vaccines).

Table 15 . Highly recommended immunizations for adults with diabetes (from the Advisory Committee on Immunization Practices and Centers for Disease Control and Prevention; ADA 2025)

Vaccine	Recommended age	Schedule
COVID-19	All people ≥ 6 months	Initial series and boosters per current guidance
Hepatitis B	Adults with diabetes < 60 years; ≥ 60 years at clinician’s discretion based on exposure risk	As per updated ACIP recommendations
Influenza	All people with diabetes	One dose of inactivated (trivalent) vaccine annually; avoid live attenuated vaccine
Pneumococcal polysaccharide (PPSV23)	19–64 years	One dose if prior PCV13; if PCV15, follow with PPSV23 ≥ 1 year later; not indicated after PCV20; after PPSV23 only, give PCV15/20 ≥ 1 year later
	≥ 65 years	Same as above
Pneumococcal conjugate (PCV15 or PCV20)	19–64 years with immunocompromise, cochlear implant, or CSF leak	Single dose of PCV15 or PCV20
	19–64 years, immunocompetent, no prior pneumococcal vaccine	Single dose of PCV15 or PCV20
	≥ 65 years, immunocompetent, after shared decision-making	Single dose; PPSV23 may follow ≥ 8 weeks after PCV15; not indicated after PCV20
RSV	≥ 75 years, and ≥ 60 years at high risk (including diabetes)	Single dose of RSV vaccine
Tdap (tetanus, diphtheria, pertussis)	All adults; pregnant individuals get an extra dose per pregnancy	Booster every 10 years
Zoster (recombinant)	≥ 50 years	Two doses, 2–6 months apart

LONG TERM COMPLICATIONS: PREVENTION AND MANAGEMENT

Long-term complications of diabetes mellitus, both microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (coronary artery disease, cerebrovascular disease, peripheral arterial disease), are major causes of disability, poor quality of life, and premature death. Prevention of these complications is crucial because once established, they may be irreversible or only partially reversible. Early and sustained control of blood glucose, blood pressure, and lipids reduce the risk and slow the progression of these complications. Prevention strategies also reduce healthcare costs, hospitalizations, and the burden on both patients and the health system (Table 13).

1. Diabetic Retinopathy

Diabetic retinopathy (DR) affects nearly one in three people with diabetes. It begins without symptoms and can progress to vision loss if unchecked. Early detection and timely treatment prevent most serious outcomes.

Diabetic retinopathy is often asymptomatic in its early stages, highlighting the importance of screening. As the disease progresses, patients may report blurred vision, floaters, visual distortion, or sudden vision loss in cases of vitreous hemorrhage or retinal detachment.

On fundoscopic exam, signs include microaneurysms, dot-blot hemorrhages, hard exudates, cotton wool spots, and neovascularization in proliferative disease.

Risk factors:

Key drivers include: Duration of diabetes, poor glycemic control (HbA1c consistently >7%), hypertension, dyslipidemia, smoking, pregnancy (in women with pre-existing diabetes).

Prevention strategies:

Prevention involves good glycemic and blood pressure control.

- **Glycemic control:** Aim for HbA1C $\leq 7\%$. Review targets in elderly or high-hypoglycemia risk.
- **Blood pressure:** Keep <130/80 mm Hg. Use ACE inhibitors or ARBs when possible.
- **Lipid management:** Statin therapy to reach LDL <70 mg/dL in those with cardiovascular risk.

- **Lifestyle:** Advise daily moderate exercise, smoking cessation, and a balanced diet rich in fruits, vegetables, and whole grains.

Screening and classification

- Type 1 diabetes: First eye exam 5 years after diagnosis; then annual if no retinopathy.
- Type 2 diabetes: First exam at diagnosis; then annually if stable.
- High-risk or existing DR: Examine every 3–6 months.
- Method: Dilated fundus examination by ophthalmologist or trained grader using slit-lamp bio microscopy or fundus photography.
- **Grading:**
 - No DR
 - Mild non-proliferative DR: Microaneurysms only
 - Moderate non-proliferative DR: More than microaneurysms but less than severe
 - Severe non-proliferative DR: Any of hemorrhages in four quadrants, venous beading in two, or intraretinal microvascular abnormalities in one
 - Proliferative DR (PDR): Neovascularization or vitreous/preretinal hemorrhage
 - Diabetic macular edema (DME): Thickening or hard exudates at the macula

Management:

Management includes timely ophthalmological interventions such as laser photocoagulation for proliferative retinopathy or macular edema, and intravitreal anti-VEGF injections where indicated.

Follow-up intervals

Severity	Interval
No DR	12 months
Mild NPDR	6–12 months
Moderate NPDR	6 months
Severe NPDR / DME	3–4 months
PDR	1–3 months

Adjust interval based on rate of progression and treatment response.

For diabetic women planning pregnancy, aim to perform a baseline retinal exam before conception, when possible, then repeat screenings once each trimester and again a year after delivery. In low-resource settings, trained technicians can use non-mydratic fundus cameras to capture images, which are then sent electronically to ophthalmologists for interpretation and follow-up.

Integration with primary care

- Embed retinal screening in routine diabetes clinics.
- Use electronic health record alerts for due exams, if available.
- Coordinate with community health workers to improve follow-up.

Patient education

- Explain the silent nature of DR and importance of annual exams.
- Teach patients to report any sudden changes in vision (floaters, blurring, field defects).
- Provide printed or digital reminders for appointments.

Early, systematic screening and a clear treatment pathway cut the risk of severe vision loss by over 90%. Consistent metabolic control, regular eye exams, and prompt ophthalmic care form the backbone of diabetic retinopathy prevention and management.

2. Diabetic Nephropathy

Symptoms of nephropathy are generally absent until advanced stages, but patients may develop frothy urine (proteinuria), ankle swelling, fatigue, and signs of fluid overload (e.g., elevated JVP, hypertension).

Early signs include microalbuminuria, progressing to overt proteinuria and reduced estimated glomerular filtration rate (eGFR).

- Normoalbuminuria: Urine albumin-to-creatinine ratio (UACR) <30 mg/g
- Microalbuminuria: UACR 30–300 mg/g
- Macroalbuminuria: UACR >300 mg/g
- Reduced eGFR: Estimated GFR <60 mL/min/1.73 m²

Screening and Diagnosis

- Frequency: Annually in all adults with diabetes, starting 5 years after diagnosis of type 1 or at diagnosis of type 2.
- Tests:
 - UACR on a spot urine sample (first-morning if possible)
 - Serum creatinine to calculate eGFR
- Confirmatory: Repeat elevated UACR twice over 3–6 months to confirm persistence.
- Exclude: Urinary tract infection, heavy exercise, fever or heart failure before lab draws.

Staging and Classification

Combine albuminuria category (A) and eGFR category (G) for risk stratification.

A category	UACR (mg/g)	G category	eGFR (mL/min/1.73 m ²)	Risk level
A1	<30 (normal)	G1	≥90	Low
A2	30–300 (micro)	G2	60–89	Moderate
A3	>300 (macro)	G3a	45–59	High
		G3b	30–44	Very high
		G4	15–29	Very high
		G5	<15	Kidney failure

Monitoring and Follow-Up

- Stable low-risk (A1, G1-G2): Annual UACR and eGFR.
- Moderate-high risk (A2-A3 or G3): Every 6 months.
- Very high risk (A3 with G3b-G5): Every 3 months or as clinically indicated.
- Check potassium and creatinine 2–4 weeks after RAAS or finerenone initiation or dose change.

Management of Complications

- Anemia: Screen when eGFR <60; treat with iron and erythropoiesis-stimulating agents per guidelines.
- Bone-mineral disorder: Monitor calcium, phosphate, PTH when eGFR <60; supplement vitamin D as needed.
- Edema: Loop diuretics tailored to volume status and eGFR.

Prevention

Prevention includes tight glycemic and blood pressure control (BP target <130/80 mmHg if albuminuria is present), and the use of ACE inhibitors or ARBs in microalbuminuria or overt nephropathy.

Statin therapy for all patients aged ≥40 years or those with cardiovascular risk factors. Target LDL-C <70 mg/dL in high-risk patients.

Target HbA1c 6.5–7.0% if low hypoglycemia risk; individualize in advanced CKD or comorbidities.

Prefer agents with proven renal benefit (SGLT2 inhibitors, GLP-1 receptor agonists). Titrate to maximum tolerated dose. Monitor serum potassium and creatinine after initiation.

Dietary salt and protein restriction may be recommended. In advanced nephropathy, management includes preparation for renal replacement therapy.

Referral Criteria

Refer to nephrology if any of the following:

- eGFR decline >5 mL/min/1.73 m² per year
- Sustained eGFR <30 mL/min/1.73 m²
- Persistent albuminuria A3
- Resistant hypertension despite ≥3 agents
- Electrolyte disturbances refractory to outpatient management
- Uncertain diagnosis or atypical features

3. Diabetic Neuropathy

In 2024, the International Diabetes Federation estimated that 9.5% of Maldivian adults—about 360,099 people—have diabetes (International Diabetes Federation). In the wider WHO South-East Asia Region, studies show that roughly one-third of people with diabetes develop neuropathy and hospital-based surveys document prevalence between 30% and 58% (for example, 33% in Singapore, over 50% in Malaysia, 42–58% in the Philippines and Indonesia, and about 34% in Thailand) (Malik 2020). By extrapolation, it's likely that around 9,000 to 18,000 Maldivian adults may be affected by diabetic neuropathy.

Symptoms include numbness, tingling, burning, or stabbing pain, in a glove-and-stocking distribution, often worse at night.

Signs may include loss of vibration sense, reduced ankle reflexes, and impaired monofilament or tuning fork test responses. Autonomic neuropathy may present with postural hypotension, gastroparesis, bladder dysfunction, or erectile dysfunction. Patients with diabetes should have their feet examined regularly—annually if they're low risk, every six months with neuropathy, quarterly when artery disease or deformities are present, and monthly after a prior ulcer or amputation. Each check must screen for loss of sensation, poor circulation, deformities, past ulcers or amputations, pre-ulcer signs, hygiene issues, and ill-fitting shoes.

Characteristic	Category	Screening frequency
No peripheral neuropathy	0	Once a year
Peripheral neuropathy	1	Every six months
Peripheral neuropathy with peripheral artery disease and/or foot deformity	2	Every 3–6 months
Peripheral neuropathy with history of foot ulcer or lower-extremity amputation	3	Every 1–3 months

Source: IWGDF guidelines 2015

4. Diabetic foot

Treat calluses, blisters, nail problems, bleeding or fungal infections right away. Teach patients to inspect and wash their feet daily (drying between toes), avoid walking barefoot or in thin-soled footwear, trim nails straight across, and use emollients for dry skin.

Recommend well-fitting shoes—and for those with deformities or high risk, therapeutic footwear, custom insoles, or orthoses—and, when appropriate, home foot-temperature monitoring to catch inflammation early.

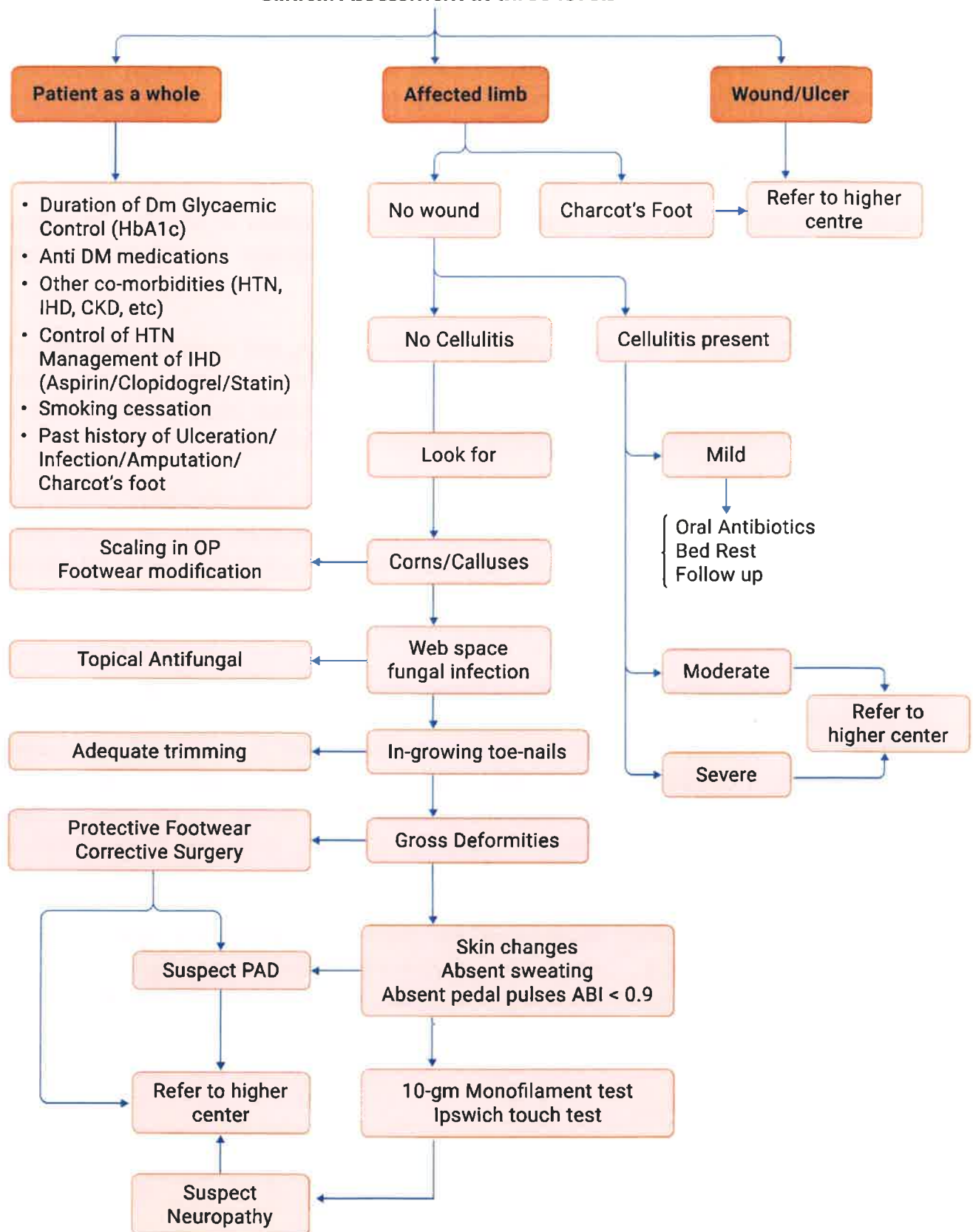
Combining professional foot care, pressure-relieving shoes, and ongoing education, with reevaluation every one to three months, prevents first and recurrent ulcers. When a wound occurs, assess the patient as a whole, the affected limb for blood flow and sensation, and the wound itself, including biomechanical factors.

Hospitalize anyone with a severe foot infection, moderate infection plus severe artery disease or no home support, patients who can't follow outpatient care, or those who fail to improve at home. Look for wounds that extend to tendon or bone, cellulitis over more than two centimeters, necrosis, deep abscess, gangrene, systemic signs like fever or low blood pressure, and lab markers such as very high white-cell count or CRP.

Admit patients who are metabolically or hemodynamically unstable, need IV antibiotics or advanced imaging, have critical foot ischemia, require more than minor surgery, or can't manage complex dressings or continuous observation at home. Before discharge, ensure surgery is complete, blood sugar is controlled, and the patient (or caregiver) can handle antibiotics, off-loading devices, and wound care. Provide a clear plan for follow-up, including antibiotic regimen, off-loading scheme, dressing instructions, and scheduled outpatient visits.

Good glycemic control helps delay onset. For painful neuropathy management focuses on symptom relief (e.g., pregabalin, duloxetine, tricyclic antidepressants), and prevention of foot complications through education, foot care, and appropriate footwear.

Clinical Assessment at three levels



Adopted from Diabetic foot prevention and management in India. Standard Treatment Guidelines.

5. Macrovascular Complications (e.g., CAD, Stroke, PAD)

Symptoms vary with the vascular territory involved.

- In CAD, patients may experience chest pain, dyspnea, or silent ischemia. In stroke, signs include sudden weakness, speech difficulty, facial asymmetry, or visual field defects.
- PAD may present as claudication (leg pain on walking), cool extremities, and diminished pulses.
- Prevention and management require intensive control of risk factors, including statins (target LDL <100 mg/dL, or <70 mg/dL if ASCVD is present), antihypertensives, aspirin in high-risk patients, smoking cessation, weight management, and the use of SGLT2 inhibitors or GLP-1 receptor agonists in suitable patients.
- Advanced cases may require revascularization procedures.

6. Metabolic Dysfunction–Associated Steatotic Liver Disease (MASLD) and its inflammatory form, Metabolic Dysfunction–Associated Steatohepatitis (MASH)

MASLD and its inflammatory form, MASH, often go unnoticed until fibrosis has set in.

- Screening targets people with obesity, type 2 diabetes or metabolic syndrome by checking liver enzymes and performing an abdominal ultrasound. If alanine aminotransferase is elevated or imaging shows steatosis, noninvasive fibrosis scores (for example, FIB-4) or transient elastography help gauge disease severity. When these tests suggest advanced fibrosis or yield unclear results, a liver biopsy remains the definitive method to confirm MASH and stage the damage.
- Management begins with lifestyle change: structured diet and exercise program aiming for 7–10 percent weight loss, which consistently improves fat accumulation and inflammation. In patients with biopsy-proven MASH and significant fibrosis, pioglitazone or vitamin E can be offered in noncirrhotic cases, alongside tight control of blood sugar, lipids and blood pressure.
- Follow-up every six to twelve months includes repeating liver tests, reassessing metabolic risk factors and monitoring cardiovascular health.

Early detection and intervention can halt progression to cirrhosis, lower liver-related complications and reduce cardiovascular risk.

Table 13: Long-term Complications of Diabetes – Prevention, Management & Screening

Complication	Prevention	Management	When to Start Screening	Screening Frequency
Retinopathy	Good glycemic and blood-pressure control	Laser photocoagulation; intravitreal anti-VEGF as needed	T1DM: 5 years after diagnosis T2DM: at diagnosis	Annually (every 1–2 years if normal)
Nephropathy	Glycemic and blood-pressure control; ACE inhibitor/ARB for microalbuminuria	Continue ACE inhibitor/ARB; optimize BP; prepare for renal replacement if advanced	T1DM: 5 years after diagnosis T2DM: at diagnosis	Annually (urine ACR or microalbuminuria)
Neuropathy	Good glycemic control	Symptom relief (pregabalin, duloxetine); foot-care education	T1DM: 5 years after diagnosis T2DM: at diagnosis	Annually
Foot complications	Glycemic control; daily foot inspection and care	Protective footwear; ulcer treatment; amputation prevention	At diagnosis	Annually (more often if high risk)
Macrovascular (CVD, PAD, stroke)	Glucose, BP and LDL control; smoking cessation; weight management	Statins; antiplatelets if indicated; SGLT-2 inhibitors/GLP-1 RAs for ASCVD; revascularization as needed	At diagnosis (with CVD risk assessment)	Lipids: every 1–2 years BP: every visit
Metabolic Dysfunction–Associated Steatotic Liver Disease (MASLD) and Metabolic Dysfunction–Associated Steatohepatitis (MASH)	Weight loss (7–10 percent); diet and exercise; optimize glycemic, lipid and BP control	Lifestyle (diet/exercise)–driven weight loss; in MASH with fibrosis consider pioglitazone or vitamin E; manage metabolic risks	At diagnosis in all patients with T2DM or metabolic syndrome	Annually (LFT and ultrasound)

Note: Target Goals HbA1C: <7% (individualized); BP: <140/90 mmHg (or <130/80 mmHg if high risk); LDL: <100 mg/dL (or <70 mg/dL if CVD present)

Table 14. Components of the comprehensive diabetes medical evaluation at initial, follow-up, and annual visits

Item	Initial	Follow-up	Annual
Diabetes history			
■ Characteristics at onset (age, symptoms/signs)	✓		
■ Review of prior treatment plans and response	✓		
■ Frequency, cause & severity of past hospitalizations	✓		

Family history			
■ Diabetes in a first-degree relative	✓		
■ Autoimmune disorders	✓		
Personal history of complications & comorbidities			
■ Common comorbidities (obesity, OSA, MASLD)	✓		✓
■ Hypertension or dyslipidemia	✓		✓
■ Macro- and microvascular complications	✓		✓
■ Hypoglycemia (awareness, frequency, causes, timing)	✓	✓	✓
■ Hemoglobinopathies or anemia	✓		✓
■ Last dental visit	✓		✓
■ Last dilated eye exam	✓		✓
■ Visits to specialists		✓	
■ Disability assessment & use of assistive devices	✓	✓	✓
■ Personal history of autoimmune disease	✓		
Surgical & procedure history			
■ Surgeries (e.g., metabolic surgery, transplant)	✓	✓	✓
Interval history			
■ Changes in medical or family history since last visit		✓	✓
Behavioral factors			
■ Eating patterns & weight history	✓	✓	✓
■ Familiarity with carbohydrate counting (MDI users)	✓		
■ Physical activity, sleep habits & OSA screening	✓	✓	✓
■ Tobacco, alcohol & substance use	✓		✓
Medications & vaccinations			
■ Current medication plan	✓	✓	✓
■ Medication-taking behavior (e.g., rationing)	✓	✓	✓
■ Intolerance or side effects	✓	✓	✓
■ Complementary/alternative medicine use	✓	✓	✓
■ Vaccination history & pending needs	✓		
Technology use			
■ Use of health apps, online education & patient portals	✓	✓	✓
■ Glucose monitoring (meter or CGM results & data review)	✓	✓	✓
■ Insulin pump settings, pen device & connected data review	✓	✓	✓

Physical examination			
■ Height, weight, BMI; growth & puberty (children/adolescents)	✓	✓	✓
■ Blood pressure	✓	✓	✓
■ Orthostatic BP (when indicated)	✓		✓
■ Fundoscopic exam (or refer to eye specialist)	✓		✓
■ Thyroid palpation	✓		✓
■ Skin exam (acanthosis, injection sites, lipodystrophy)	✓	✓	✓
■ Comprehensive foot exam	✓		✓
■ Visual foot inspection (integrity, callus, deformity, nails)*	✓	✓	✓
■ Pedal pulses & PAD screening (ABI if it alters management)	✓		✓
■ Sensation testing (temperature, vibration/pinprick, 10-g monofilament)	✓		✓
■ Mental-health screen (depression, anxiety, distress, fear of hypo)	✓		✓
■ Cognitive performance assessment (if indicated) at 65 years of age or older	✓		✓
■ Functional performance assessment (if indicated) At 65 years of age or older	✓		✓
■ Bone-health consideration (height loss, kyphosis)	✓		✓
Laboratory examination			
■ A1C (if no result in past 3 months)	✓	✓	✓
■ Lipid profile (total, LDL, HDL, triglycerides)‡	✓		✓
■ Liver function tests (including FIB-4)‡	✓		✓
■ Spot urinary albumin-to-creatinine ratio	✓		✓
■ Serum creatinine & eGFR§	✓		✓
■ TSH in type 1 diabetes‡	✓		✓
■ Celiac screening in type 1 diabetes	✓		
■ Vitamin B12 (if on metformin > 5 years)	✓		✓
■ CBC with platelets	✓		✓
■ Serum potassium (on ACEI, ARB or diuretics)§	✓		✓
■ Calcium, vitamin D & phosphorus (as indicated)	✓		✓

ABI, ankle brachial index; ARBs, angiotensin receptor blockers; CBC, complete blood count; CGM, continuous glucose monitor; FIB-4: fibrosis-4 index; MASLD, metabolic-associated steatotic liver disease; MDI, multiple daily injections; OSA, obstructive sleep apnea; PAD, peripheral arterial disease.

- Visual inspection includes skin integrity, callus formation, foot deformities or ulcers and toenail assessment.
- ‡ Frequency may vary based on risk factors. In people without dyslipidemia and not on cholesterol-lowering therapy, testing may be less frequent.
- § Adjust testing interval to clinical context. May be needed more frequently in people with diabetes with known chronic kidney disease or with changes in medications that affect kidney function and serum potassium
- || Testing once at diagnosis suffices unless clinically indicated later

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