

AUSTRALIAN TYPE 2 DIABETES GLYCAEMIC MANAGEMENT ALGORITHM

This Type 2 Diabetes Glycaemic Management Algorithm should be read in conjunction with the Living Evidence Guidelines in Diabetes (please click here).

All patients should receive education regarding lifestyle measures: healthy diet, physical activity and weight management.

Determine the individual's HbA1c target – commonly ≤ 53 mmol/mol (7.0%) but should be appropriately individualised (refer to ADS position statement).

+ Weight loss of $\geq 10\%$ will likely allow a reduction or cessation of glucose lowering medication. Consider intensive weight management options including:

- Low energy or very low energy diets with meal replacements
- Pharmacotherapy
- Bariatric surgery.

 **Click here for the Australian Obesity Management Algorithm**

Review treatment: if not at target HbA1c or if presence of cardiovascular/chronic kidney disease –

- Check patient understanding of self-management including drug treatment
- Ensure current therapies are clinically appropriate including comorbidities/therapies impacting glycaemic control
- Review medication adherence
- Assess tolerability, adverse effects and risk of interactions

Review treatment in 3 months. If HbA1c not at target: Reinforce lifestyle measures and review weight management strategies.

MONOTHERAPY: Metformin is the usual monotherapy unless contraindicated or not tolerated

Metformin	SU	Insulin	Less commonly used: acarbose, DPP-4 inhibitor, SGLT2 inhibitor, GLP-1RA, or TZD. Only acarbose is PBS reimbursed for monotherapy.
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DUAL THERAPY: Choice of treatment – add on an oral agent or injectable therapy

Choice of dual therapy should be guided by clinical considerations (presence of, or high risk of, cardiovascular disease, heart failure, chronic kidney disease, hypoglycaemia risk, obesity), side effect profile, contraindications and cost.

SGLT2 inhibitor	GLP-1RA	DPP-4 inhibitor	SU	Insulin	Less commonly used are: acarbose or TZD.
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MULTIPLE THERAPIES: Choice of treatment : include additional oral agent or GLP-1 RA or insulin

Choice of agents should be guided by clinical considerations as above. Note: combinations not approved by PBS include GLP-1RA with SGLT2i. Consider reviewing any previous medication that has not reduced HbA1c by $\geq 0.5\%$ after 3 months and take into consideration glycaemic AND non-glycaemic benefits.

SGLT2 inhibitor	GLP-1RA	DPP-4 inhibitor	SU	Insulin	Less commonly used are: acarbose or TZD.
THEN...					

To intensify treatment to meet glycaemic targets

- If on metformin+SU+DPP-4i, consider *adding* SGLT2i, or *switching* DPP-4i to a GLP-1RA, or an SGLT2i.
- When adding incretin therapy, use either a DPP4i or GLP-1RA (not both together).
- If on basal insulin, consider *adding* SGLT2i or GLP-1RA or bolus insulin with meals, or *change* to premixed/coformulated insulin.
- If on metformin+DPP4i+SGLT2i consider adding SU or insulin.

With increasing clinical complexity consider specialist endocrinology consultation

Note: combinations not approved by PBS include GLP-1RA with SGLT2i. Consider reviewing any previous medication that has not reduced HbA1c by $\geq 0.5\%$ after 3 months, and take into consideration glycaemic AND non-glycaemic benefits.

- Recommendation for addition of an SGLT2i (or GLP-1RA where SGLT2i is not tolerated or contraindicated) to other glucose lowering medication(s) in adults with type 2 diabetes who also have cardiovascular disease, multiple cardiovascular risk factors and/or kidney disease.
 - Conditional recommendation for metformin as first-line monotherapy in adults with type 2 diabetes.
 - Conditional recommendation for DPP-4i addition to other glucose lowering medication(s) in adults with type 2 diabetes who have cardiovascular disease, multiple cardiovascular risk factors and/or kidney disease, and are unable to be prescribed an SGLT2i or a GLP-1RA due to either intolerance or contraindication.
 - Conditional recommendation against sulphonylurea being the first choice medication to add to metformin as dual therapy in adults with type 2 diabetes as it may increase the risk of severe hypoglycaemia.
 - Dark blue boxes indicate usual therapeutic strategy (order is not meant to denote any specific preference); usual refers to commonly available, evidence based, cost effective therapy.
 - Light blue boxes denote alternate approaches (order is not meant to denote any specific preference).
 - White boxes indicate less commonly used approaches.
- PBS = Pharmaceutical Benefits Scheme, HF = heart failure, CKD = chronic kidney disease, SU = sulphonylurea, TZD = thiazolidinedione, DPP-4i = dipeptidyl peptidase-4 inhibitor, GLP-1RA = glucagon like peptide-1 receptor agonist, SGLT2i = sodium glucose co-transporter inhibitor.

For more details click here to access the Living Evidence Guidelines in Diabetes.

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Table of Evidence and Properties of Glucose-Lowering Agents†

Glucose-lowering Class and Drugs	Mechanism of Action	Outcome data	Contraindications	Precautions, Side Effects and Administration	Cost* and Accessibility
Biguanide • metformin • metformin XR	Reduces hepatic glucose output, lowers fasting glucose levels	UKPDS ¹	Renal impairment (eGFR<30 ml/min/1.73m ²) Severe hepatic impairment	Precautions Suspend treatment during acute disease/ conditions with the potential to cause tissue hypoxia or alter renal function. Side Effects GI side effects, lactic acidosis, weight neutral Administration Oral Start at low dose and up-titrate Slow release preparations available	General schedule on PBS \$
Sulfonylureas • glibenclamide • gliclazide • gliclazide MR • glimepiride • gliclazide	Triggers insulin release in a glucose-independent manner	UKPDS ² ADVANCE ³ - GliclazideMR	Severe renal or hepatic impairment	Precautions Hypoglycaemia Side Effects Weight gain Administration Oral Start at low dose and up-titrate Slow release preparation available	General schedule on PBS \$
Dipeptidylpeptidase-4 (DPP-4) inhibitors • alogliptin • linagliptin • saxagliptin • sitagliptin • vildagliptin	Decreases inactivation of glucagon-like peptide (GLP-1) thereby increasing its availability. GLP-1 stimulates beta cell insulin release.	EXAMINE ^{4,5} - Alogliptin SAVOR-TIMI 53 ^{6,7} - Saxagliptin TECOS ⁸ - Sitagliptin CARMELINA ⁹ - Linagliptin CAROLINA ¹⁰ - Linagliptin vs Glimepiride	Pancreatitis ¹¹ Hospitalisation due to heart failure with saxagliptin ⁶	Precautions Nasopharyngitis-often subsides in 10-14 days Side Effects Rash, pancreatitis, GI disturbances, weight neutral Administration Oral Dosage adjustment in renal impairment (except linagliptin) ¹²	Alogliptin, linagliptin, saxagliptin, sitagliptin, vildagliptin are PBS subsidised for use with either metformin or sulfonylurea (i.e. dual therapy) Linagliptin, saxagliptin, sitagliptin and vildagliptin are PBS subsidised for use with metformin and sulfonylurea (i.e. triple therapy) If on any DPP4i plus metformin, addition of dapagliflozin, empagliflozin or ertugliflozin (i.e. triple therapy) is PBS subsidised Linagliptin, sitagliptin and vildagliptin are PBS subsidised for use with insulin
Thiazolidinediones (TZD) • pioglitazone • rosiglitazone is not available in Australia	Transcription factor peroxisome proliferator-activated receptor gamma agonists. Durably lowers glucose levels through insulin sensitisation.	PROACTIVE ¹³ - Pioglitazone RECORD ¹⁴ - Rosiglitazone		Precautions Symptomatic heart failure Side Effects Fluid retention, heart failure, increased risk of non-axial fractures in women, increased risk of bladder cancer, weight gain Administration Oral	PBS subsidised for use in combination with metformin or sulfonylurea or both Patient must have a contraindication or intolerance to metformin- sulfonylurea combination PBS subsidised for use with insulin
Alpha 1 glucosidase inhibitors • acarbose	Slows intestinal carbohydrate absorption and reduces postprandial glucose levels		Severe renal impairment (creatinine clearance < 25 ml/min/1.73m ²)	Precautions Gastrointestinal disorders associated with malabsorption Side effects Bloating and flatulence, weight neutral Administration Oral Take with meals as tolerated	General schedule on PBS \$
Sodium-glucose co-transporter-2 (SGLT2) inhibitors • dapagliflozin • empagliflozin • ertugliflozin • canagliflozin is not available in Australia	Inhibits a Sodium-glucose cotransporter to induce urinary glucose loss and decrease blood glucose levels Non-glycaemic benefits shown in heart failure and CKD still to be defined	DECLARE ¹⁵ - Dapagliflozin DAPA-HF ¹⁶ - Dapagliflozin DAPA-CKD ¹⁷ - Dapagliflozin EMPA-REG OUTCOME ¹⁸ - Empagliflozin EMPEROR-Reduced ¹⁹ - Empagliflozin EMPEROR-Preserved ²⁰ - Empagliflozin VERTIS-CV ²¹ - Ertugliflozin	Caution and review use with diuretics	Precautions very low carbohydrate intake, bowel preparation, perioperatively Reduced or insignificant glycaemic effectiveness at eGFR<45 ml/min/1.73m ² , however heart failure and chronic kidney disease benefits persist down to an eGFR<25 ml/min/1.73m ² . Side effects Dehydration, dizziness, genitourinary infections (advise adequate fluid intake and meticulous toileting hygiene), ketoacidosis, weight loss Administration Oral	Dapagliflozin and empagliflozin: PBS subsidised for use in combination with metformin, sulfonylurea or both. PBS subsidised for use with insulin Ertugliflozin: PBS subsidised for use in combination with metformin or sulfonylurea If on any SGLT2 i plus metformin, addition of either saxagliptin, sitagliptin or linagliptin (i.e. triple therapy) is PBS subsidised Not PBS subsidised for use as monotherapy or in combination with a thiazolidinedione (glitazone), or glucagon-like peptide-1
Glucagon-like peptide-1 (GLP-1) receptor agonists • dulaglutide • exenatide • liraglutide • semaglutide • exenatide ER and lixisenatide are not available in Australia	Stimulates beta-cell insulin release and slows gastric emptying Benefits include weight loss, BP lowering and very low risk of hypoglycaemia unless used with SU or insulin	REWIND ²² -Dulaglutide LEADER ²³ -Liraglutide SUSTAIN 6 ²⁴ -Semaglutide	Avoid with history of pancreatitis or pancreatic malignancy	Precautions Dosage adjustment in moderate-severe renal impairment, Increased risk of pancreatitis Side effects Nausea, vomiting, weight loss, increased heart rate Administration Subcutaneous injection	Exenatide, dulaglutide and semaglutide: PBS subsidised for use in combination with metformin, sulfonylurea or both Exenatide, dulaglutide and semaglutide: PBS subsidised for use with insulin Not PBS subsidised for use as monotherapy or in combination with DPP-4 inhibitor (gliptin), a thiazolidinedione (glitazone) or an SGLT2 inhibitor
Insulin Can be prescribed as basal (eg glargine), prandial (eg aspart, glulisine) or premix/coformulation (eg degludec/aspart)	Directly activates the insulin receptor	UKPDS ² ORIGIN ²⁵ - Insulin glargine DEVOTE ²⁶ - Insulin degludec		Precautions Consider need for dosage adjustment in moderate-severe renal disease Side effects Hypoglycaemia, weight gain Administration Subcutaneous injection-consider early if BGL is very high	General schedule on PBS \$-\$\$\$ Levemir Insulin: PBS subsidy restricted to Type 1 diabetes

† Gunton JE et al. MJA 2014, 201(11), 650-53.

*COST: \$ = \$0-\$499 \$\$ = \$500-\$999; \$\$\$ = > \$1,000 per annum cost to the PBS

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