A BRIEF 2024 UPDATE ON DIABETES

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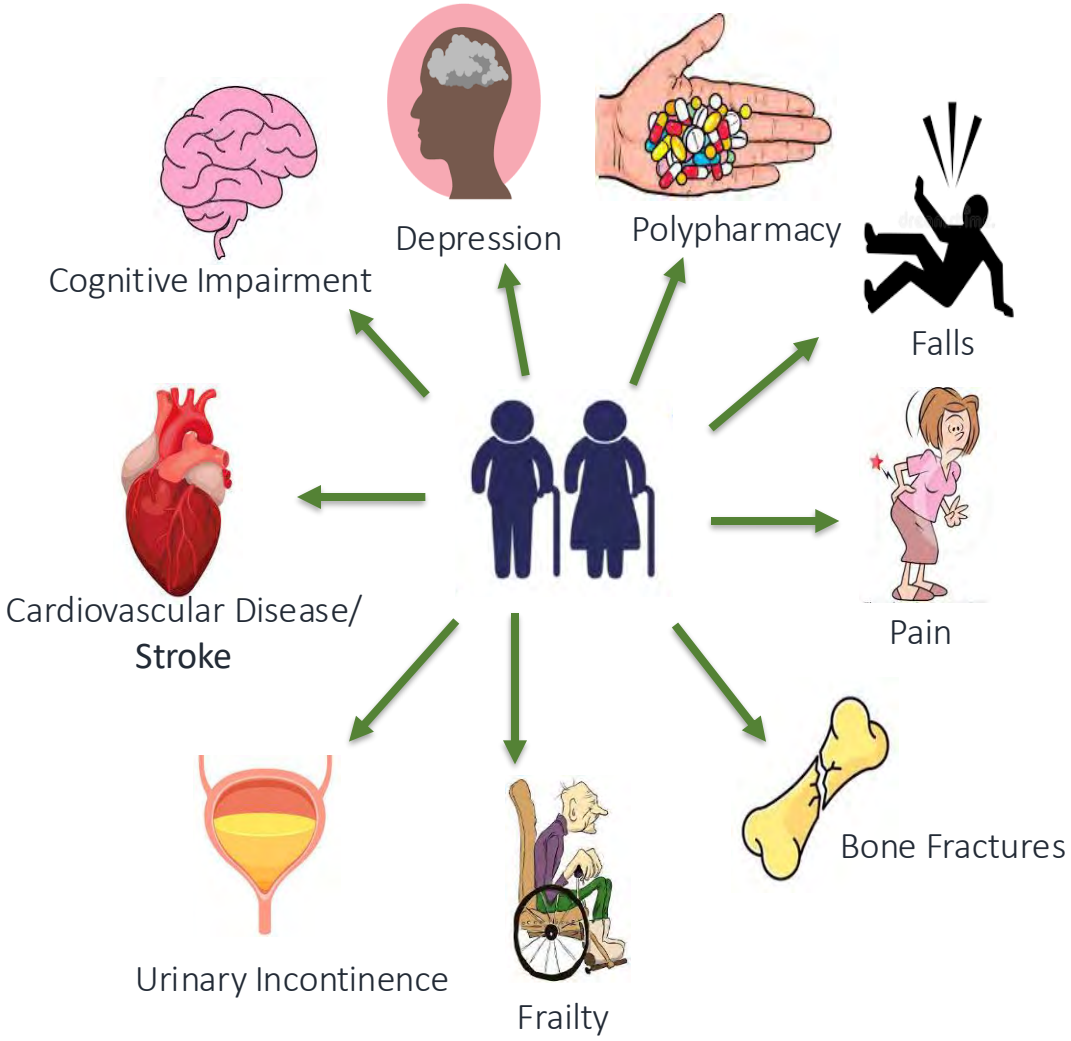
Disclosures

- Grant funding from HRSA
- I have used some educational slides from the American Diabetes Association

Objectives

- Identify strategies to optimize diabetes management in older adults in diverse settings
- Incorporate the use of newer agents to improve cardiometabolic and renal outcomes
- Identify and reduce risks of hypoglycemia
- Discuss potential applications and benefits of wearable diabetes technologies

Common Geriatric Syndromes Found in older Patients with Diabetes



Longo M, et al. *Front Endocrinol (Lausanne).* 2019;10:45

2024 PALTmed Diabetes Management CPG Released Aug 2024

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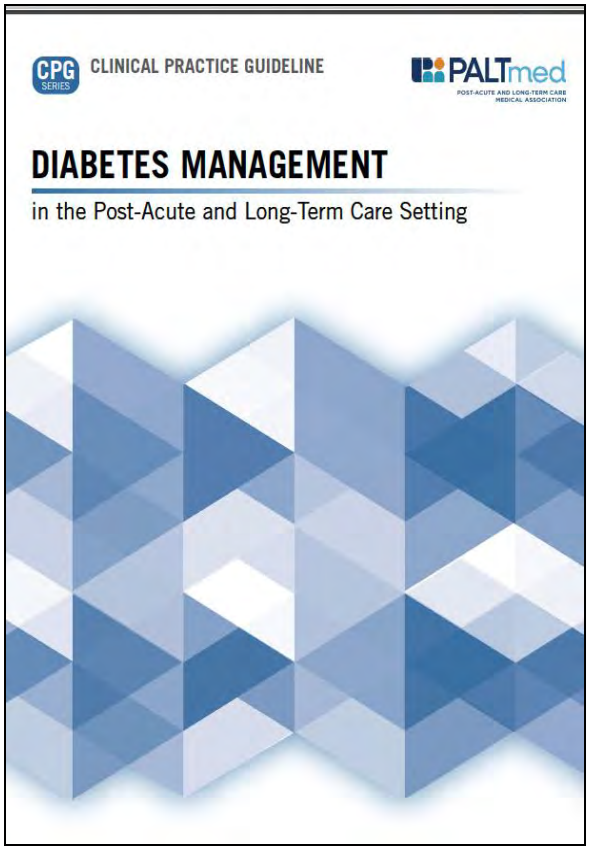


https://paltmed.org/products/diabetes-management-cpg

Introduction to Diabetes in Post-Acute and Long-Term Care; Scope of the Problem

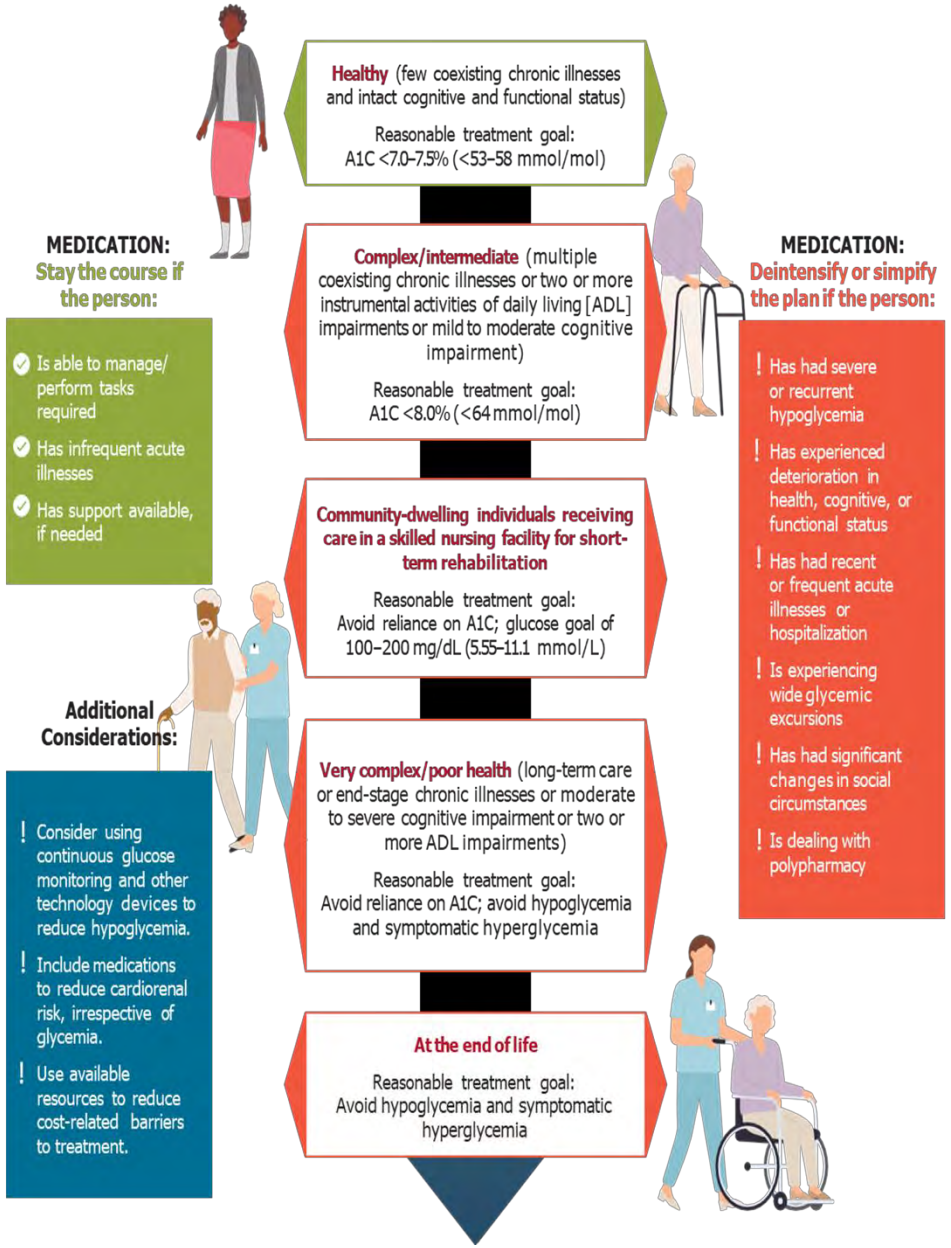
- The prevalence of patients with diabetes in post-acute and long-term (PALTC) facilities in the United States is estimated to be between 25% to 34%.
- For older adults, diabetes is an independent predictor of placement in a PALTC facility.
- Patients living with diabetes are a vulnerable group who have the following problems
  - atypical presentation
  - take multiple medications
  - experience frequent infections
  - high rates of cardiovascular and renal complications
  - risk for dehydration, hyperosmolar states
  - recurrent hospitalizations
  - functional decline, mobility impairment
  - cognitive impairment
  - hypoglycemia

TABLE 7. Problems and Complications Associated with Diabetes in Older Adults

- Accelerated atherosclerosis with vascular complications (e.g., myocardial infarction, stroke)
- Changes in weight (gain or loss)
- Confusion, acceleration of cognitive impairment
- Decline in ability to perform activities of daily living
- Dehydration
- Depression
- Excessive skin problems (infections, ulcers, delayed wound healing)
- Eye problems (e.g., blurring or loss of vision)
- Falls
- Foot ulcers, foot deformities, gangrene, other foot problems
- Frequent infections
- Impaired pain perception, neuropathy

How to individualize care and glycemic goals

Individualization of Treatment Goals and Medication Plans for Older Adults With Diabetes



American Diabetes Association Primary Care Advisory Group. 13. Older adults: Standards of Care in Diabetes—2024 abridged for primary care professionals. Clin Diabetes 2024;42:216–217 (doi: 10.2337/cd24-as13)

Using the 4Ms Framework of Age-Friendly Health Systems to Address Issues That Can Affect Diabetes Management in the PALTC Setting

MENTATION	MEDICATIONS
❖ Ability to use diabetes technology ❖ Anxiety ❖ Depression or dementia ❖ Coping skills and self-care	❖ Affordability or insurance coverage ❖ End-organ disease or complications affecting medication choice ❖ History of adverse medication effects ❖ Social and family support ❖ Risk of hypoglycemia, hypoglycemia unawareness
MOBILITY	**WHAT MATTERS MOST**
❖ Foot complications ❖ Functional ability ❖ Frailty and sarcopenia ❖ Leg weakness ❖ Neuropathy ❖ Vision status	❖ Advanced care planning ❖ Macrovascular and microvascular complications ❖ Quality of life ❖ Remaining life expectancy ❖ Risks, burdens and benefits of treatment ❖ Treatment preferences (diet, injections, blood glucose monitoring)

What are the priorities for setting glycemic goals?

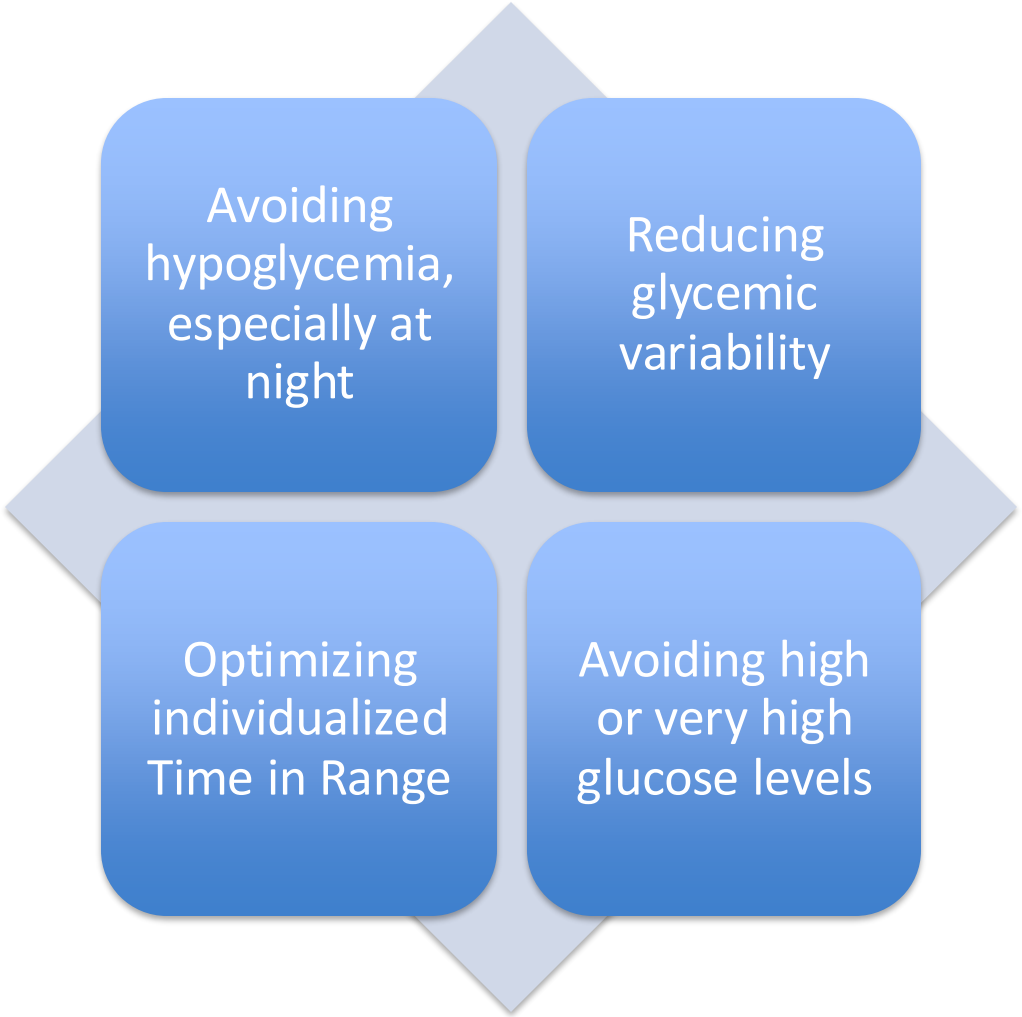


TABLE 12. Clinical Care Considerations Across the PALTC Continuum

LONG-TERM CARE			ALF
SKILLED REHAB	LTC	HOSPICE/PALLIATIVE	
Avoid reliance on A1C BG target 100–200 mg/dL (5.5–11.1 mmol/L) Potential for discharge Cognitive impairment Expressed wishes of patient Self care and function Community support	Avoid reliance on A1C Avoid hypoglycemia and symptomatic hyperglycemia Goals of care Cognitive impairment Glycemic goals Complications and comorbidities	Avoid hypoglycemia and symptomatic hyperglycemia Goals of care Clinical complexity Comfort Wishes of patient and family	Avoid hypoglycemia A1C below 8% if feasible Complications and comorbidities Cognition Functional ability Staffing capability BG monitoring/injections

ASSESS ALL PATIENTS FOR THE FOLLOWING:

- Hypoglycemic risk
- Renal function
- CV risks and complications
- Weight loss
- Frailty
- Prognosis

TABLE 13. Framework for Considering Diabetes Management Goals in PALTC Facilities

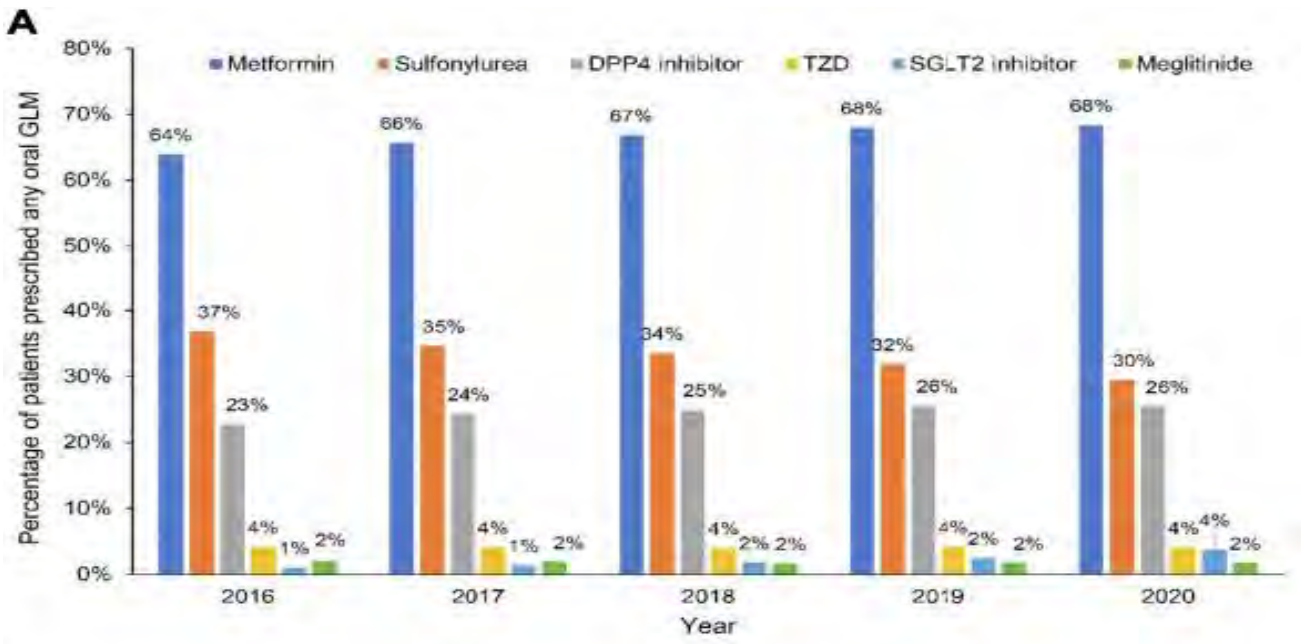
	Special Considerations	Rationale	A1C	Fasting and Premeal Blood Glucose Targets	Blood Glucose Monitoring
Patients residing in ALFs	■ Multiple chronic conditions ■ Impairment in 2 or more IADLs ■ Variable life expectancy	■ Individual preferences ■ Facility capabilities	Less than 8.0% (64 mmol/mol)	90–150 mg/dL (5.0–8.3 mmol/L)	Monitoring frequency based on complexity of regimen
Community-dwelling patients at SNF for rehabilitation	■ Rehabilitation potential ■ Goal to discharge home	■ Need optimal glycemic control after acute illness	■ Avoid relying on A1C due to acute illness ■ Follow current blood glucose trends	100–200 mg/dL	Monitoring frequency based on complexity of regimen
Patients residing in LTC	■ Limited life expectancy ■ Frequent health changes ■ Avoid symptomatic hyper- or hypoglycemia	■ Limited benefit of intensive control ■ Focus on QOL	Avoid relying solely on A1C	100–200 mg/dL	Monitoring frequency based on complexity of regimen and risk of hypoglycemia
Patients at end of life	Avoid invasive diagnostic/therapeutic procedures with little benefit		No role for A1C	Avoid symptomatic hyperglycemia	Monitoring periodically only to avoid systemic hyperglycemia

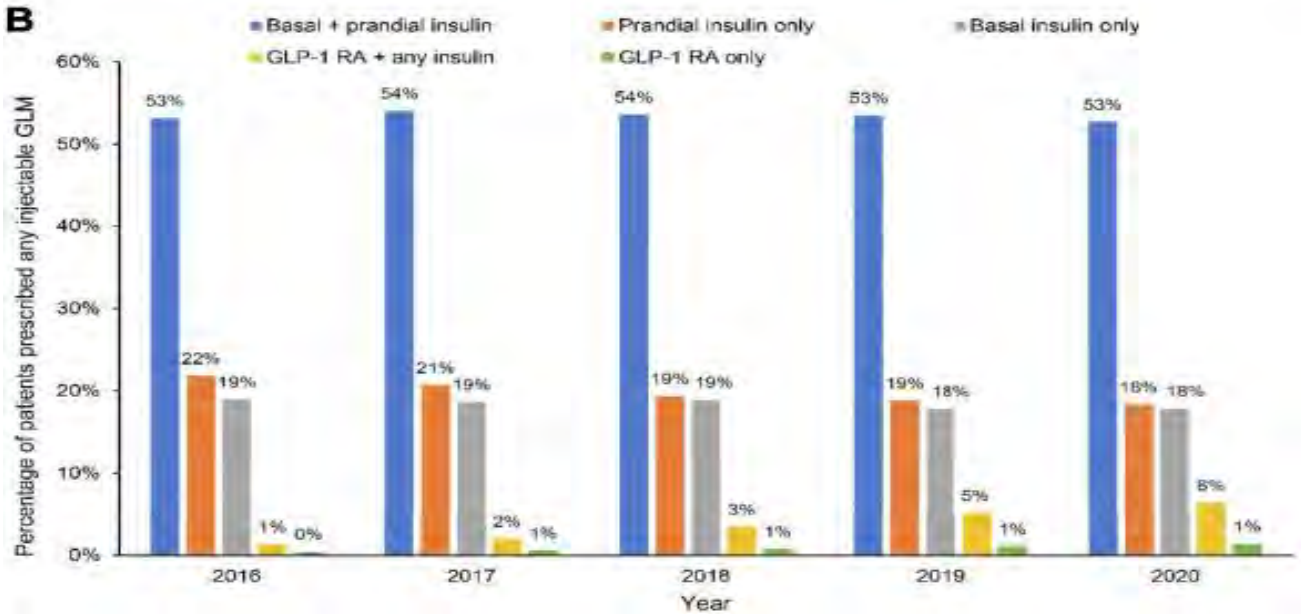
Key Issues to Remember About Type 1 Diabetes in PALTC

- Do not assume all patients have T2DM, especially if there is a lack of caregiver engagement or access to current medical records. Patients' medical records may not correctly identify a diagnosis of T1DM, and for those with cognitive impairment and poor social support, clarification of this may not be available.
- Insulin is a life-preserving therapy, and basal insulin is required even if meal intake is poor
- Hyperglycemia and diabetic ketoacidosis (DKA) may develop if insulin treatment is inadequate or omitted due to fear of hypoglycemia
- DKA may be mistaken for, or occur concurrently with, organ failure, sepsis, or medication-related acidosis, and may not be recognized or managed in a timely manner
- People with T1DM are at high risk for hypoglycemia, especially if they are cognitively impaired
- Insulin requirements may increase during acute infections, cardiovascular events, and other medical emergencies
- Practitioners may be unfamiliar with insulin pumps or CGM, which can help reduce hypoglycemia and glycemic variability
- Consider an endocrinology consultation to guide therapy in patients with complex treatment regimens or those who are using advanced therapeutic technologies
- First-line caregivers and nursing staff may need more-intensive diabetes management education, especially if a patient is using an insulin pump or CGM.

Weinstock RS, et al. Diabetes Care 2016;39: 603–610.
Pandya, N. et al.(2020). Diabetes Spectrum, 33(3), 236-245.

PHARMACOLOGIC THERAPY FOR T2DM; RECOMMENDATIONS





What IS prescribed for T2 DM patients in PALTC?

Pandya, N., Jung, M.,et al. (2023). Journal of the American Medical Directors Association, 24(6), 790-797.

Commonly used pharmacological therapies in older adults

Adapted from Leung G , Munshi et al. Diab Sectrum 2018

Medication class	Benefits	Cautions	Caveats and considerations
Biguanides	• Safe if no contraindications • Low risk of hypoglycemia • Low cost	• May cause GI disturbances • Weight loss • Vitamin B12 deficiency	• First-line treatment if no contraindications • ER may reduce GI disturbances
Sulfonylureas	• Low cost	• Hypoglycemia risk • Drug interactions (e.g., warfarin, allopurinol)	• Short-acting glipizide to reduce hypoglycemia • Avoid glyburide (renal elimination)
Meglitinides	• Skip dose if skipped meal • Useful if variable eating habits	• Increased pill burden • High cost	• Useful with one large meal – controls PP hyperglycemia

Up to 2%

Up to 2%

Up to 2%

	Medication class	Benefits	Cautions	Caveats and considerations
Up to 1%	Glucagon-like peptide 1 receptor agonists	• Consider if overweight • Low hypoglycemia • Can use in CKD • Convenience	• Nausea, vomiting, diarrhea, satiety • High cost • Usually injectable	• Unintended weight loss • Limited safety profile in elderly
Up to 1%	Dipeptidyl peptidase 4 inhibitors	• Low hypoglycemia risk	• Nausea, vomiting, diarrhea • High cost • Low efficacy	• Well tolerated, once daily formulation
Up to 1.5%	Thiazolidinediones	• Low hypoglycemia risk • Can be used in CKD patients	• Edema and HF • Inc bone loss and Fx risk • Bladder cancer concerns	• Contraindications in elderly • Well tolerated, reduces insulin resistance
Up to 1%	Sodium-glucose transporter 2 inhibitors	• Low hypoglycemia • ASCVD or HF benefit • Decrease renal disease progressio	• Genital yeast infections, UTI, dehydration, increase K and LDL	• Limited safety profile in older adults • Avoid if frail, and hydration issues

Caveats and Cautions when Prescribing Diabetes Medications in PALTC

Med	AVOID IF	USE IF
Metformin	GFR<30, decompensated HF, hepatic disease, risk of dehydration, unexplained diarrhea	
GLP1-RA	Weight loss, anorexia, gastroparesis, chronic constipation, unexplained GI symptoms	ASCVD CKD
SGLT2i	AVOID if on dialysis, unable to drink fluids independently, dehydration, incontinence, UTI, genital yeast infection, weight loss, fractures. Stop 5 d prior to elective procedure to avoid DKA	HF CKD (eGFR ≥25 mL/min/1.73 m^2)
DPP-4i	Unexplained GI symptoms, severe anorexia (stop concurrent GLP1-RA)	Safe for most patients
Basal insulin	Injectable treatments not possible if BG monitoring inconsistent, lack of caregiver support, hypoglycemia risk (stop sulfonylureas, stop SSI)	Insulin-dependent
Prandial insulin	Injectables not possible in care setting, if BG monitoring inconsistent, lack of caregiver support, hypoglycemia risk, erratic intake, tube feeding (stop sulfonylureas, stop SSI)	BG goals not met
Sulfonylurea	Hypoglycemia risk, dementia, concurrent insulin use	
TZDs	HF, other edema, osteoporosis, bladder cancer	

TABLE 16. Guidance on Optimal Medication Selection by Clinical Criteria

	eGFR <30 OR ESRD ON DIALYSIS		eGFR >30		HIGH HYPOGLYCEMIA RISK	END OF LIFE
Patient Characteristics	Normal appetite, no weight loss	Frail, anorexia, low body weight	Normal appetite, no weight loss	Frail, anorexia, low body weight	Multiple comorbidities. Tight glycemic control. Hypoglycemia or lack of awareness. Sulfonylurea or insulin. Cognitive impairment. Inconsistent meal intake.	Goals of comfort. Avoidance of hypoglycemia and hyperglycemia
Preferred Medications	DPP4 inhibitor (linagliptin) GLP1-RA Basal insulin*	DPP4 inhibitor Basal insulin*	Metformin ER DPP4 inhibitors SGLT2 inhibitors GLP1-RA Basal insulin*	DPP4 inhibitors Metfor-min ER basal insulin*	Metformin ER DPP4 inhibitors SGLT2 inhibitors GLP1-RA	DPP4 inhibitors Linagliptin Basal insulin**

* Use basal insulin if additional glucose lowering or long-term use of basal insulin is needed

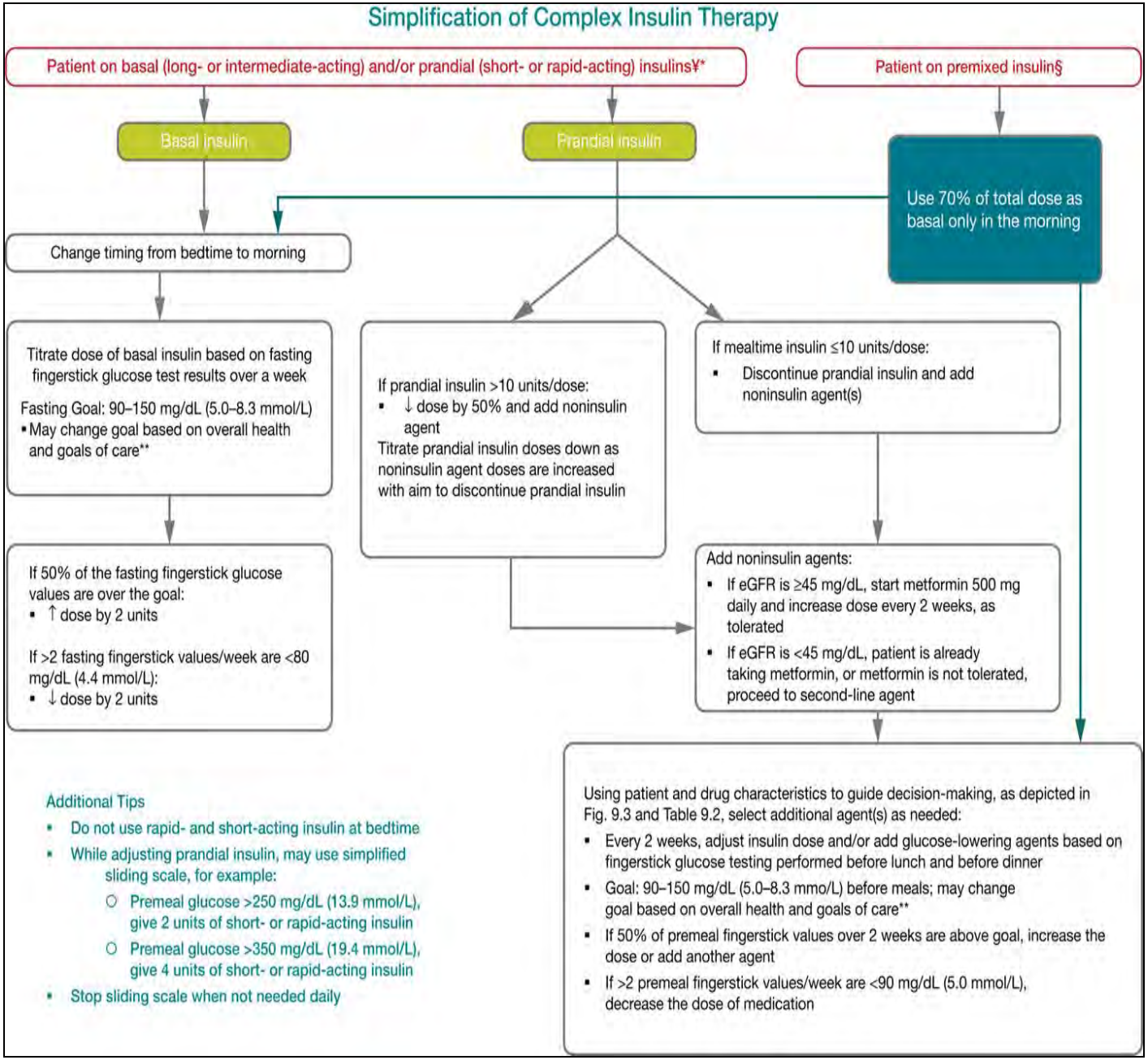
** Use basal insulin with caution if patient has symptomatic hypoglycemia

DPP-4, dipeptyl peptidase 4; eGFR, estimated glomerular filtration rate; ER, extended release; ESRD, end-stage kidney disease; GLP1-RA, glucagon-like peptide-1 receptor agonist; SGLT2, sodium glucose transporter 2

When to Use Injectable Therapy in Type 2 Diabetes

Which therapy should I start first?	When should I start insulin first?	Can I use combination insulin and non-insulin injectable therapy?	When would I use combination insulin and noninsulin injectable therapy?	When should I modify a patient's injectable therapy?
✓ Treatment with a glucagon-like peptide 1 (GLP-1) receptor agonist or a dual glucose-dependent insulinotropic polypeptide (GIP)/GLP-1 receptor agonist is preferred before insulin therapy because of its ability to achieve both glycemic and weight management goals. ✓ Some GLP-1 receptor agonists also provide cardiovascular benefit.	✓ If there is evidence of catabolism (e.g., unexpected weight loss) ✓ When A1C or blood glucose levels are very high (A1C >10% [>86 mmol/mol] or blood glucose ≥300 mg/dL [≥16.7 mmol/L])	✓ Yes; combination therapy with insulin and a noninsulin injectable is recommended for greater glycemic effectiveness and beneficial effects on weight and hypoglycemia risk. ✓ If insulin is already being used, insulin dosing should be reassessed upon addition or dose escalation of a GLP-1 or dual GIP and GLP-1 receptor agonist.	✓ Consider combination insulin and GLP-1 or dual GIP/GLP-1 receptor agonist therapy when individualized goals are not met using either one separately.	✓ Intensify or deintensify therapy when an individual is not meeting treatment goals, including management of hyperglycemia and weight and avoidance of hypoglycemia.

American Diabetes Association Primary Care Advisory Group. 9. Pharmacologic approaches to glycemic treatment: *Standards of Care in Diabetes—2024* abridged for primary care professionals. Clin Diabetes 2024;42:206–208 (doi: 10.2337/cd24-a009)


Simplification of Complex Insulin Therapy
Patient on basal (long- or intermediate-acting) and/or prandial (short- or rapid-acting) insulins¥*
Patient on premixed insulin§
Basal insulin
Prandial insulin
Use 70% of total dose as basal only in the morning
Change timing from bedtime to morning
Titrate dose of basal insulin based on fasting fingerstick glucose test results over a week
Fasting Goal: 90–150 mg/dL (5.0–8.3 mmol/L)
• May change goal based on overall health and goals of care**
If 50% of the fasting fingerstick glucose values are over the goal:
• ↑ dose by 2 units
If >2 fasting fingerstick values/week are <80 mg/dL (4.4 mmol/L):
• ↓ dose by 2 units
If prandial insulin >10 units/dose:
• ↓ dose by 50% and add noninsulin agent
Titrate prandial insulin doses down as noninsulin agent doses are increased with aim to discontinue prandial insulin
If mealtime insulin ≤10 units/dose:
• Discontinue prandial insulin and add noninsulin agent(s)
Add noninsulin agents:
• If eGFR is ≥45 mg/dL, start metformin 500 mg daily and increase dose every 2 weeks, as tolerated
• If eGFR is <45 mg/dL, patient is already taking metformin, or metformin is not tolerated, proceed to second-line agent
Additional Tips
• Do not use rapid- and short-acting insulin at bedtime
• While adjusting prandial insulin, may use simplified sliding scale, for example:
○ Premeal glucose >250 mg/dL (13.9 mmol/L), give 2 units of short- or rapid-acting insulin
○ Premeal glucose >350 mg/dL (19.4 mmol/L), give 4 units of short- or rapid-acting insulin
• Stop sliding scale when not needed daily
Using patient and drug characteristics to guide decision-making, as depicted in Fig. 9.3 and Table 9.2, select additional agent(s) as needed:
• Every 2 weeks, adjust insulin dose and/or add glucose-lowering agents based on fingerstick glucose testing performed before lunch and before dinner
• Goal: 90–150 mg/dL (5.0–8.3 mmo/L) before meals; may change goal based on overall health and goals of care**
• If 50% of premeal fingerstick values over 2 weeks are above goal, increase the dose or add another agent
• If >2 premeal fingerstick values/week are <90 mg/dL (5.0 mmol/L), decrease the dose of medication

Strategies to Replace SSI in PA LTC Munshi MN, et al. *Diab Care*.2016;39(2)

Current regimen	Suggested steps
SSI is the sole mode of insulin treatment	• Give 50-75% of the av. daily insulin requirement over 5-7d as basal • Stop SSI • Use non-insulin agents or fixed dose meal time insulin for PPG PRN • Consider basal insulin in AM to impact post PPG and reduce hypoglycemia.
SSI used in addition to scheduled basal insulin	• Add 50-75% of the av. insulin requirement used as SSI to the existing basal dose • Use non-insulin agents or fixed dose meal time insulin for PPG PRN
SSI is utilized in addition to basal and scheduled meal time insulin (Correction Dose insulin)	• If correction dose required frequently, the av. correction dose before a meal may be added to the scheduled meal time insulin dose at the ***preceding*** meal. • Similarly if BG is consistently elevated before BF requiring correction doses, the **scheduled basal inulin dose could be increased** by the av. correction dose used
SSI is used in short term due to irregular intake or illness	• Generally needed for acute illness and irregular dietary intake • As health and BG stabilize, stop SSI, return to previous regimen as tolerated, and reduce frequency of monitoring
Wide fluctuations in BG levels in patients with cognitive decline and/or irregular intake	• Use scheduled basal and meal time insulin based on individual needs with goal of avoiding low glucose • May use simple scale such as “give 4 units prandial insulin if BG >300” • Keep patients hydrated when glucose levels are high (>300)

TABLE 24. Suggested Elements of Comprehensive Monitoring for Patients with Diabetes Who Have Minimal Physical and Cognitive Impairments

Indicator	Suggested Monitoring Interval
Blood glucose levels	Individualize according to the patient's needs and goals
Blood pressure	■ Monthly ■ More frequently if poor control or medication dose change
A1C	■ Every 6 mo if well controlled ■ Every 3 mo if poorly controlled
Electrolytes and eGFR	■ Annually ■ More frequently in patients with pre-existing chronic kidney disease or who are on a nephrotoxic medication
24-h urine protein/ creatinine clearance	■ If significant decline in renal function (as clinically indicated) ■ If nephrotic syndrome suspected
Lipid profile	■ Annually (if appropriate) ■ 6 wk after initiating or changing medical treatment
Foot care	■ Daily inspection by patient if able ■ Weekly inspection by caregivers ■ Annual comprehensive foot examination by practitioner (inspection, evaluation of foot pulses and loss of protective sensation)
Pain control	As clinically indicated
Depression	Annually or as clinically indicated
Cognition	Annually or as clinically indicated
Weight	■ Monthly ■ More frequently if more than 5% change (gain or loss)

Strategies that may improve cardiovascular and cardiorenal outcomes

Epidemiology of Common Comorbidities in DM

Up to 40% of patients with T2DM develop CKD[1]

2–4 FOLD

increased risk of CVD in T2DM vs general population[2]

2–5 FOLD

increased risk of HF in T2DM vs general population[3]

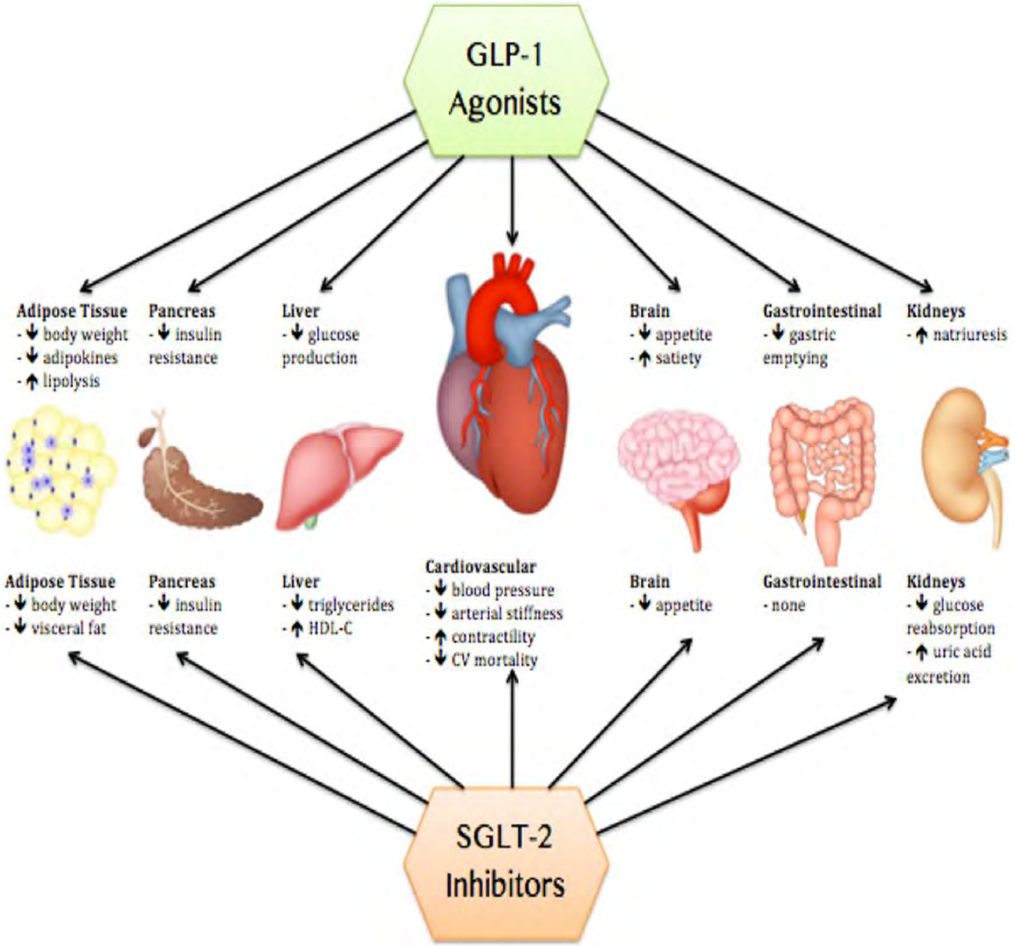
Cardiorenal Comorbidities

- In patients with eGFR < 30 ml/min/1.73m2, **glucagon-like peptide-1 receptor agonists such as subcutaneous liraglutide, semaglutide, or dulaglutide** are preferred, as they demonstrated advantageous atherosclerotic cardiovascular and kidney outcomes

- In patients with **heart failure (systolic and/or diastolic), and/or** with **CKD** with eGFR between 25 and 60 ml/min, a **sodium-glucose co-transporter 2 inhibitor such as empagliflozin, canagliflozin or dapagliflozin** is the preferred choice that have demonstrated cardiorenal benefit.

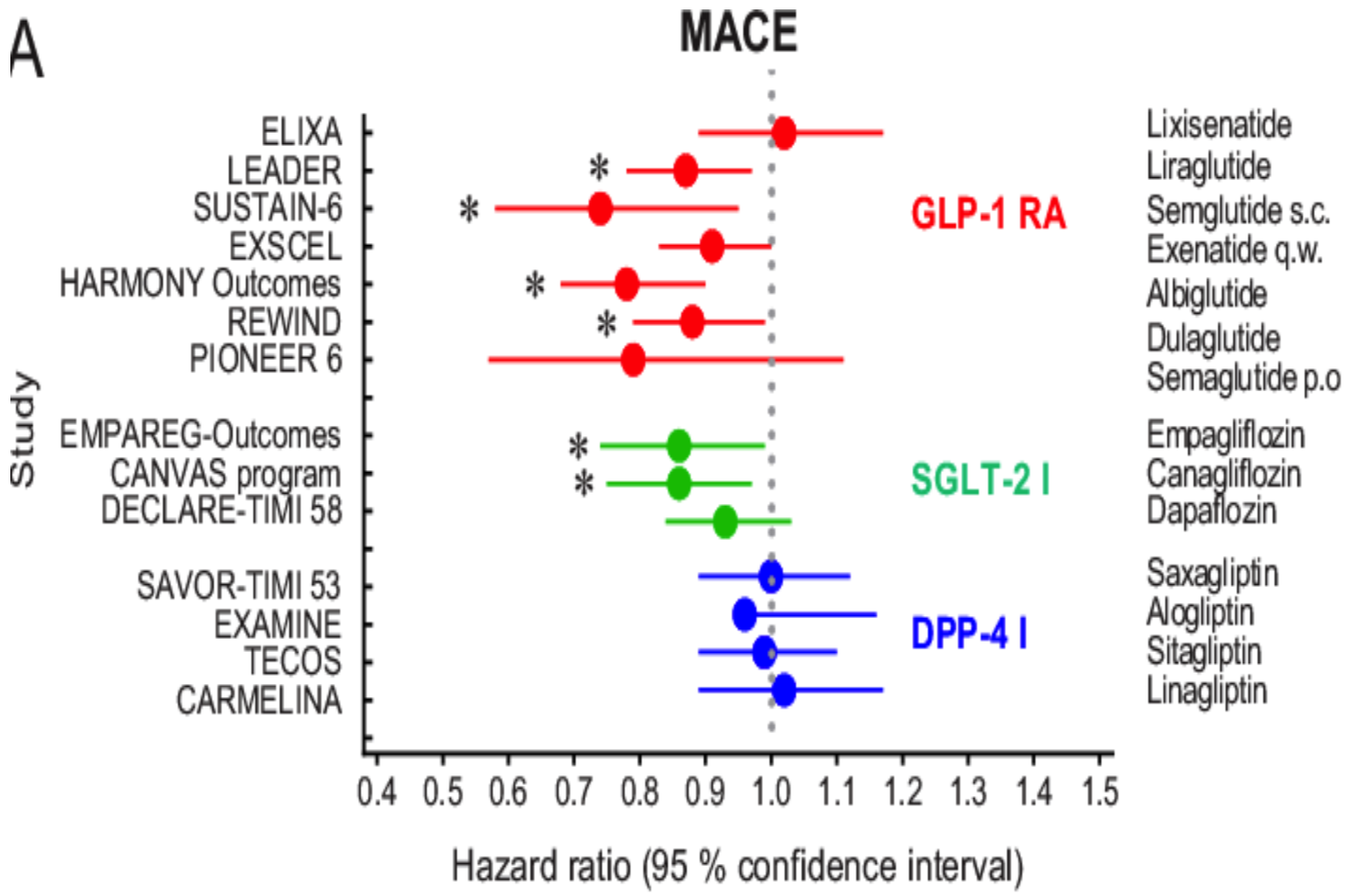
- SGLT2 inhibitors should not be initiated if eGFR <30 to 45 mL /min. In this case, the use of an alternative or additional agent (commonly a GLP-1 RA) is indicated to achieve glycemic goals.

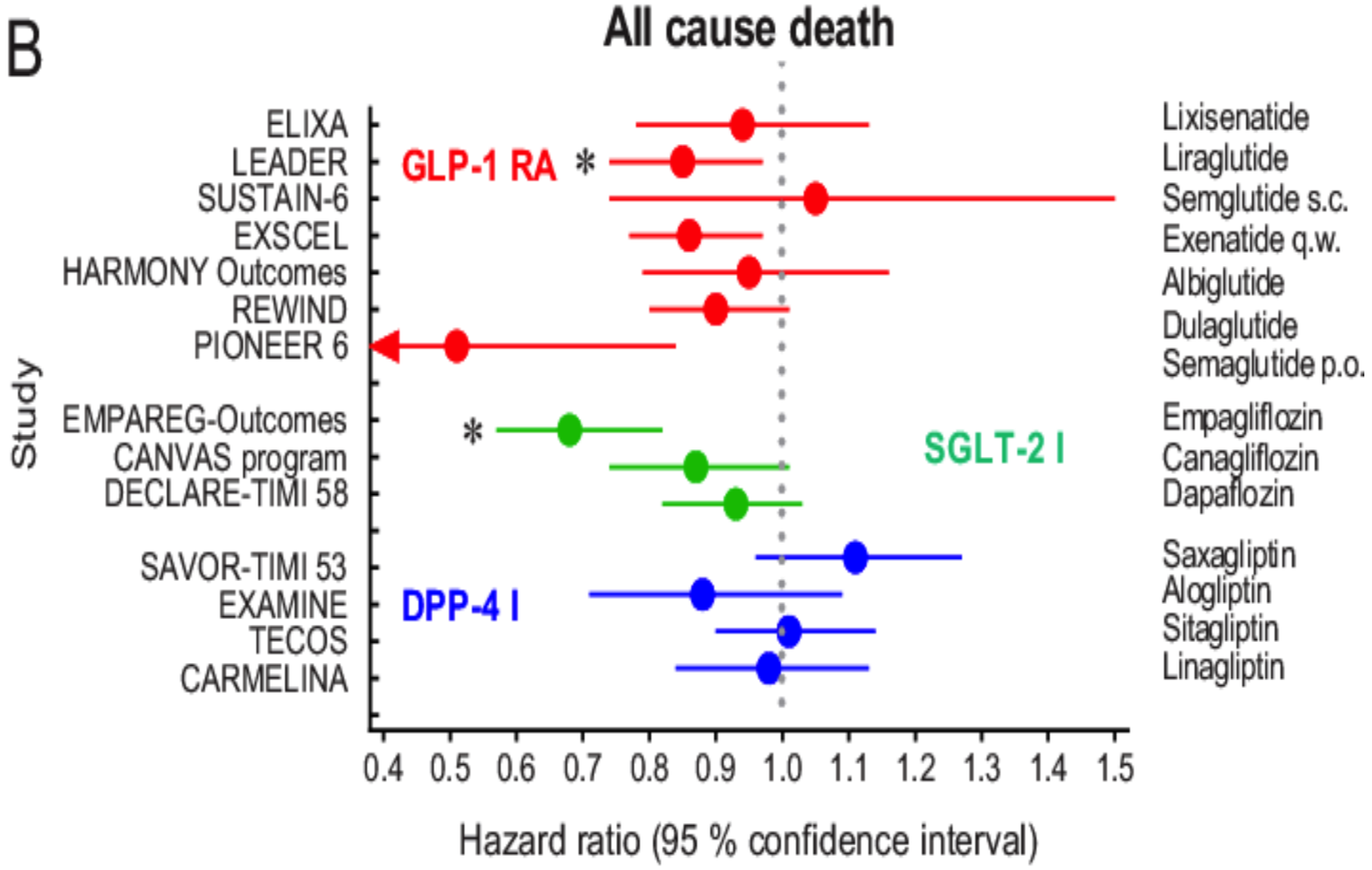
Effects of sodium glucose cotransport 2 (SGLT-2) inhibitors and glucagon-like peptide 1 (GLP-1) agonists.



Are all GLP-1 agonists and SGLT2i equal in the treatment of type 2 diabetes?

.Nauck, Michael & Meier, Juris. (2019). European Journal of Endocrinology. 181. 10.1530/EJE-19-0566.

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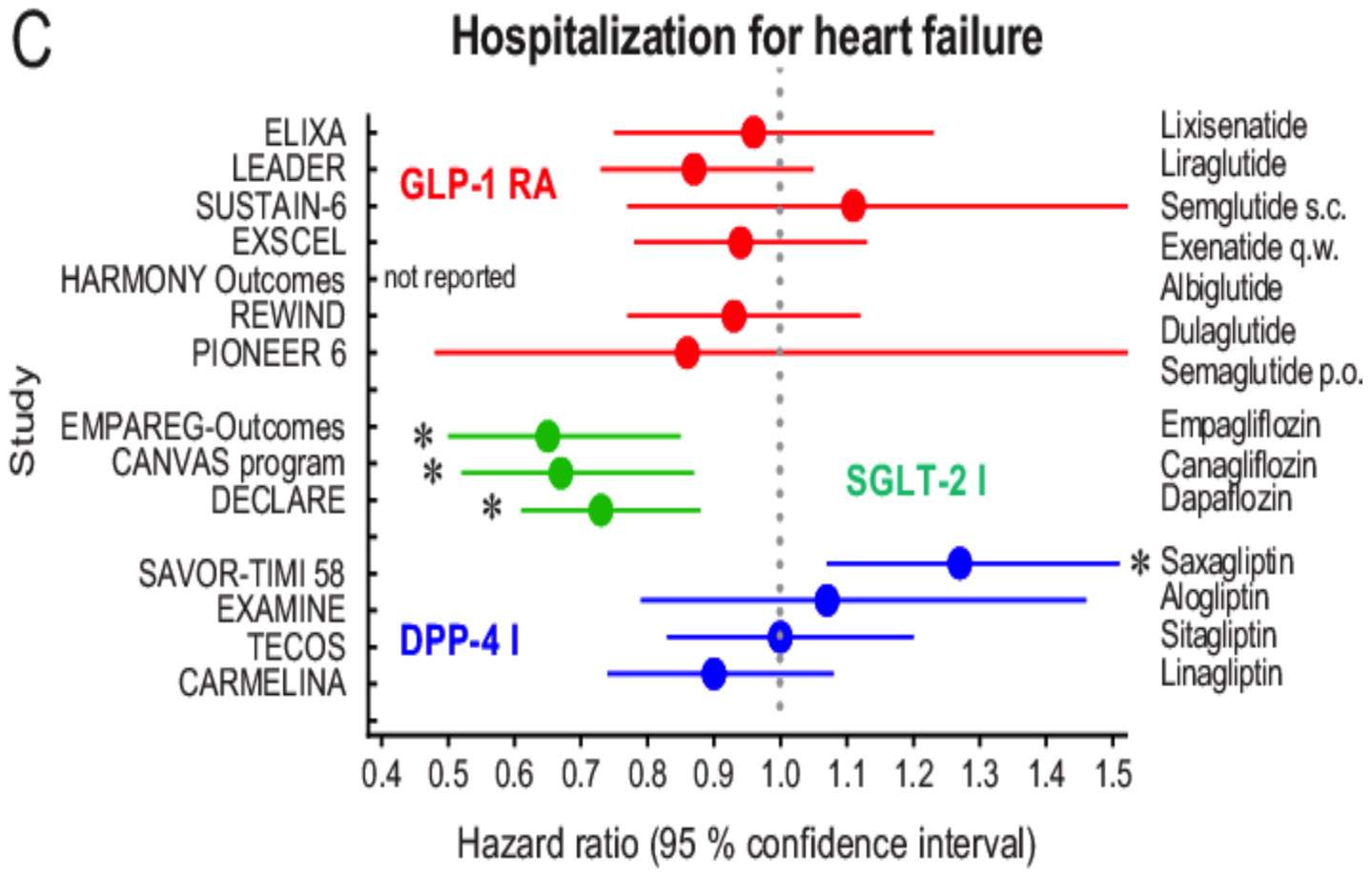
Hazard ratio (95 % confidence interval)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Liraglutide
Semglutide s.c.
Exenatide q.w.
Albiglutide
Dulaglutide
Semaglutide p.o.
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Canagliflozin
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Alogliptin
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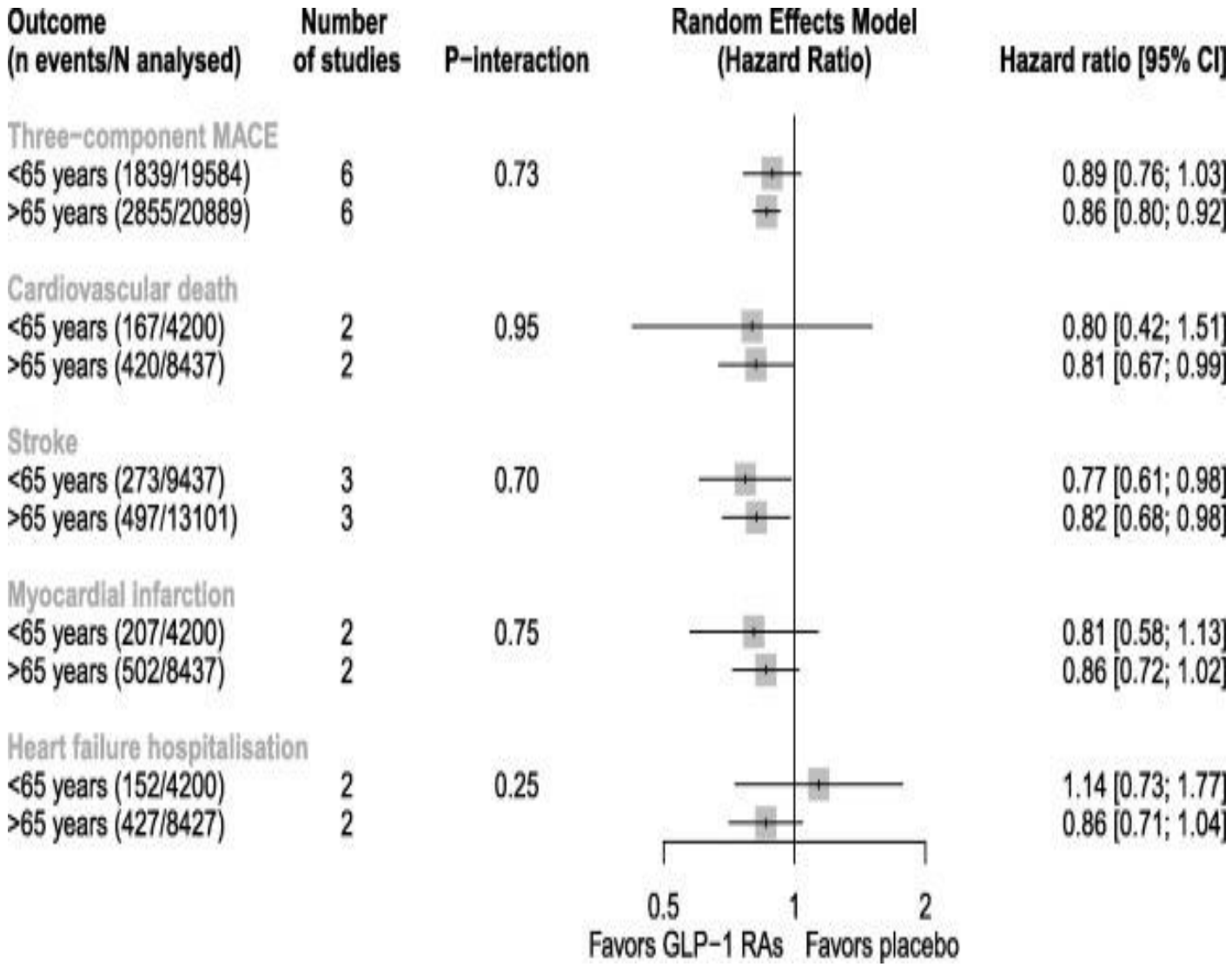
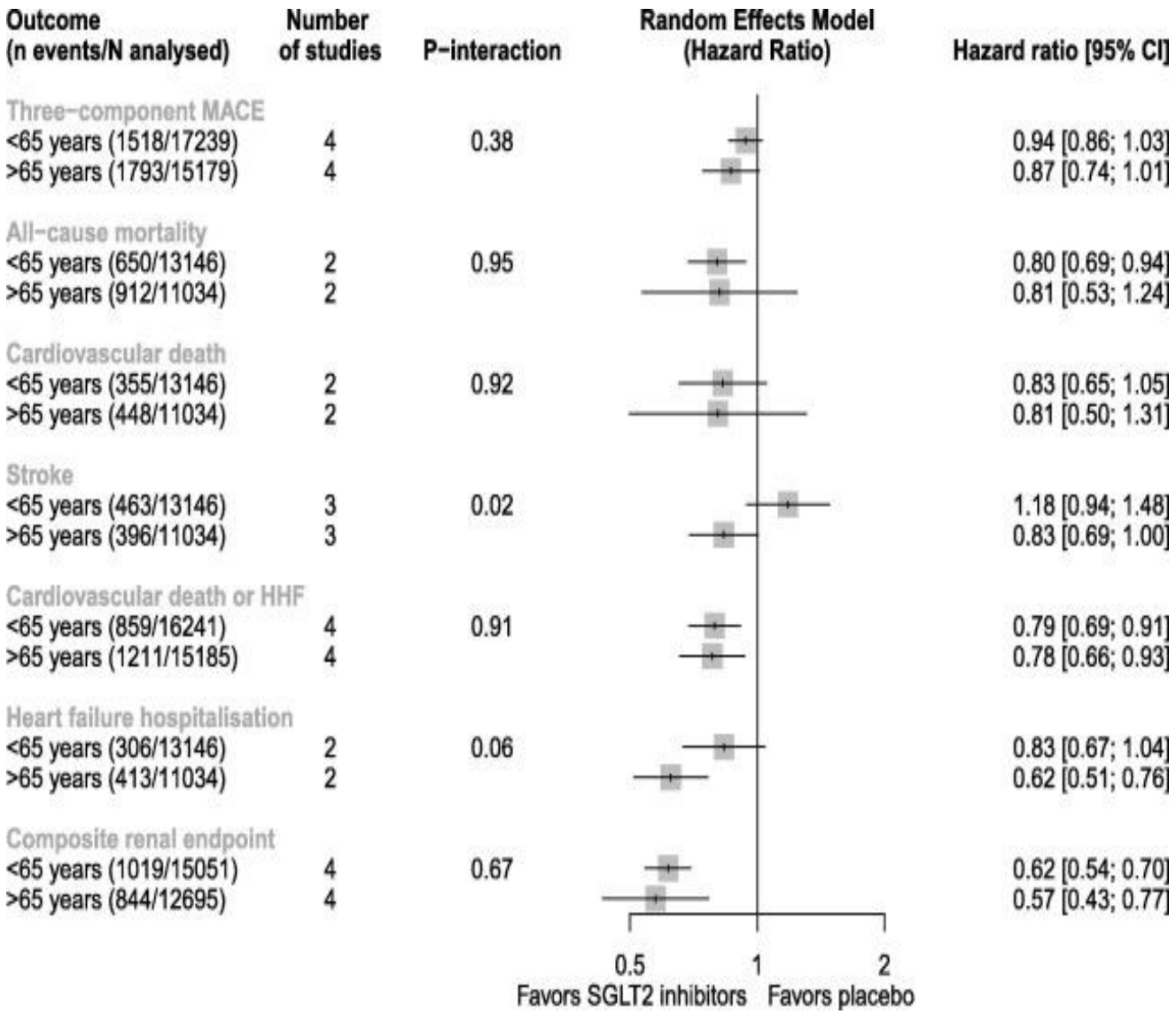
Hazard ratio (95 % confidence interval)

Use of GLP1-RA in older people with type 2 DM- meta-analysis; 11 studies, 93,500pts



T. Karagiannis. Diab Res and Clin Pract. April 2021;174

Use of SGLT2in older people with type 2 DM- meta-analysis; 11 studies, 93,500pts

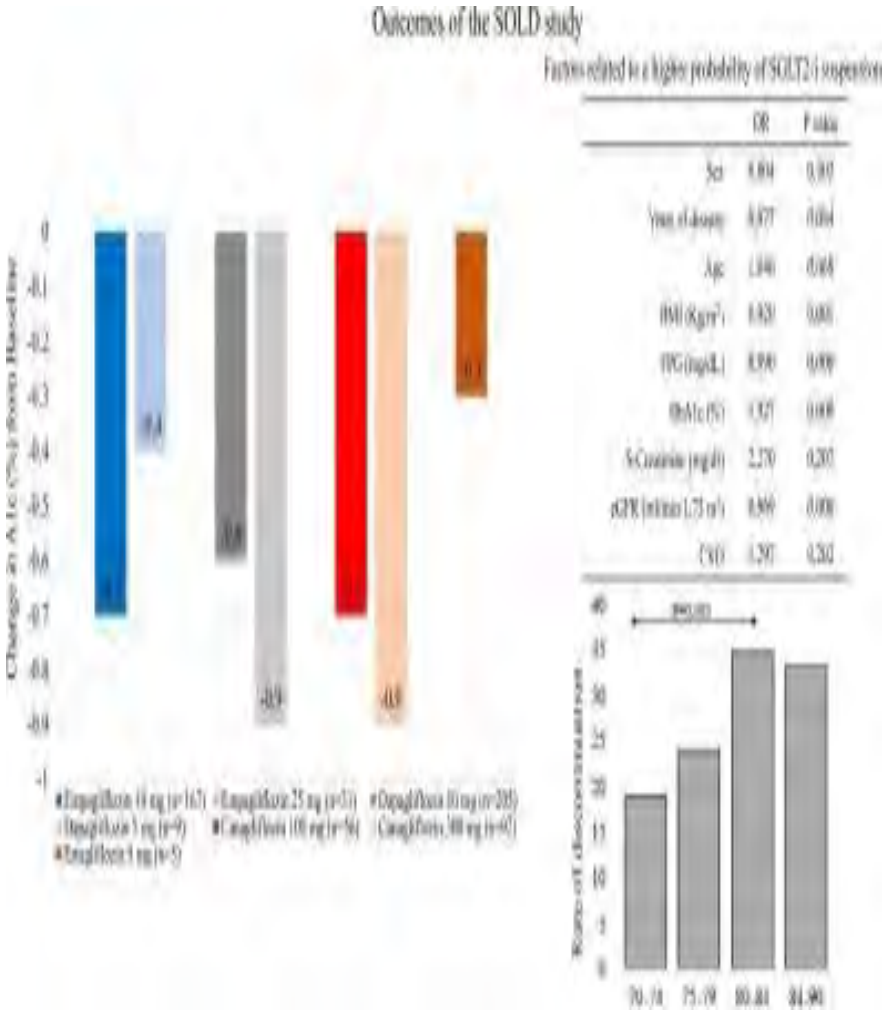


T. Karagiannis. Diab Res and Clin Pract. April 2021;174

SGLT2-inhibitors are effective and safe in the elderly: The SOLD study

E. Lunati et al. Pharm Research September 2022;183

- 739 adults >70 y started on an SGLT2i
- SGLT2i (Empagliflozin, Dapagliflozin, Canagliflozin, Ertugliflozin) add-on therapy to Metformin in 88.6%, to basal insulin in 36.1% and other antidiabetic drugs in 29.6%
- 23.5% discontinued treatment due to adverse events- SGLT2i related (UTI and renal function decline)
- A significant reduction of A1C (baseline vs 12 m: 7.8 ± 1.1 vs 7.1 ± 0.8%, $p < 0.001$) and BMI (29.2 ± 4.7 vs 28.1 ± 4.5 kg/m2, $p < 0.001$)
- Overall, eGFR remained stable over time, with significant reduction of urinary albumin excretion
- Subgroup of patients ≥ 80 years, a significant improvement in A1C values without renal function alterations



HYPOGLYCEMIA

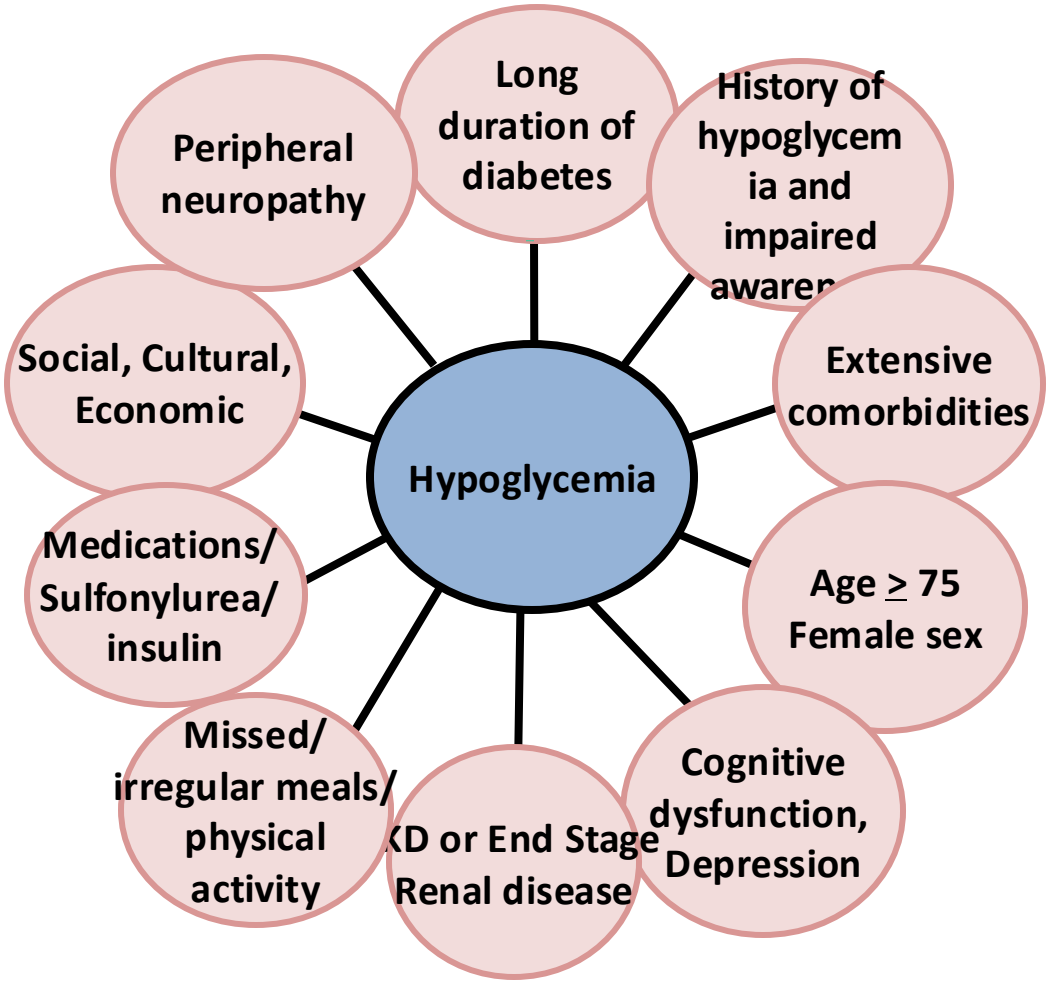
Table 6.4—Classification of hypoglycemia

	Glycemic criteria/description
Level 1	Glucose <70 mg/dL (3.9 mmol/L) and ≥54 mg/dL (3.0 mmol/L)
Level 2	Glucose <54 mg/dL (3.0 mmol/L)
Level 3	A severe event characterized by altered mental and/or physical status requiring assistance for treatment of hypoglycemia

Reprinted from Agiostratidou et al. (51).

Risk factors for hypoglycemia

Presenting symptoms may be neuroglycopenic rather than adrenergic



CVD = cardiovascular disease; VD = vascular disease.

Ahrén B. *Vasc Health Risk Manag*. 2013:9:155–163. Abdelhafiz AH, et al. Aging Dis.,2015;6(2):156–67.

Impact of hypoglycemia in the elderly

- Hypoglycemia can worsen neuropathic pain
- Likelihood of falls, fractures,and dizziness can increase
- Cognitive impairment increases the likelihood of hypoglycemia
- **But** hypoglycemia can worsen cognitive impairment
- Hypoglycemia unawareness
- Increase in cardiovascular events, hospitalization and total mortality; (HR 2.48 [1.41–4.38]) whether clincially mild or severe hypoglycemia
- Longer hospital stays and cost (8 vs 6.7d, $19,800 vs. $16,800)

Ligthelm J AM Geriatr Soc 2012 Aug;60(8):1564-70. doi: 10.1111.
Pai-Feng Hsu et al. Diabetes Care 2013 Apr; 36(4)
Pandya, N., Trenery, A. Et al. American Journal of Managed Care, 27(10).

Hypoglycemia Assessment, Prevention, and Treatment

Prevention and management of hypoglycemia
Use CGM for individuals at high risk for hypoglycemia.
Glucose is the preferred treatment for hypoglycemia in conscious individuals with glucose levels <70 mg/dL (<39 mmol/L), although any form of fast-acting carbohydrate can be used. Re-test and re-treat, if needed, after 15 minutes.
Ensure that glucagon is prescribed for all those taking insulin and those at high risk for hypoglycemia, with education provided on its use and proper storage.
Offer structured education on hypoglycemia prevention and treatment to all individuals taking insulin and those at high risk for hypoglycemia.
Upon occurrence of one or more episodes of level 2 or level 3 hypoglycemia, promptly reevaluate the treatment plan, including considering whether to deintensify or switch medications.
Refer individuals with impaired hypoglycemia awareness to a trained health care professional for evidence-based interventions to help reestablish awareness of hypoglycemia symptoms.
Conduct ongoing assessments of cognitive function, ensuring extra caution and support for hypoglycemia if impaired or declining cognition is identified.

American Diabetes Association Primary Care Advisory Group. 6. Glycemic goals and hypoglycemia: *Standards of Care in Diabetes—2024* abridged for primary care professionals. Clin Diabetes 2024;42:196–200 (doi: 10.2337/cd24-a006)

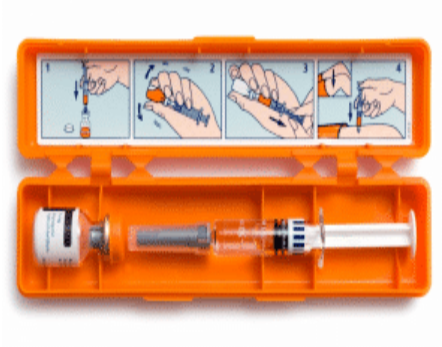
Treatment of hypoglycemia–Rule of 15

- Give **15 g** of glucose or carbohydrate, equivalent to
  - ½ cup juice, or soda
  - ½ cup apple sauce
  - _1 tablespoon sugar or honey
  - 1 cup milk
  - 1 tube glucose gel
  - 3-4 glucose tablets, 3 marshmallows
- Wait **15 minutes**
- Recheck blood glucose. If still below the target, give **another 15 g** of glucose or carbohydrate
- Assess for possible cause of hypoglycemia and document

- Patients who are unconscious may be treated with IM or SC glucagon (1 mg or 1 unit), or intravenous 50% dextrose (usually 50 mL, although a lesser volume may be used)

American Medical Directors Association. *Diabetes Management in the Long Term Care Setting*: *Clinical Practice Guideline*. Columbia, MD: AMDA 2015

GLUCAGON DELIVERY SYSTEMS



Glucagon kit- standard

Nasal glucagon

Prefilled glucagon pen

DIABETES TECHNOLOGY

CONTINUOUS GLUCOSE MONITORING (CGM)

Diabetes technology includes:

Insulin pumps (also called continuous subcutaneous insulin infusion [CSII] systems) are insulin delivery devices that are worn on the body.

Connected insulin pens and pen caps are insulin delivery pens or related devices that can record and/or send insulin dose data and may also calculate doses.

Continuous glucose monitoring (CGM) systems and **glucose meters** are devices to monitoring glucose levels.

Automated insulin delivery (AID) systems connect a CGM system and an insulin pump with a control algorithm to deliver insulin automatically.

Diabetes self-management support software includes apps or online platforms that are intended to treat a medical or psychological condition or assist with data management or lifestyle modification.

American Diabetes Association Primary Care Advisory Group. 7. Diabetes technology: *Standards of Care in Diabetes—2024* abridged for primary care professionals. Clin Diabetes 2024;42:201–203 (doi: 10.2337/cd24-a007)

What's in a number?
Pitfalls in interpretation of A1C

A1c may be increased by

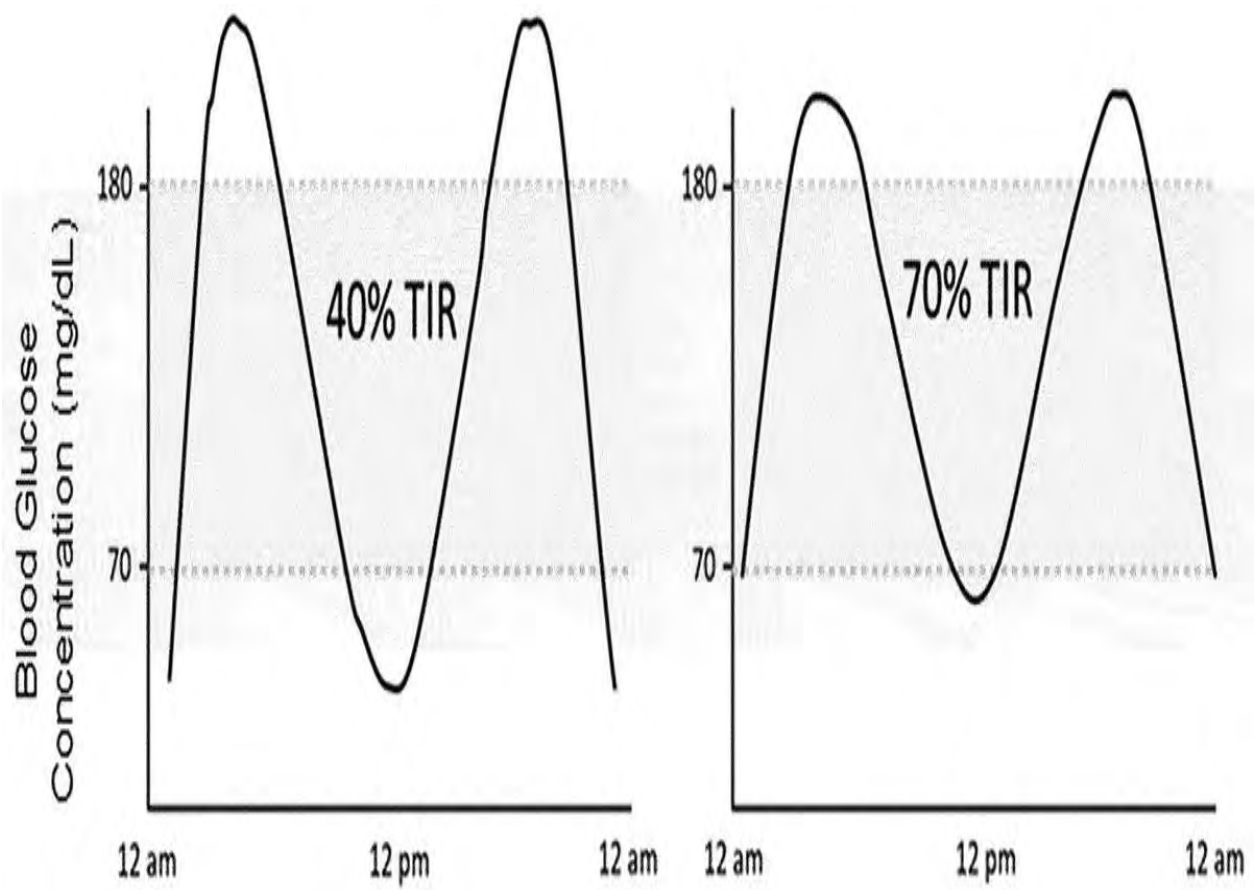
- Age (insulin resistance)
- Race (AA or Hispanic)
- Hypothyroidism
- Splenectomy
- Aplastic anemia
- Polycythemia
- Hb variants
- Iron deficiency anemia
- Metabolic acidosis/uremia

A1C may be decreased by

- Hemolytic anemia
- Blood loss, transfusions
- Abnormal Hb (hemolysis)
- Hemodialysis and Hct <30%
- Liver disease
- Erythropoetin therapy

C. Kim et al. Diabetes Care **April 2010** vol. 33
PeacocK et al. Kidney International (2008) **73**

Identical A1C values, but dramatically different amounts time spent in hypoglycemia and hyperglycemia, and glycemic variability.



Two representative glucose profiles with the same A1C of ~7.0%.

The TIR for the representative figures are 40% and 70%.

Data from https://diatribe.org/time-range

Choosing the right patient for right technology

Healthy
- Comorbidities do not interfere with selfcare
- Intact cognition
- No caregiver need

→ Can use either isCGM or rtCGM based on patient preference
TIR goal: 90-180 mg/dL
Hypoglycemia goal: avoid all hypo

Intermediate Health
- >5 comorbidities
- Mild-moderate cognitive dysfunction
- 2+ IADL dependency

→ isCGM is preferred
Can also be helpful to caregiver
If already using rtCGM, may be able to continue
TIR goal: 100-200 mg/dL
Hypoglycemia goal: avoid all hypo

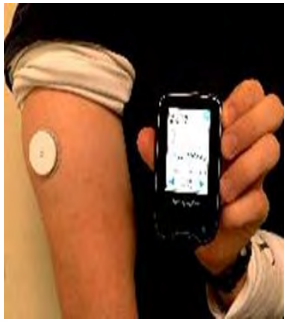
Poor Health
- End-stage chronic diseases
- Moderate-severe cognitive dysfunction
- 2+ ADL dependency

→ isCGM to avoid multiple finger sticks
ProCGM can help clinician to assess risk of hypoglycemia
TIR goal: 100-250 mg/dL
Hypoglycemia goal: avoid all hypo

Munshi MN; Diabetes Tech and Therap 25(3) 2023; S56-64

Types of CGM

Type of CGM	Description
Real time CGM	CGM systems that measure and display glucose levels continuously
Intermittently scanned CGM	CGM systems that measure glucose levels continuously but only display glucose values when swiped by a reader or a smartphone
Professional CGM	CGM devices that are placed on the patient in the provider's office (or with remote instruction) and worn for a discrete period of time (generally 7–14 days). Data may be blinded or visible to the person wearing the device.

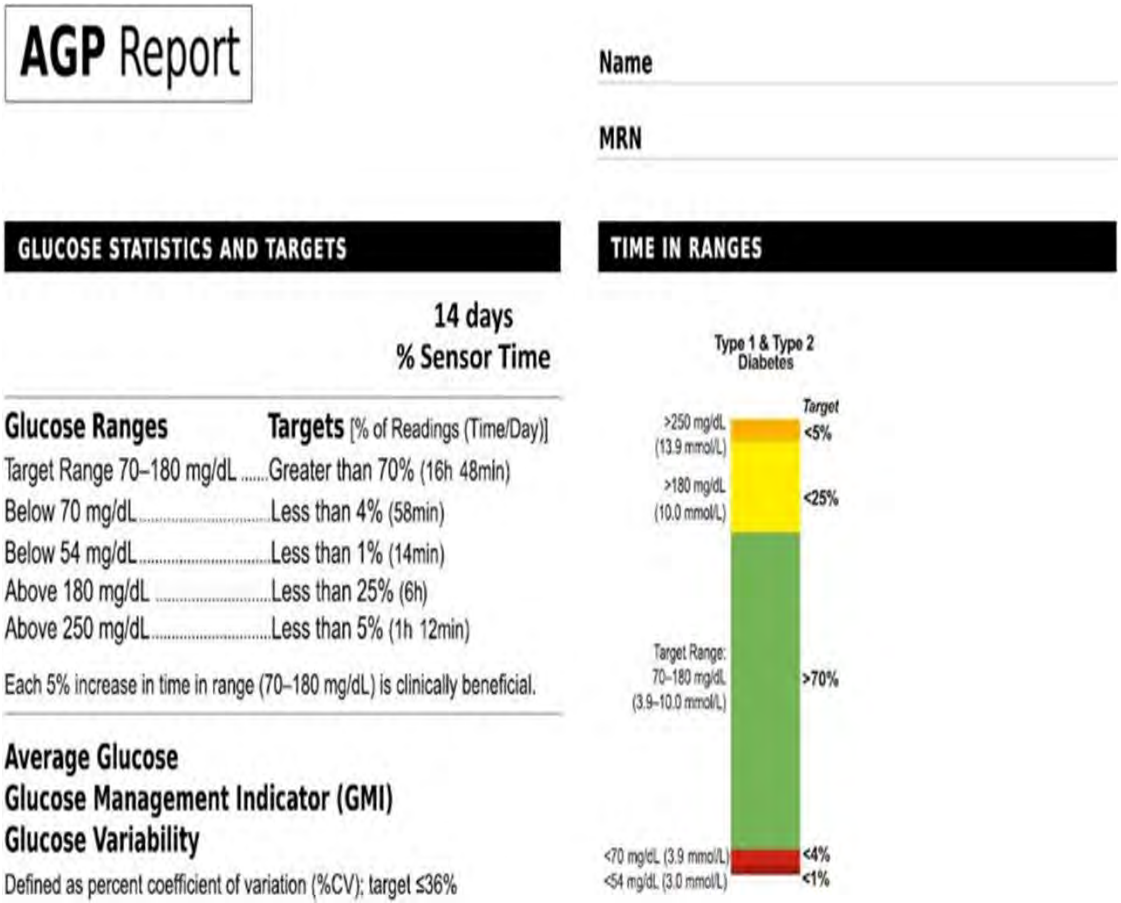


Diabetes Technology:
Standards of Medical Care in Diabetes - 2022. Diabetes Care 2022;45

CGM Metrics and Targets for Clinical Care (ADA, IDC)

Metrics	T1D/ T2D targets	Older/ High risk targets
# days CGM worn	≥ 14d	≥ 14d
% Time CGM active	>70%	>50%
Av mean Glucose	Individualized	Individualized
GMI	Individualized	Individualized
Glycemic variability (%CV)	≤ 36%	≤ 36%
% Time above range >250 mg/dL (V High)	< 5%	< 10%
% Time above range >180 mg/dL (High)	< 25%	--
% Time in range (70-180 mg/dL) (TIR)	> 70%	>50%
% Time below range (<70 mg/dL) (Low)	< 4%	<1 %
% Time below range (<54 mg/dL) (V Low)	<1 %	__

Key points included in standard ambulatory glucose profile (AGP) report.



AGP Report

Name

MRN

GLUCOSE STATISTICS AND TARGETS

Glucose Ranges	Targets [% of Readings (Time/Day)]
	14 days % Sensor Time
Target Range 70–180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70–180 mg/dL) is clinically beneficial.

Average Glucose

Glucose Management Indicator (GMI)

Glucose Variability

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

American Diabetes Association

American Diabetes Association Dia Care 2021;44:S73-S84

AMBULATORY GLUCOSE PROFILE (AGP)

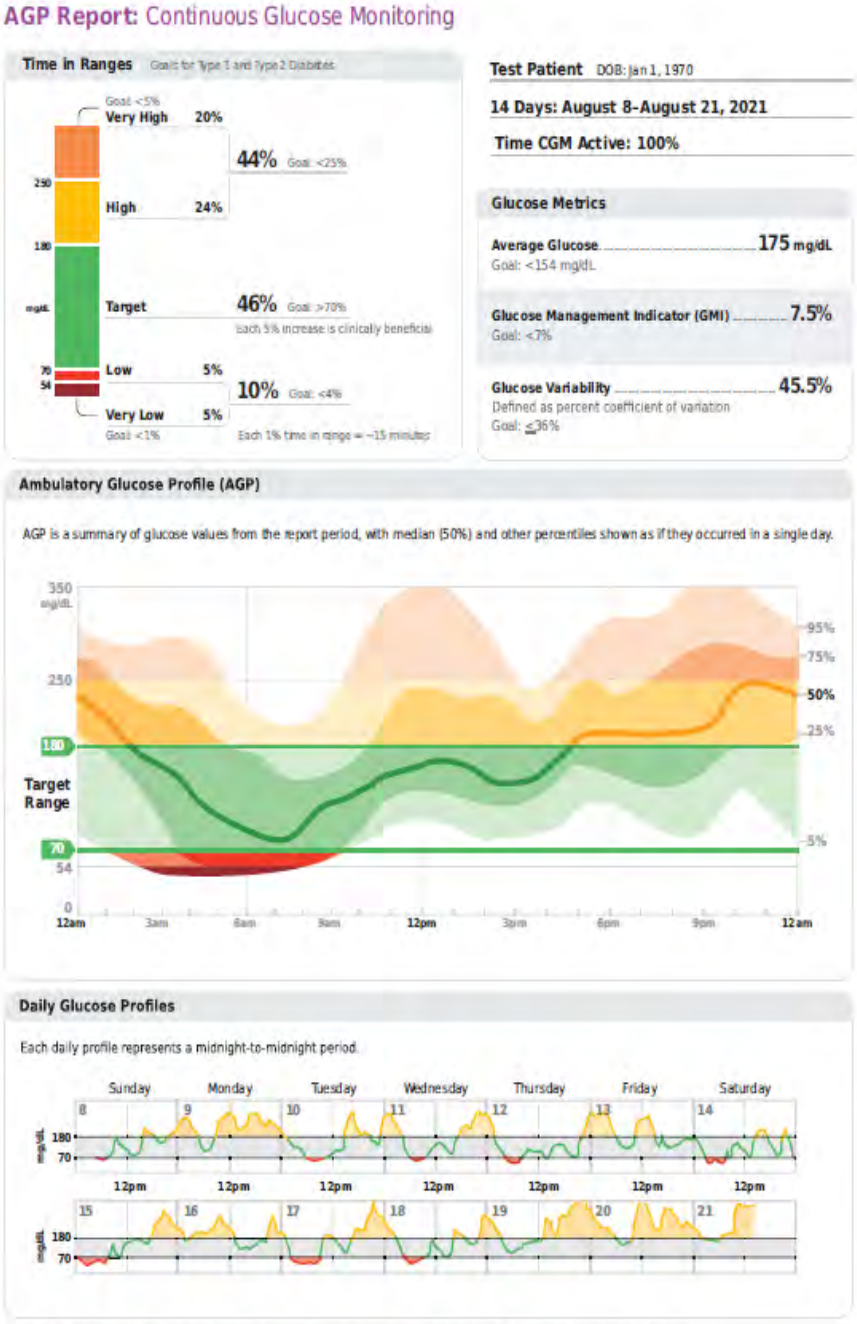


Figure 6.1—Key points included in standard ambulatory glucose profile (AGP) report. Reprinted from Holt et al. (33).

Glycemic Targets:
Standards of Medical Care in Diabetes - 2022. Diabetes Care 2022;45(Suppl. 1)

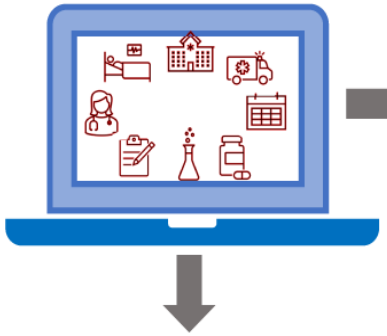
Rationale for use of CGM in community older adults

- Many clinical variables affect A1C levels (anemia, transfusion, hemolysis, CKD)
- Older adults are more likely to have hypoglycemia unawareness, and longer periods of hypoglycemia; may be unrecognized by care partners
- A1C levels do not always reflect risk of hypoglycemia
- The coefficient of variation (%CV), and GMI may be better indicators of hypoglycemia risk than A1C
- Improved glycemic outcomes (lower A1C and Time in Range) without significant severe hypoglycemia or DKA
- Frequent CBG monitoring is time-consuming, poorly documented, difficult to perform in those with cognitive impairment, poor coordination, lack of social support, or diabetes distress
- Practitioners lack time to review BG logs, and adjust treatments
- Care partners can have remote access to BG trends and alarm

Munshi, Diab Technol & Ther 2023; 25, Suppl 3
Prately RE, et al. JAMA 2020;323 (23)
Argento NB et al. Endocr Pract 2014;20

Real World Data: Initiation of CGM

- **VA Electronic Health Records**



Diabetes

CGM initiation versus self-monitoring glucose

	Type 1 diabetes	Type 2 diabetes
12-month change in HbA1c	n=4,930 vs. n=3,263	n=15,292 vs. n=28,467
CGM use leads to more reduction in 12-month HbA1c		
β (95% CI):	–0.26 (–0.33, –0.19) ↓	–0.35 (–0.42, –0.36) ↓

Clinical events over 12 months	n=5,015 vs. n=3,815	n=15,706 vs. n=29,912
I. Hypoglycemia admissions	**CGM use leads to reduced hypoglycemia admissions in T1D**	
HR (95% CI):	0.69 (0.48, 0.98) ↓	0.93 (0.74, 1.16)
II. Hyperglycemia admissions	**CGM use leads to reduced hyperglycemia admissions in T2D**	
HR (95% CI):	0.83 (0.65, 1.06)	0.87 (0.77, 0.99) ↓
III. All hospitalizations	**CGM use leads to reduced hospitalizations**	
HR (95% CI):	0.75 (0.63, 0.93) ↓	0.89 (0.82, 0.87) ↓

CGM, continuous glucose monitoring; HR, hazard ratio; T1D, type 1 diabetes; T2D, type 2 diabetes; VA, Veterans Administration.

Reaven PD, Diabetes Care, 2023

Potential advantages of CGM in PALTC

- Reduction of staff time in monitoring capillary blood glucose
- Ability to monitor glucose levels closely in very sick patients on room isolation
- Ability to improve detection of hypoglycemia
- Ability to detect hypoglycemia in patients at the end of life
- Ability to review BG levels in multiple patients in different parts of a facility utilizing on-line access
- Ability to optimize BG control across transitions in sites of care

What data do we have so far on CGM use in PALTC? (1 of 3)

- **Feasibility study in older home-dwelling people with diabetes** receiving home care did not reveal major problems- extensive training was required
- **Study of 35 patients completing a 7-day blinded flash CGM review in 10 Connecticut nursing homes**
  - 1 in 3 had at least 2 consecutive BGs <70mg/dl
  - 1 in 4 had BGs <60 mg/dl
  - 1 in 12 had BGs <50 mg/dl
  - Hypoglycemia by fingerstick (FS) was very rare, with a total of just 4 FS <70 mg/dl during all observation periods combined

Larsen, A.B., Hermann, M. & Graue, M. Pilot Feasibility Stud 7, 12 (2021)
Kasia J. Lipska, et al. Diabetes 1 June 2020; 69 (Supplement_1): 380–P.

What data do we have so far on CGM use in PALTC? (2 of 3)

Glycemic Control Utilizing CGM vs. POC Testing in 97 older adults with T2D in LTC facilities

- POC subjects tested ac and hs and wore a blinded Dexcom CGM up to 60 days; treatment adjusted by the primary care team, with a target glucose of 140-180 mg/dL
- Rt-CGM subjects adjusted based on daily CGM profile.
- Baseline characteristics (mean age: 74.7, mean A1c: 8.06)
- The mean daily glucose by POC was lower than CGM (171±45 vs. 188±45 mg/dL, $p<0.01$)
- CGM detected more subjects with hypoglycemia <70 mg/dL and <54 mg/dL; as well as hyperglycemia >250 mg/dL compared to POC testing, all $p<0.001$
- **Conclusion**: In older adults with T2D admitted to LTC, the use of CGM significantly improved detection of hypoglycemic and hyperglycemic events compared to POC

THAER IDREES, IRIS A. CASTRO-REVOREDO et al. Diabetes 20 June 2023; 72 (Supplement_1): 947–P.

Diabetes. 2023;72(Supplement_1). doi:10.2337/db23-947-P

	POC Data	CGM Data	P value
Glycemic Control			<0.001
Mean daily Glucose, mg/dL	171± 45	188± 45	
BG >180 mg/dL, n (%)	77 (80%)	96 (99%)	
BG >250 mg/dL, n (%)	54 (56%)	75 (77%)	
BG <70 mg/dL, n (%)	13 (14%)	39 (40%)	
BG <54 mg/dL, n (%)	1 (1.0%)	20 (21%)	

What data do we have so far on CGM use in PALTC? (3 of 3)

- **CGM-Guided Insulin Administration in Long-Term Care Facilities: A Randomized Clinical Trial**
- Insulin treated T2 DM patients POC testing group wore blinded CGM compared to rt-CGM group with daily treatment adjustments
- No significant difference
  - in TIR (53.38% ± 30.16% vs 48.81% ± 28.03%, P = .40),
  - Mean daily CGM glucose (184 vs. 190)
  - TBR (<70 md/dL) or TBR (<54 mg/dL)

Use of rt-CGM is safe and effective in guiding insulin therapy in LTC with similar improvement in glycemic control compared to POC-guided therapy

Idrees, T., Castro-Revoredo, I. A. et al. Journal of the American Medical Directors Association, 25(5), 884-888.

Factors affecting use of technology in PALTC

- Site of care (ALF, SNF, LTC, group homes, rural facilities)
- Diabetes complications, comorbidities, prognosis, hypoglycemia risk, transitions of care
- Goals of care (overall and glycemic goals)
- Facility characteristics
  - Staffing shortages
  - Clinical competency of staff
  - Facility culture, relationship with clinicians
  - Location and internet connectivity
- Clinician knowledge and familiarity with diabetes technology
  - Supervision of NPs, Pas
  - Frequency of medical visits (low in rural NH)
  - Treatment changes if receiving steroids, tube feedings
  - insurance coverage for CGM
- High degree of state regularity oversight

CPT CODES FOR CGM

	CGM Services		
	95249 Personal CGM - Startup/Training Ambulatory CGM for minimum of 72 hours; **patient-provided** equipment, sensor placement, hook-up, calibration of monitor, patient training, and printout of recording.	**95250 Professional CGM** Ambulatory CGM for a minimum of 72 hours; **physician or professional (office) provided** equipment, sensor placement, patient training, removal of sensor, and printout	**95251 CGM Interpretation** Ambulatory CGM of interstitial tissue fluid via a subcutaneous sensor for a minimum of 72 hours; analysis, interpretation and report.
Medicare physician office fee schedule	$61.67	$147.07	$34.56
Private payer (2023)	$130	$320	$98

DISCUSSION

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