# 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

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## 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

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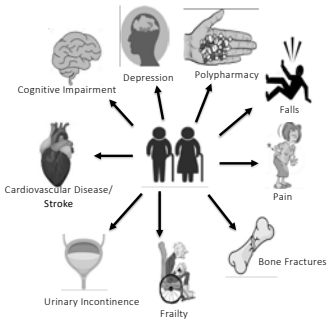
## Common Geriatric Syndromes Found in older Patients with Diabetes




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

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## 2024 PALTmed Diabetes Management CPG Released Aug 2024

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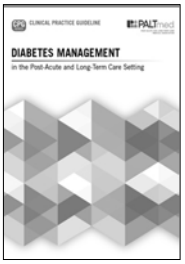


5 **https://paltmed.org/products/diabetes-management-cpg**

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## 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

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**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

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## How to individualize care and glycemic goals

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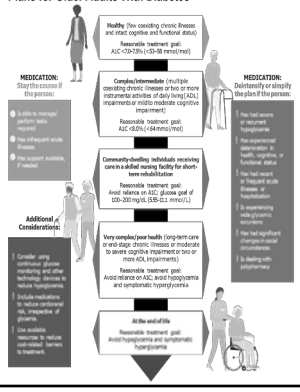
**Individualization of Treatment Goals and Medication Plans for Older Adults With Diabetes**

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

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## What are the priorities for setting glycemic goals?

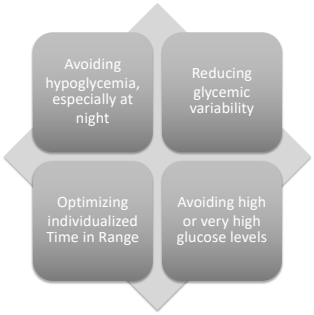


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TABLE 12. **Clinical Care Considerations Across the PALTC Continuum**

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

**ASSESS ALL PATIENTS FOR THE FOLLOWING:**
- Hypoglycemic risk
- Renal function
- CV risks and complications
- Weight loss
- Frailty
- Prognosis

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**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<br>▪ Impairment in 2 or more IADLs<br>▪ Variable life expectancy | ▪ Individual preferences<br>▪ 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<br>▪ Goal to discharge home | ▪ Need optimal glycemic control after acute illness | ▪ Avoid relying on A1C due to acute illness<br>▪ Follow current blood glucose trends | 100–200 mg/dL | Monitoring frequency based on complexity of regimen |
| **Patients residing in LTC** | ▪ Limited life expectancy<br>▪ Frequent health changes<br>▪ Avoid symptomatic hyper- or hypoglycemia | ▪ Limited benefit of intensive control<br>▪ 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 |

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***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.

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## PHARMACOLOGIC THERAPY FOR T2DM; RECOMMENDATIONS

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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.

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**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 (Up to 2%) | • Safe if no contraindications<br>• Low risk of hypoglycemia<br>• Low cost | • May cause GI disturbances<br>• Weight loss<br>• Vitamin B12 deficiency | • First-line treatment if no contraindications<br>• ER may reduce GI disturbances |
| Sulfonylureas (Up to 2%) | • Low cost | • Hypoglycemia risk<br>• Drug interactions (e.g., warfarin, allopurinol) | • Short-acting glipizide to reduce hypoglycemia<br>• Avoid glyburide (renal elimination) |
| Meglitinides (Up to 2%) | • Skip dose if skipped meal<br>• Useful if variable eating habits | • Increased pill burden<br>• High cost | • Useful with one large meal – controls PP hyperglycemia |

Medication class
Benefits
Cautions

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

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## 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<br>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<br>CKD (eGFR ≥25 mL/min/1.73 m²) |
| 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 | |

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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.<br>Inconsistent meal intake. | Goals of comfort. Avoidance of hypoglycemia and hyperglycemia |
| Preferred Medications | DPP4 inhibitor (linagliptin) GLP1-RA<br>Basal insulin* | DPP4 inhibitor<br>Basal insulin* | Metformin ER<br>DPP4 inhibitors<br>SGLT2 inhibitors<br>GLP1-RA Basal insulin* | DPP4 inhibitors<br>Metformin<br>ER basal insulin* | Metformin ER<br>DPP4 inhibitors<br>SGLT2 inhibitors<br>GLP1-RA | DPP4 inhibitors<br>Linagliptin<br>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

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**STANDARDS OF CARE: SECTION 9**

## 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.<br>✓ Some GLP-1 receptor agonists also provide cardiovascular benefit. | ✓ If there is evidence of catabolism (e.g., unexpected weight loss)<br>✓ 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.<br>✓ 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-ab06)

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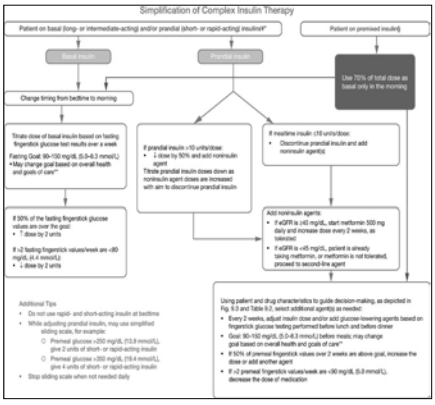


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## Strategies to Replace SSI in PA LTC Munshi MN, et al. *Diab Care*.2016;39(2)

| 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<br>• Stop SSI<br>• Use non-insulin agents or fixed dose meal time insulin for PPG PRN<br>• 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<br>• 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.<br>• 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<br>• 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<br>• May use simple scale such as "give 4 units prandial insulin if BG >300"<br>• Keep patients hydrated when glucose levels are high (>300) |

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**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<br>■ More frequently if poor control or medication dose change |
| **A1C** | ■ Every 6 mo if well controlled<br>■ Every 3 mo if poorly controlled |
| **Electrolytes and eGFR** | ■ Annually<br>■ 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)<br>■ If nephrotic syndrome suspected |
| **Lipid profile** | ■ Annually (if appropriate)<br>■ 6 wk after initiating or changing medical treatment |
| **Foot care** | ■ Daily inspection by patient if able<br>■ Weekly inspection by caregivers<br>■ 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<br>■ More frequently if more than 5% change (gain or loss) |

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## Strategies that may improve cardiovascular and cardiorenal outcomes

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## 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]**

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## 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.

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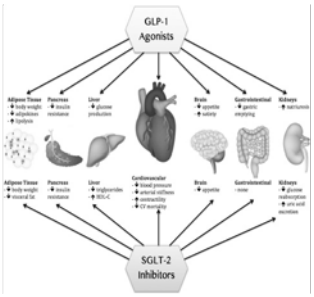
Effects of sodium glucose cotransport 2 (SGLT-2) inhibitors and glucagon-like peptide 1 (GLP-1) agonists.

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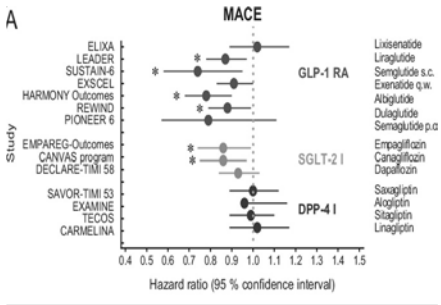
Are all GLP-1 agonists and SGLT2i equal in the treatment of type 2 diabetes?

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

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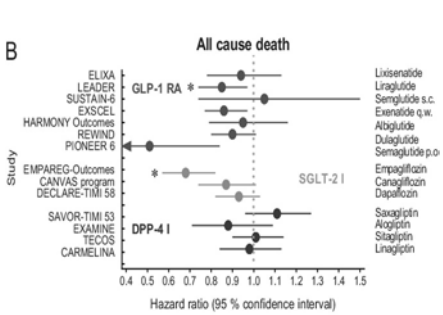


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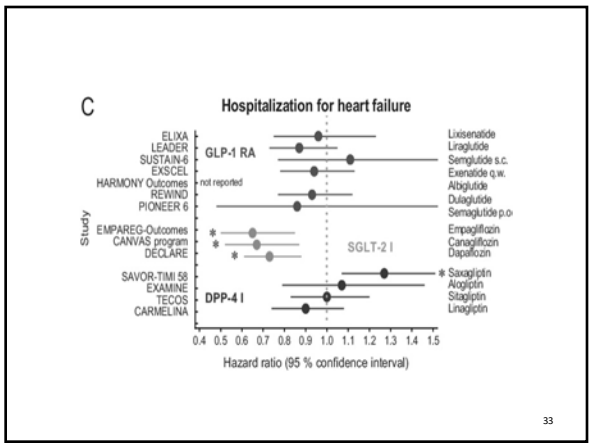


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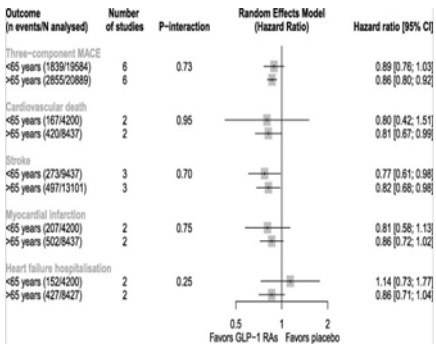
## Use of GLP1-RA in older people with type 2 DM- meta-analysis; 11 studies, 93,500pts




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

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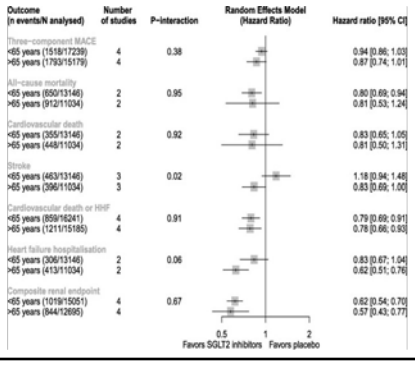
## Use of SGLT2in older people with type 2 DM- meta-analysis; 11 studies, 93,500pts




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

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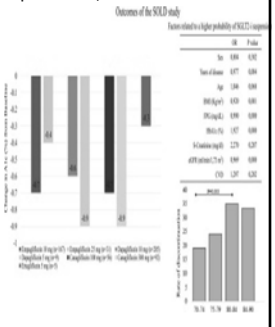
## SGLT2-inhibitors are effective and safe in the elderly: The SOLD study

**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



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## HYPOGLYCEMIA

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**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).

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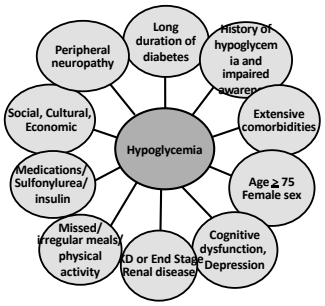
## Risk factors for hypoglycemia

Presenting symptoms may be neuroglycopenic rather than adrenergic




CVD = cardiovascular disease; VD = vascular disease.

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

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## 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).

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## 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 providers. Clin Diabetes 2024;42:196-200 doi: 10.2337/cd24-SC06.

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## 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.

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## GLUCAGON DELIVERY SYSTEMS

Glucagon kit- standard

Nasal glucagon


Prefilled glucagon pen

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## DIABETES TECHNOLOGY

## CONTINUOUS GLUCOSE MONITORING (CGM)

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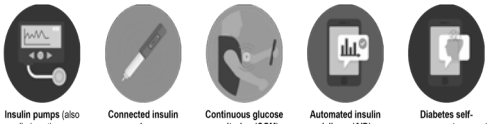
## Diabetes technology includes:



**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;42:201–220 (doi: 10.2337/cd24-s007)

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## 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**

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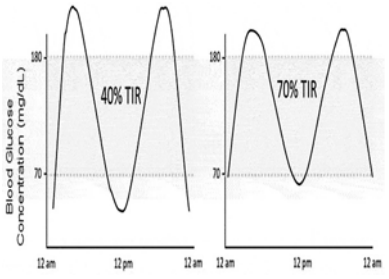
## Identical A1C values, but dramatically different amounts time spent in hypoglycemia and hyperglycemia, and glycemic variability.




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

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## 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

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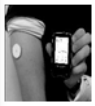
## Types of CGM

| 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

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## 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 % | -- |

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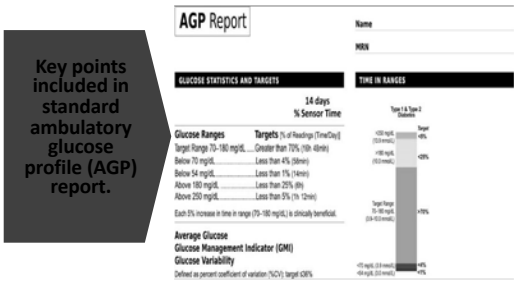
**Key points included in standard ambulatory glucose profile (AGP) report.**




American Diabetes Association.

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

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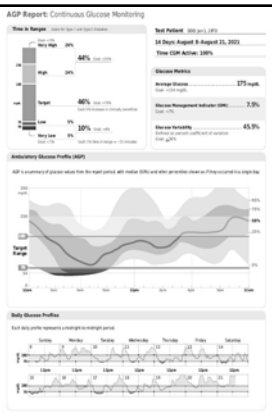
AMBULATORY GLUCOSE PROFILE (AGP)




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

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## 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

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## Real World Data: Initiation of CGM


Reaven PD, Diabetes Care, 2023

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## 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

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## 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.

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## 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.

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American Diabetes Association.

From: **947-P: Glycemic Control Utilizing Continuous Glucose Monitoring vs. Point-of-Care Testing in Older Adults with Type 2 Diabetes in Long-Term Care Facilities**

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%) | |

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## 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.

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## 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

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## 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 |

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## DISCUSSION

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