DIABETES MANAGEMENT IN PALTC: A BRIEF UPDATE
FL Society for PALTC Journal Club

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Disclosures

- Grant funding from HRSA
- Consultant for Sanofi

Strategies to optimize diabetes management in PALTC

Use of newer therapeutic agents to improve cardiorenal outcomes

Potential applications and benefits of wearable diabetes technologies

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

MENTATION

- Ability to use diabetes technology
- Anxiety
- Depression or dementia
- Coping skills and self-care

MEDICATIONS

- 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

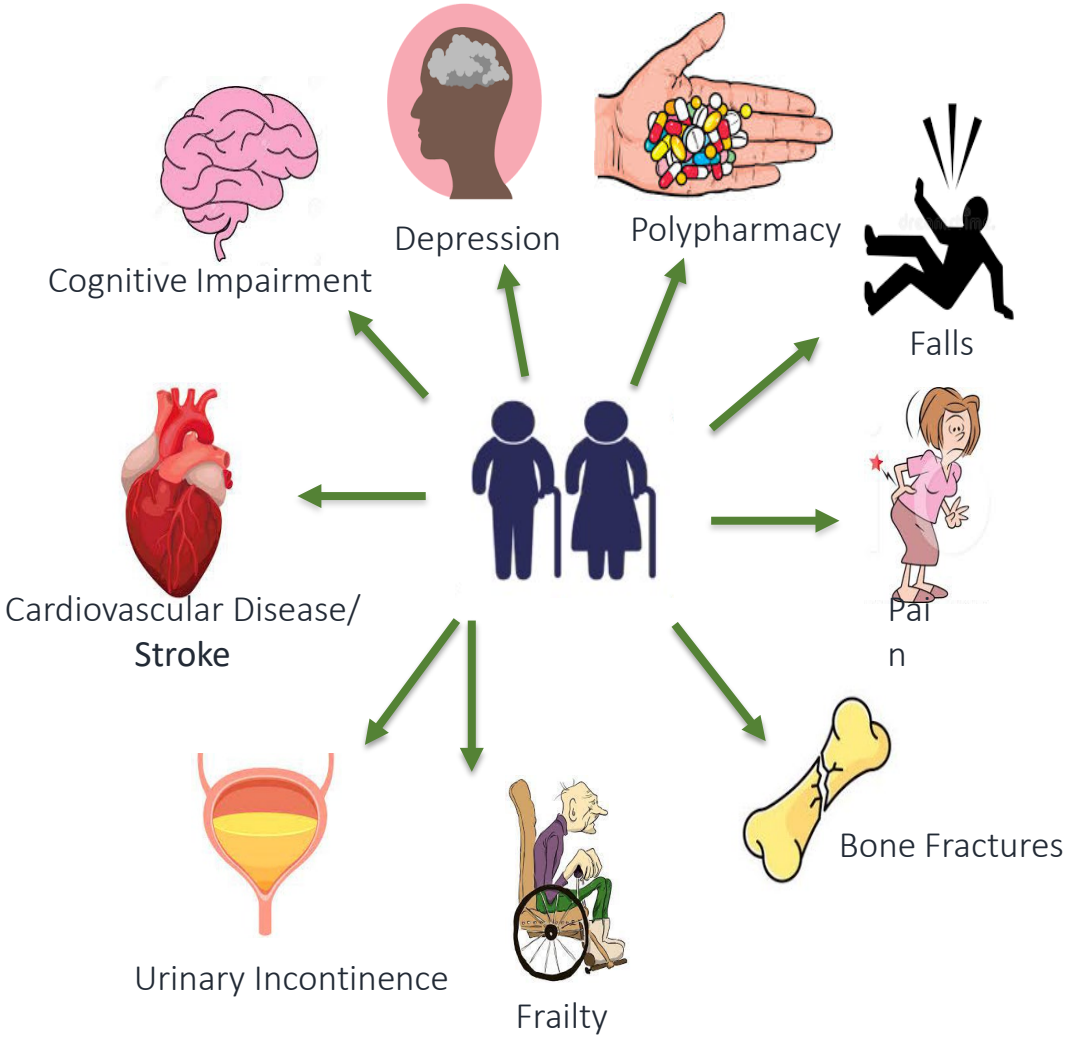
MOBILITY

- Foot complications
- Functional ability
- Frailty and sarcopenia
- Leg weakness
- Neuropathy
- Vision status

WHAT MATTERS MOST

- 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)

Common Geriatric Syndromes Found in older Patients with Diabetes



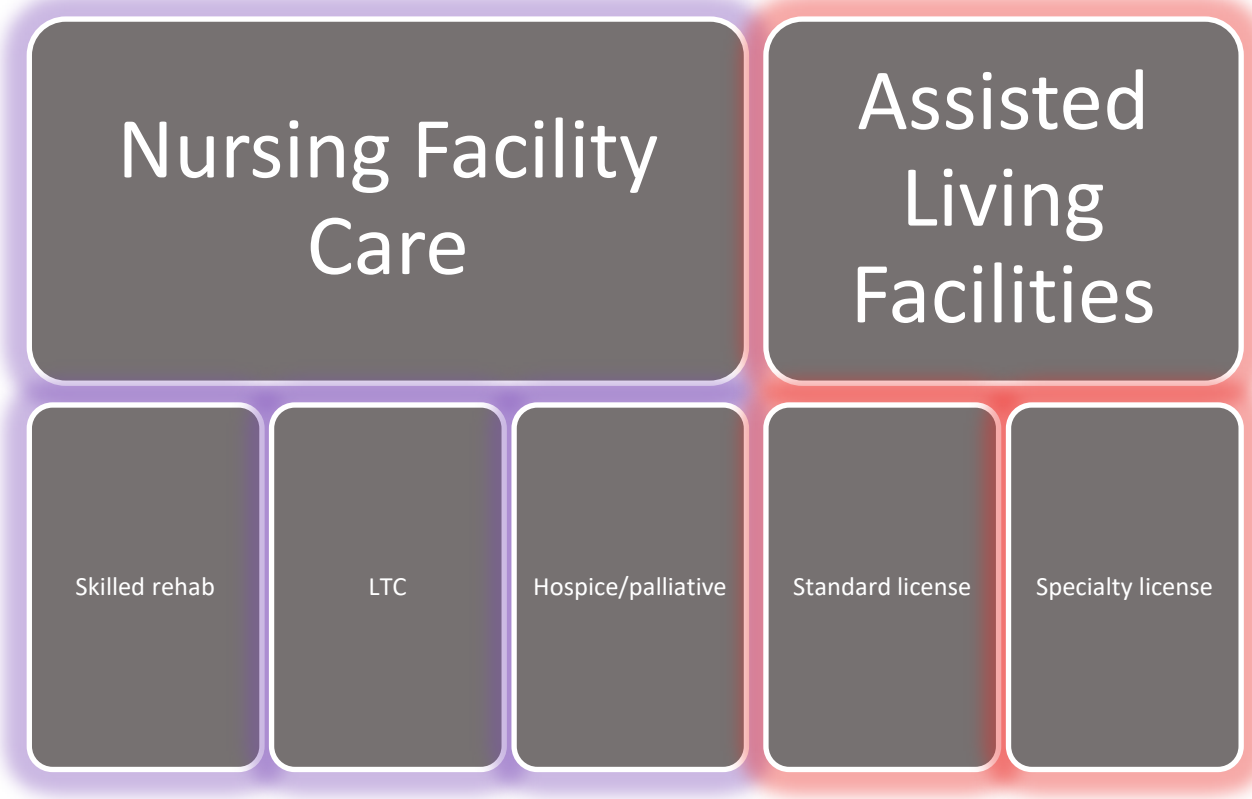
Longo M, et al. *Front Endocrinol (Lausanne).* 2019;10:45

Optimal Care for Older Adults with Type 1 Diabetes

- Longevity increasing in the West with higher comorbidity burden (better glycemic control and improved cardiovascular risk factors)
- T1 DM may also develop throughout adult life and into old age
- Challenges in PALTC
  - Assumption that patients have T2 DM (lack of caregiver engagement, medical records)
  - High risk of hypoglycemia especially if cognitively impaired
  - Hyperglycemia and DKA may develop if insulin treatment is inadequate, or omitted due to fear of hypoglycemia
  - Insulin requirements may increase during acute infections, cardiovascular events, and other medical emergencies
  - DKA may be mistaken for, or occur concurrently with organ failure, sepsis, or medication-related acidosis, and not be recognized or managed in a timely manner
  - First-line caregivers and nursing staff need more intensive diabetes management education, especially if an insulin pump or CGM is being utilized

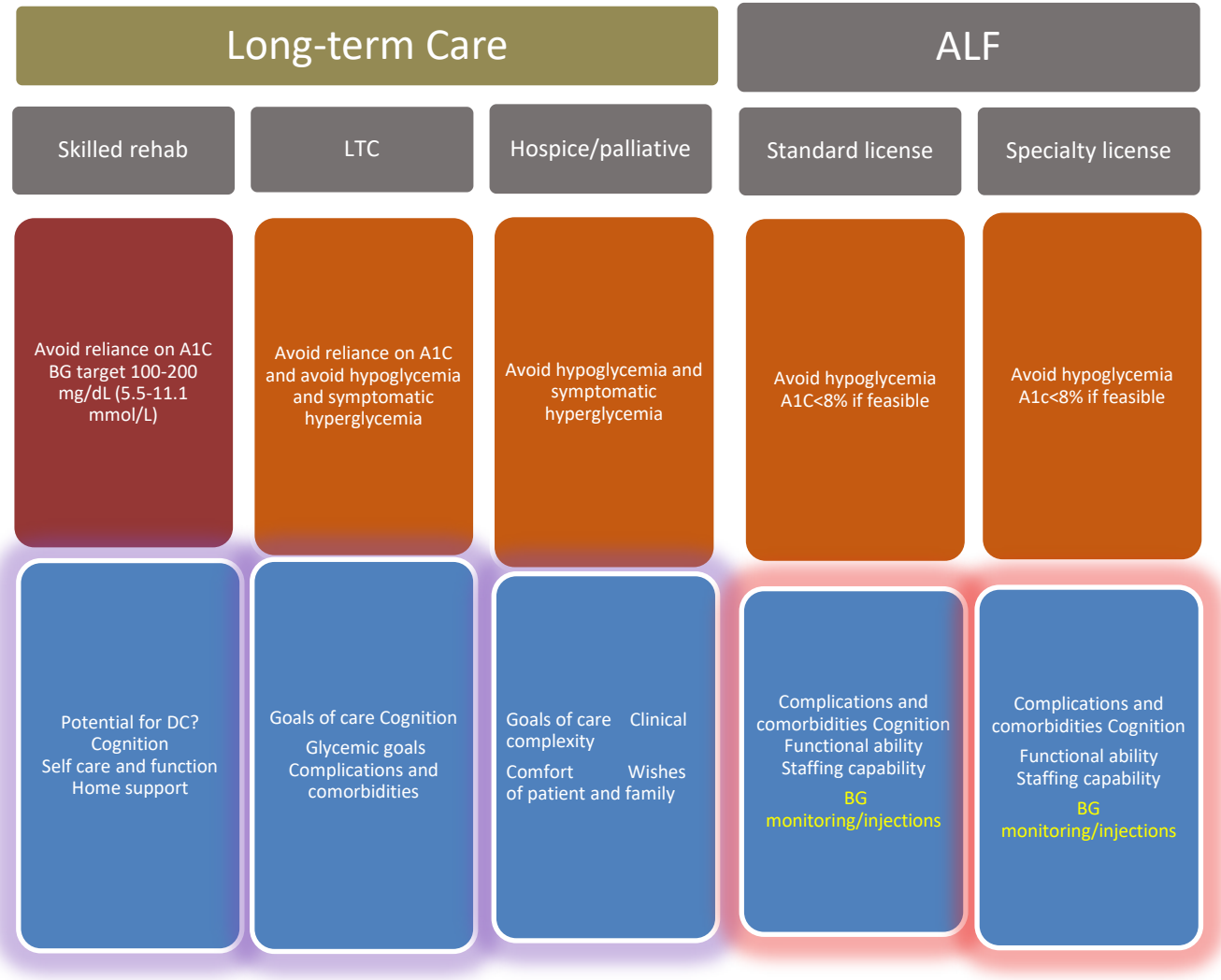
Weinstock RS, et al. Diabetes Care 2016;39: 603–610. Pandya, N. et al.(2020). *Diabetes Spectrum*, *33*(3), 236-245.

Sites of care in Post-Acute and Long-Term Care (PALTC)



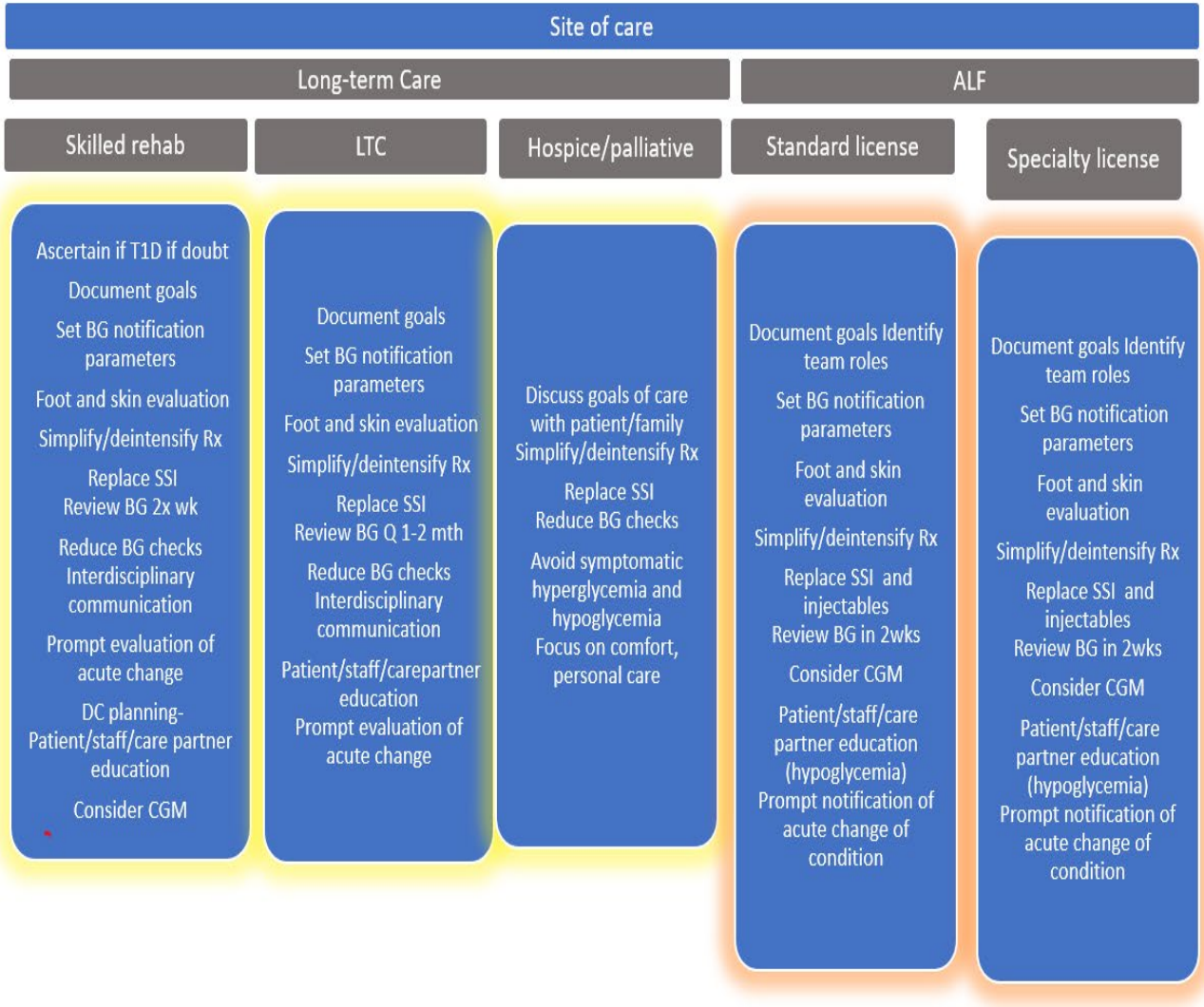
Extended Congregate Care
Limited Nursing
Limited Mental Health

Goals of care



In all, assess hypoglycemic risk, renal function, CV risks and complications, weight loss, frailty, prognosis, insurance

Care Considerations



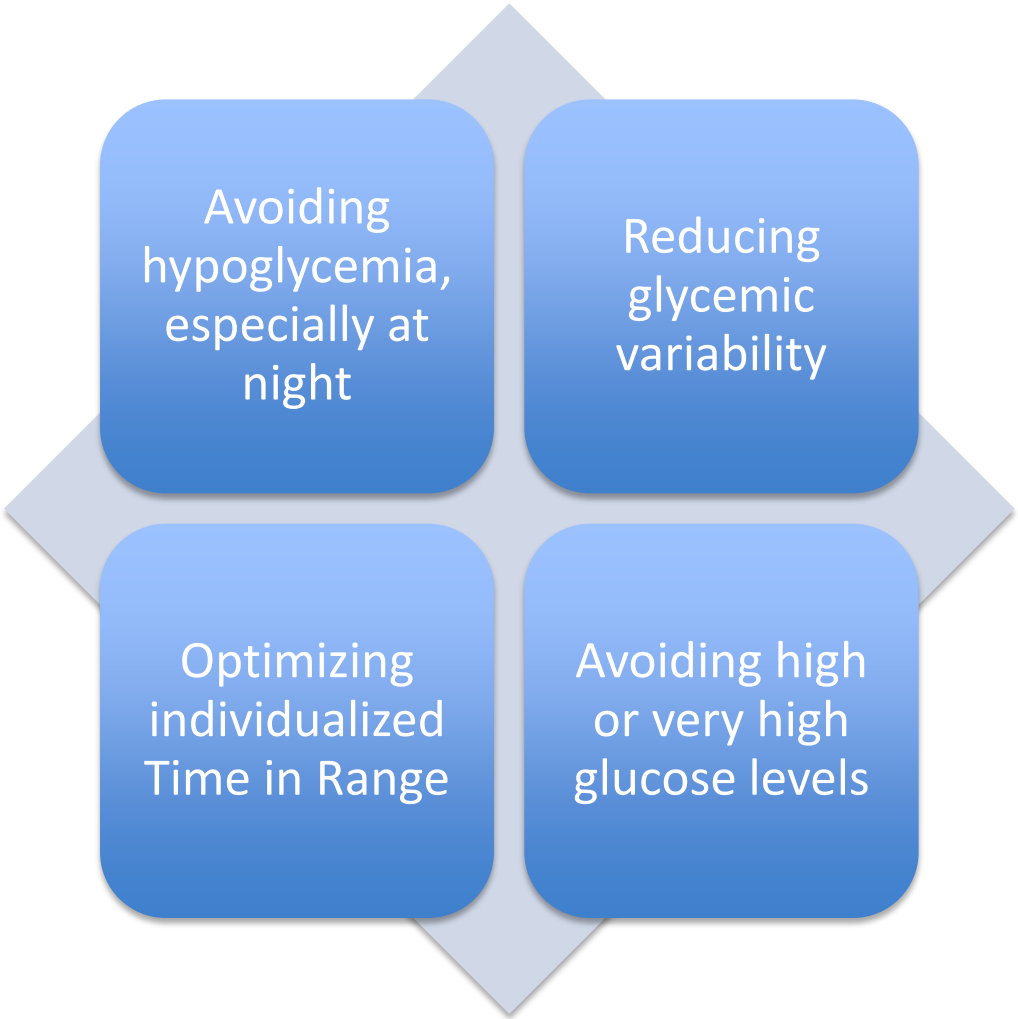
CARE CONSIDERATIONS

Note ideal frequency of monitoring

Foot and skin checks on shower days
Look for

- Intertrigo
- Overgrown nails
- Ulcers
- Non-healing wounds
- Cold or blue areas

WHAT ARE THE PRIORITIES FOR SETTING GLYCEMIC GOALS?



	Special considerations	Rationale	A1C	Fasting and premeal blood glucose targets	Glucose monitoring
Patients residing in assisted living facilities	•Multiple chronic conditions •Impairment in ≥2 IADLs •Variable life expectancy	•Individual preferences •Facility capabilities	•<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 hypo	•Limited benefit of intensive control •Focus on QOL	Avoid relying 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 of A1C	Avoid symptomatic hyperglycemia	Monitoring periodically only to avoid systematic hyperglycemia

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

A1c may be increased by

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

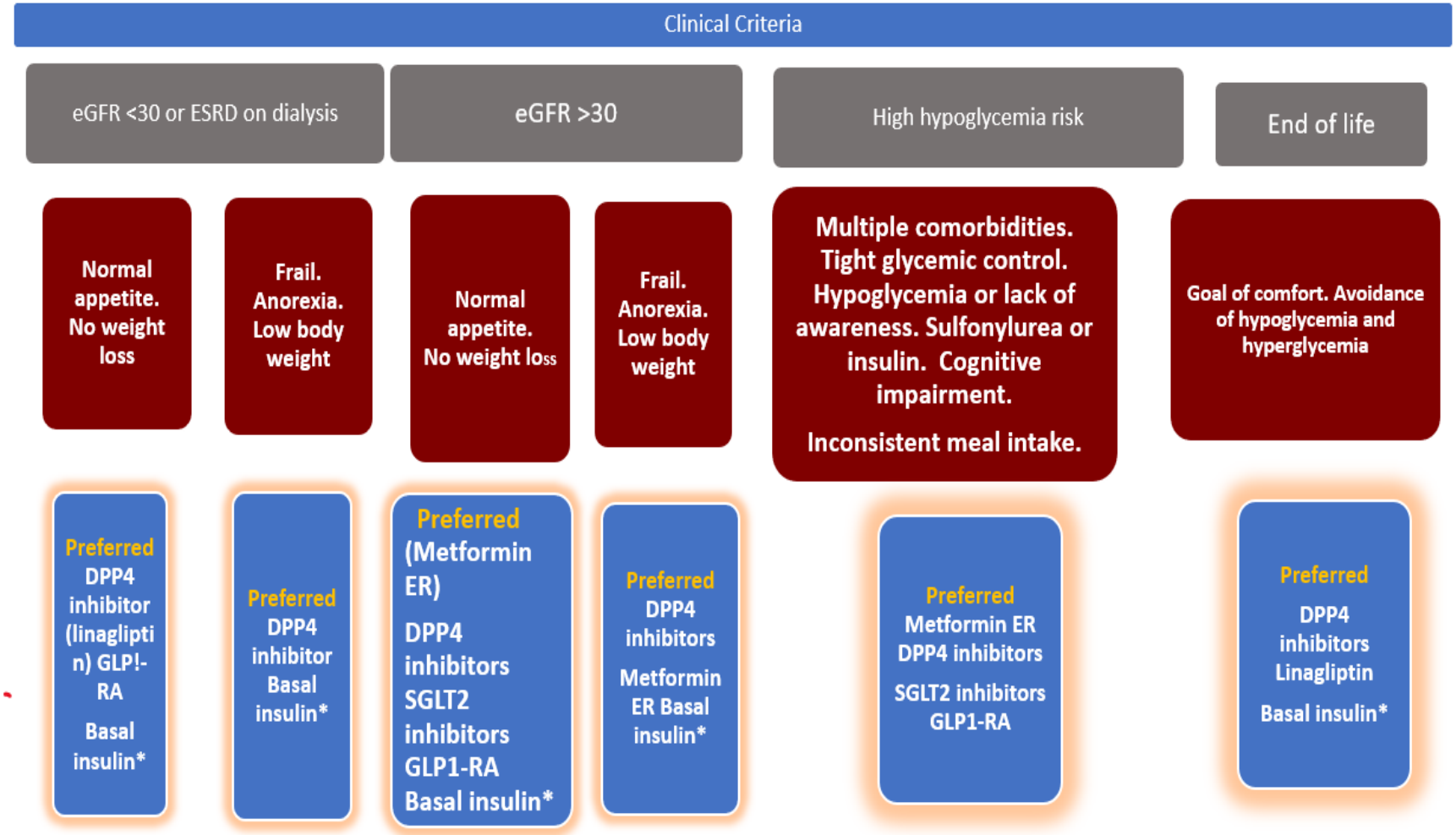
C. Kim et al. Diabetes Care **April 2010** vol. 33

PeacocK et al. Kidney International (2008) **73**

A1C may be decreased by

- Hemolytic anemia
- Blood loss, transfusions
- Abnormal Hb (hemolysis)
- Hemodialysis and Hct <30%
- Liver disease
- Pregnancy 2nd and 3rd trimester
- Erythropoetin therapy

Optimal medication selection by clinical criteria

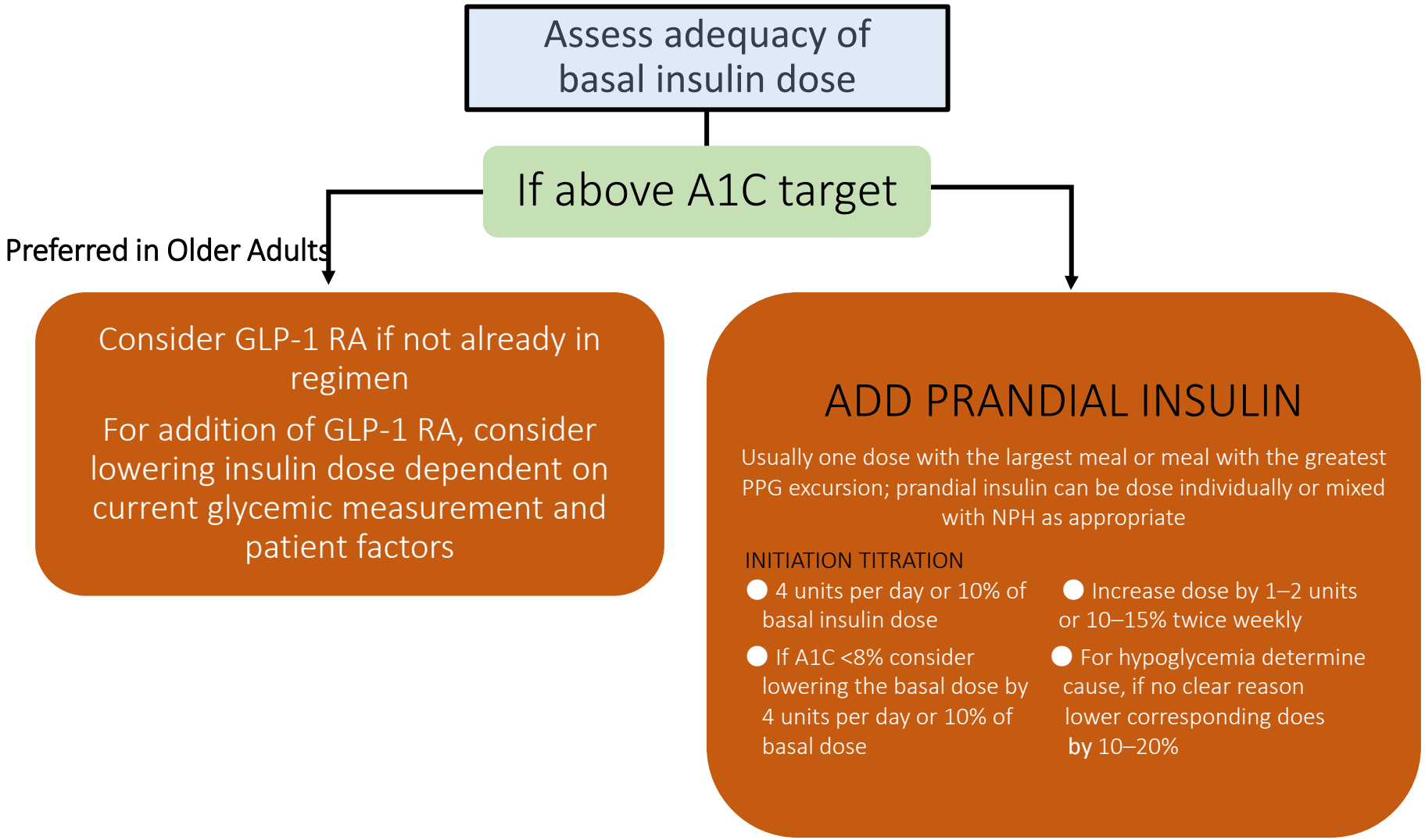


* = use basal insulin if additional glucose lowering is needed, or long-term use of basal insulin

Caveats and Cautions when Prescribing Diabetes Medications in PALTC

Medication	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 patient 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	Injectable treatments not possible in care setting, if BG monitoring inconsistent, lack of caregiver support, hypoglycemia risk, erratic meal consumption, tube feeding (stop sulfonylureas, stop SSI)	

2022 ADA Guidelines
Intensifying Injectable Therapies in T2DM



American Diabetes Association. *Diabetes Care.* 2022;42(Suppl. 1):S195-S207.

Strategies to Replace SSI in PA LTC

Munshi MN, et al. *Diabetes 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 insulin • Stop SSI • Use non-insulin agents or fixed dose meal time insulin for PPG as needed • Consider giving basal insulin in AM to impact post PPG and reduce hypoglycemia.
SSI is utilized 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 as needed
SSI is utilized in addition to basal and scheduled meal time insulin (i.e. Correction Dose insulin)	• If correction dose is required frequently, the average 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 breakfast 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	• Short term use is generally needed for acute illness and irregular dietary intake • As health and BG stabilize, stop SSI, return to previous regimen

USE OF NEWER THERAPEUTIC AGENTS TO IMPROVE 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]

1. Gheith O, et al. *J Nephropharmacol.* 2016;5(1):49-56; 2. King RJ, Grant PJ. *Herz*. 2016;41(3):184-192; 3. Rosano GM, et al. *Card Fail Rev*. 2017;3(1):52-55.

Cardiorenal Comorbidities

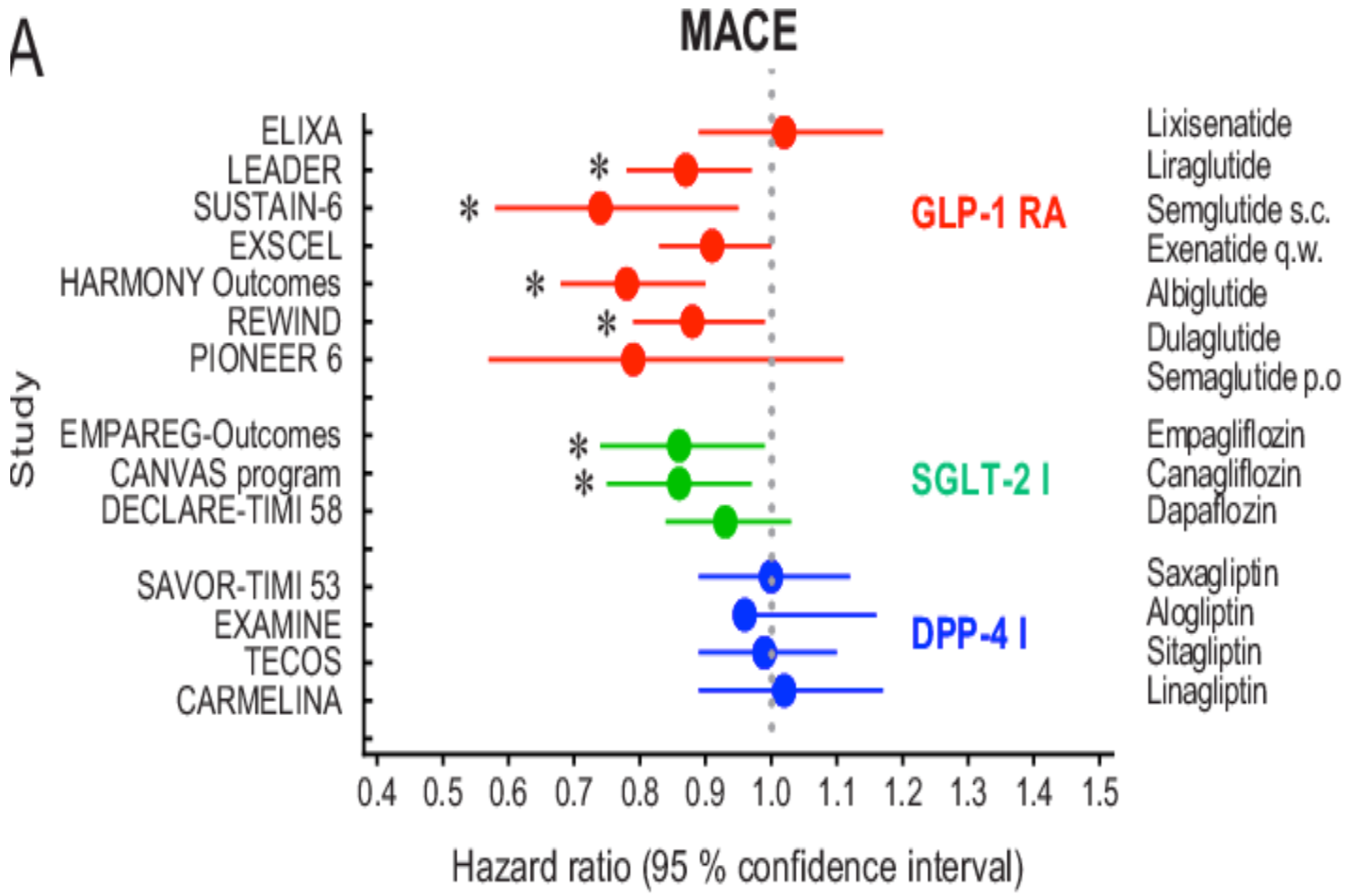
- In patients with eGFR < 30 ml/min/1.73m2, **glucagon-like peptide-1 receptor agonists such as subcutaneous liraglutide, semaglutide, or dulaglutide** are preferred, as they demonstrated advantageous atherosclerotic cardiovascular and kidney outcomes

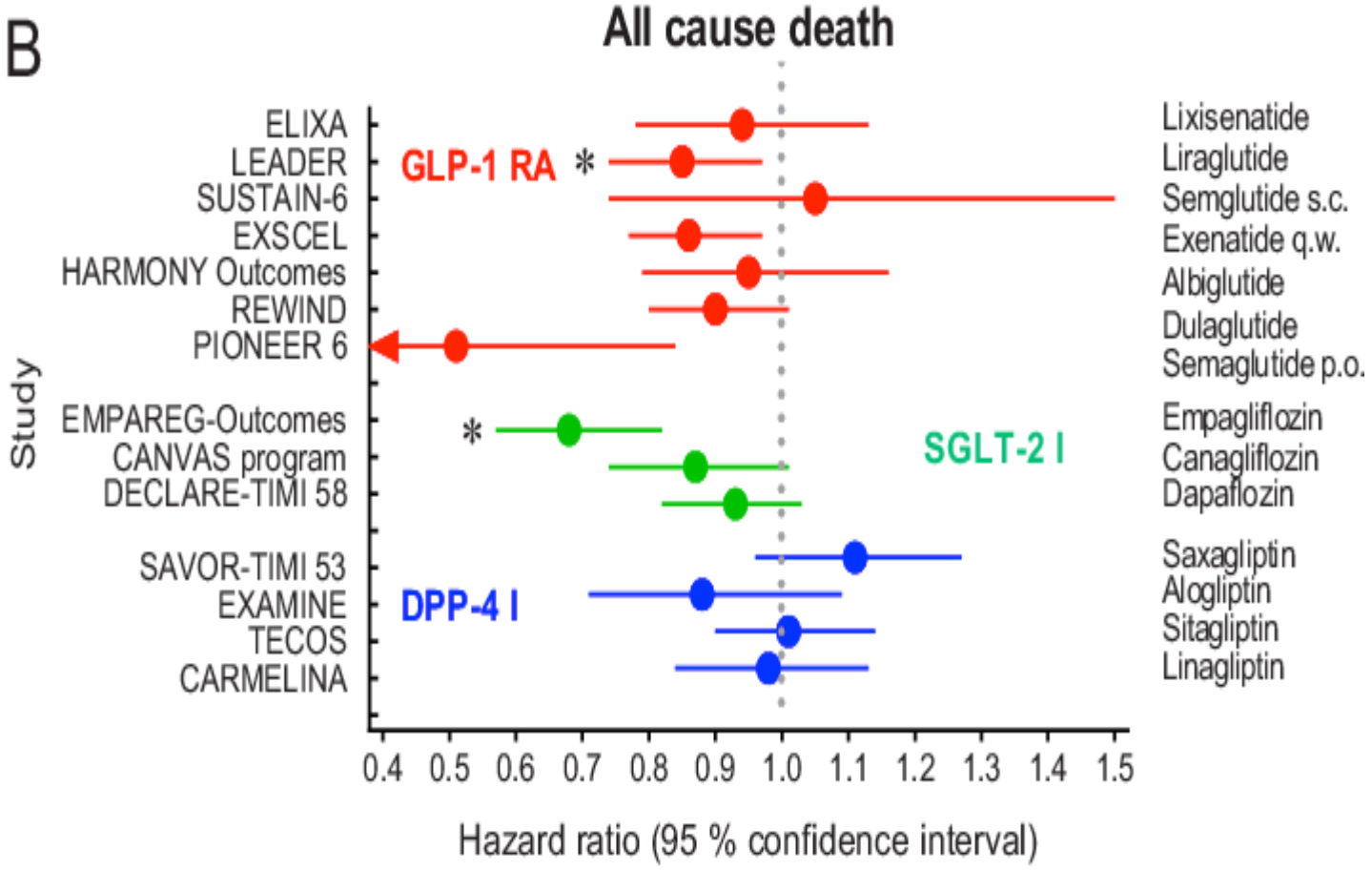
- In patients with **heart failure (systolic and/or diastolic), and/or** with **CKD** with eGFR between 25 and 60 ml/min, a **sodium-glucose co-transporter 2 inhibitor such as empagliflozin, canagliflozin or dapagliflozin** is the preferred choice that have demonstrated cardiorenal benefit.

- 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.

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.




B
All cause death
ELIXA
LEADER
SUSTAIN-6
EXSCEL
HARMONY Outcomes
REWIND
PIONEER 6
GLP-1 RA *
EMPAREG-Outcomes
CANVAS program
DECLARE-TIMI 58
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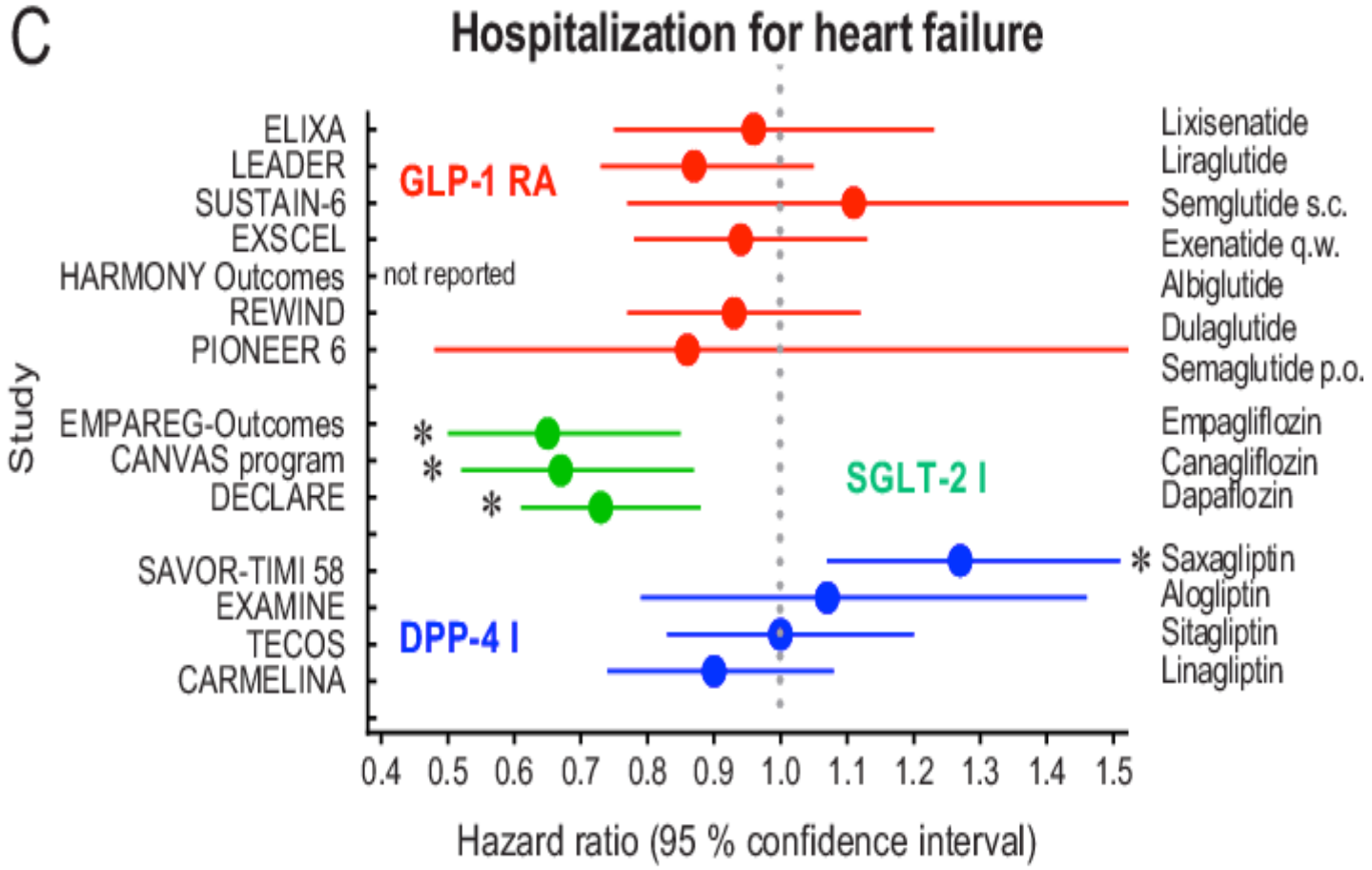
SGLT-2 I
SAVOR-TIMI 53
EXAMINE
TECOS
CARMELINA
DPP-4 I
Study
Lixisenatide
Liraglutide
Semglutide s.c.
Exenatide q.w.
Albiglutide
Dulaglutide
Semaglutide p.o.
Empagliflozin
Canagliflozin
Dapaflozin
Saxagliptin
Alogliptin
Sitagliptin
Linagliptin
0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5
Hazard ratio (95 % confidence interval)


C
Hospitalization for heart failure
Study
ELIXA
LEADER
SUSTAIN-6
EXSCEL
HARMONY Outcomes
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GLP-1 RA
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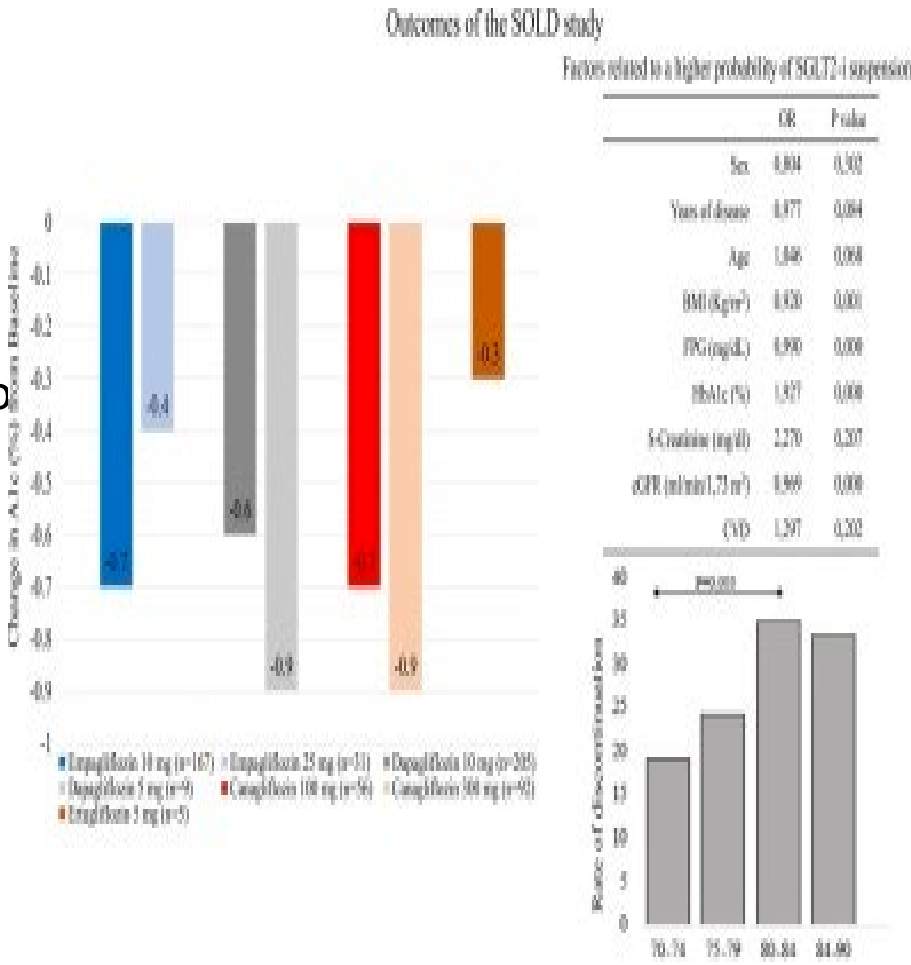
Semglutide s.c.
Exenatide q.w.
Albiglutide
Dulaglutide
Semaglutide p.o.
EMPAREG-Outcomes
CANVAS program
DECLARE
SGLT-2 I
Empagliflozin
Canagliflozin
Dapaflozin
SAVOR-TIMI 58
EXAMINE
TECOS
CARMELINA
DPP-4 I
Saxagliptin
Alogliptin
Sitagliptin
Linagliptin
0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5
Hazard ratio (95 % confidence interval)

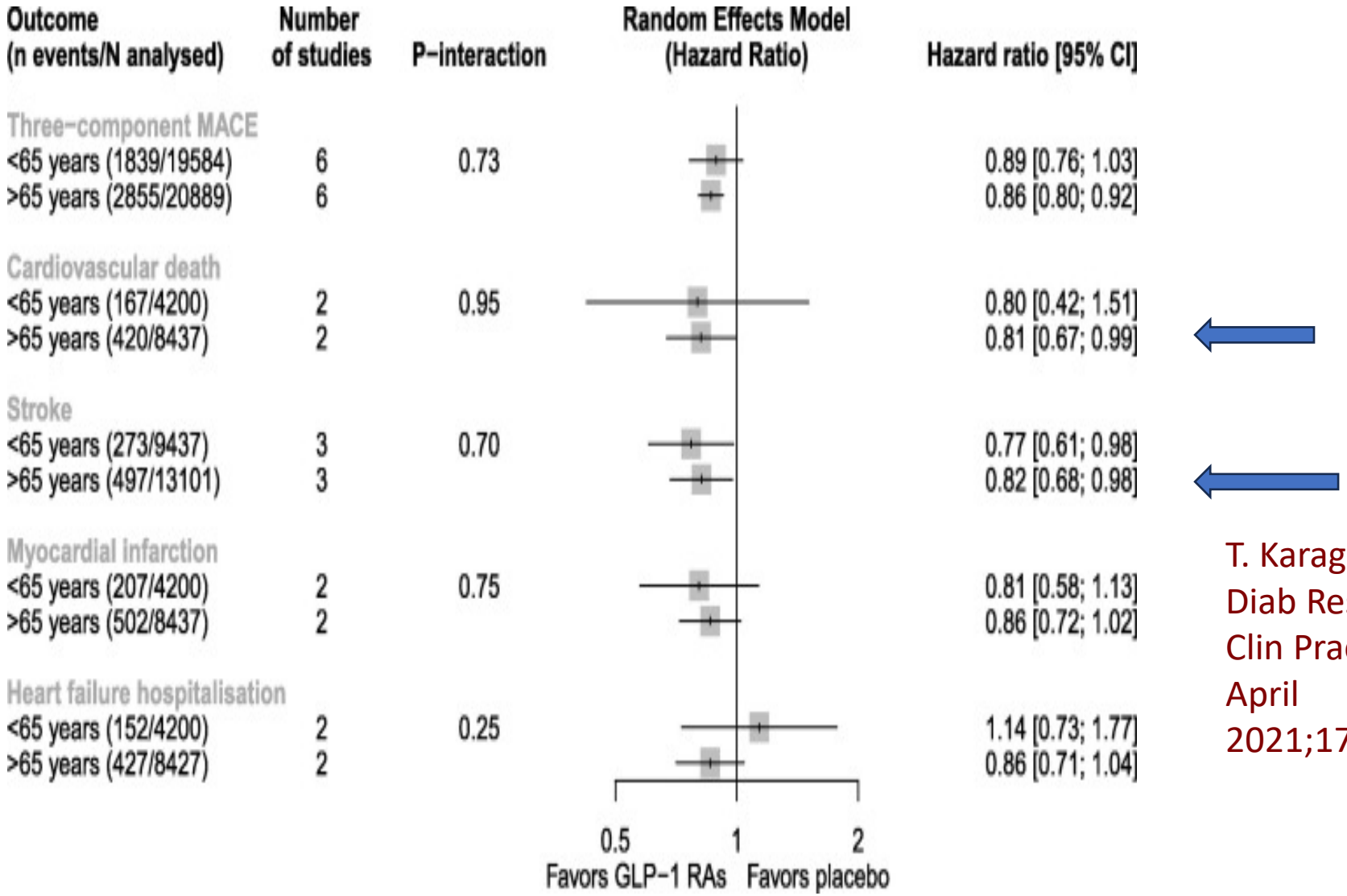
SGLT2-inhibitors are effective and safe in the elderly: The SOLD study

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%
- 174 (23.5%) discontinued treatment due to adverse events which were SGLT2i related (UTI and renal function decline)
- A significant reduction of A1C (baseline vs 12 months: 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

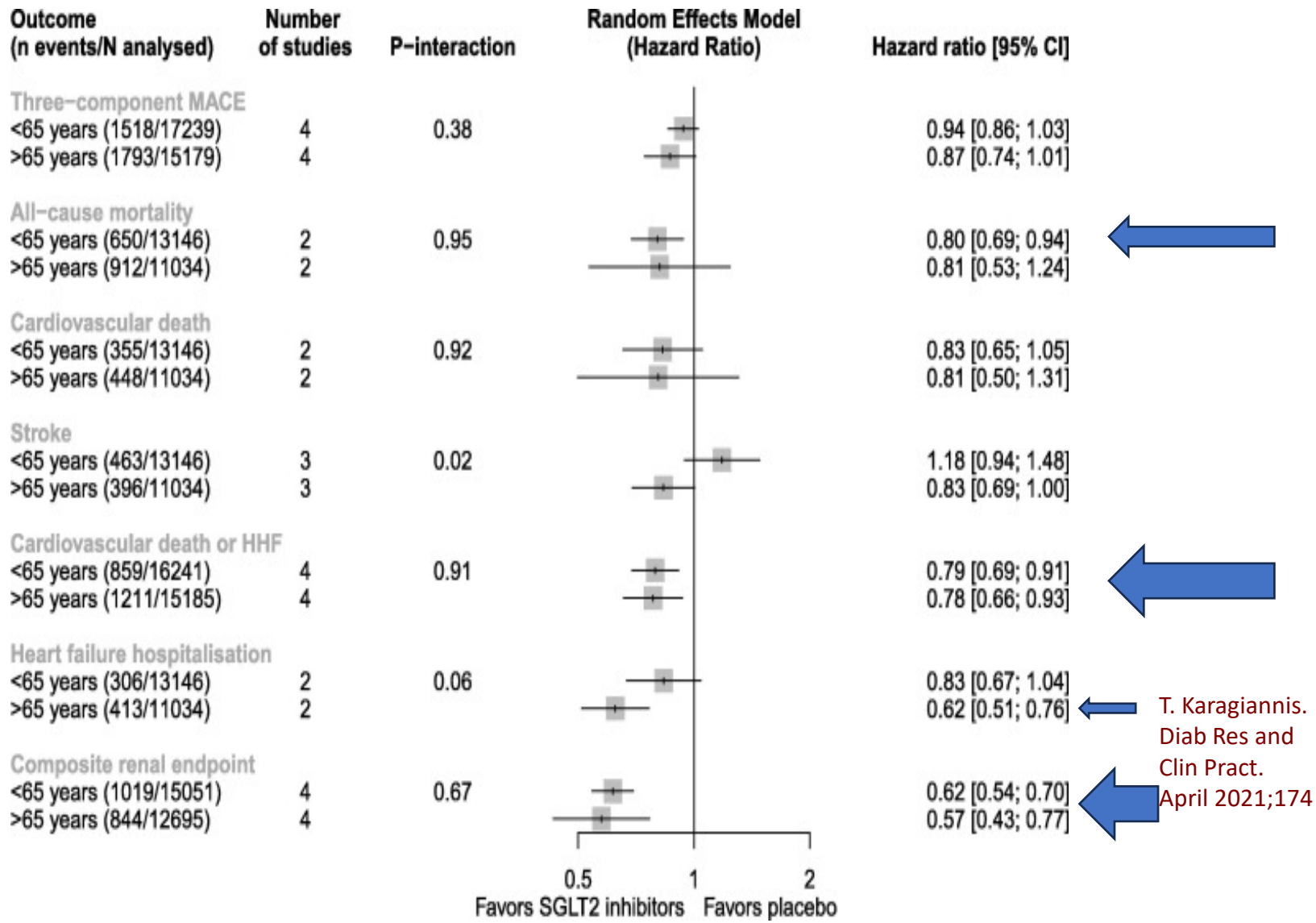


Use of GLP1-RA in older people with type 2 DM- meta-analysis; 11 studies, 93,500pts



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

DIABETES TECHNOLOGY

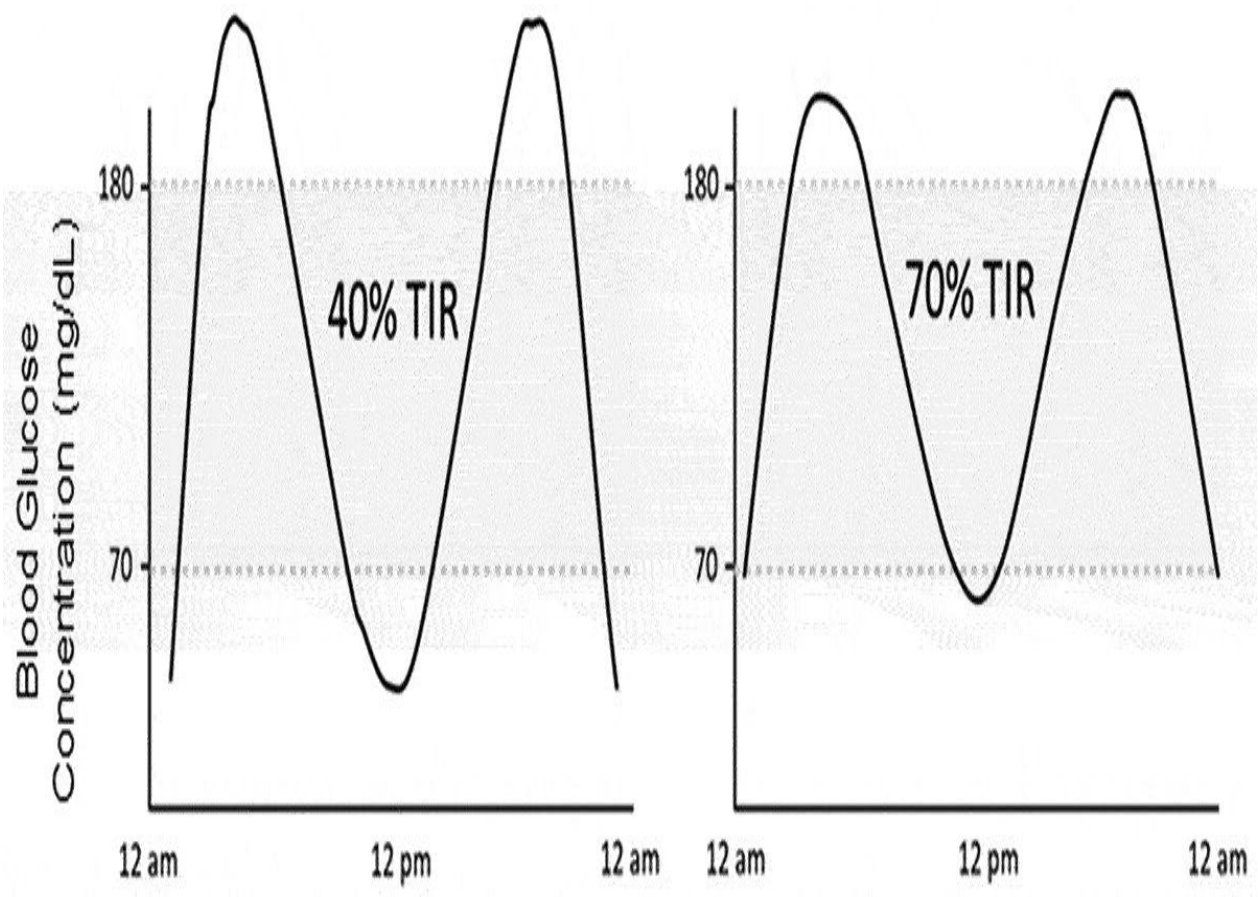
CONTINUOUS GLUCOSE MONITORING (CGM)

Glucose Assessment by Continuous Glucose Monitoring

- Standardized, single-page glucose reports from CGM devices with visual cues, such as the ambulatory glucose profile (AGP), should be considered as a standard printout for all CGM devices.
- Time in range (TIR) is inversely associated with the risk of microvascular complications and can be used for assessment of glycemic control.
- Additionally, time below target and time above target are useful parameters for the evaluation of the treatment regimen and making targeted changes

Standards of Care in Diabetes – 2024. Diabetes Care 1 January 2024; 47 (Supplement_1): S111–S125

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

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

AGP Report

Name

MRN

GLUCOSE STATISTICS AND TARGETS

14 days
% Sensor Time

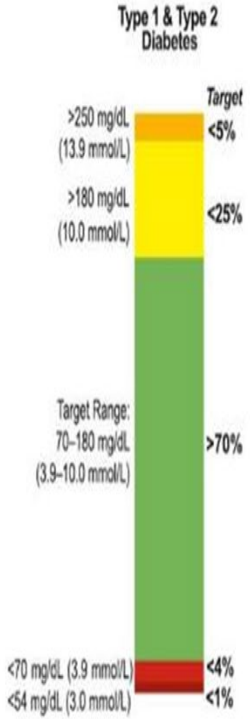
Glucose Ranges	Targets [% of Readings (Time/Day)]
Target Range 70–180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

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



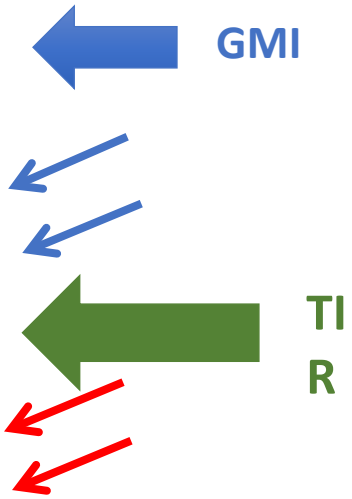
American Diabetes Association.

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

Standardized CGM Metrics

1. Number of days CGM device is worn (recommend 14 days)	
2. Percentage of time CGM device is active (recommend 70% of data from 14 days)	
3. Mean glucose	
4. Glucose management indicator	
5. Glycemic variability (%CV) target ≤36%*	
6. TAR: % of readings and time >250 mg/dL (>13.9 mmol/L)	Level 2 hyperglycemia
7. TAR: % of readings and time 181–250 mg/dL (10.1–13.9 mmol/L)	Level 1 hyperglycemia
8. TIR: % of readings and time 70–180 mg/dL (3.9–10.0 mmol/L)	In range
9. TBR: % of readings and time 54–69 mg/dL (3.0–3.8 mmol/L)	Level 1 hypoglycemia
10. TBR: % of readings and time <54 mg/dL (<3.0 mmol/L)	Level 2 hypoglycemia

CGM, continuous glucose monitoring; CV, coefficient of variation; TAR, time above range; TBR, time below range; TIR, time in range. *Some studies suggest that lower %CV targets (<33%) provide additional protection against hypoglycemia for those receiving insulin or sulfonylureas. Adapted from Battelino et al. (35).



Standards of Care in Diabetes – 2024. Diabetes Care 1 January 2024; 47 (Supplement_1): S111–S125

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

CGM Metrics and Targets for Clinical Care

(ADA, IDC)

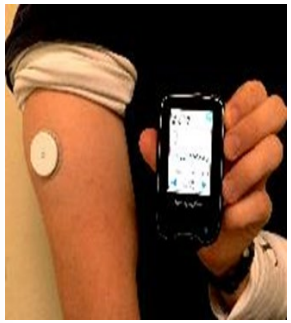
Metrics	T1D/ T2D targets	Older/ High risk targets
# days CGM worn	≥ 14d	≥ 14d
% Time CGM active	>70%	>50%
Av mean Glucose	Individualized	Individualized
GMI	Individualized	Individualized
Glycemic variability (%CV)	≤ 36%	≤ 36%
% Time above range >250 mg/dL (V High)	< 5%	< 10%
% Time above range >180 mg/dL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

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

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 Care in Diabetes -2024. Diabetes Care 1 January 2024; 47 (Supplement 1): S111–S125

DEXCOM G6- Example of Real Time CGM

Reader or phone app

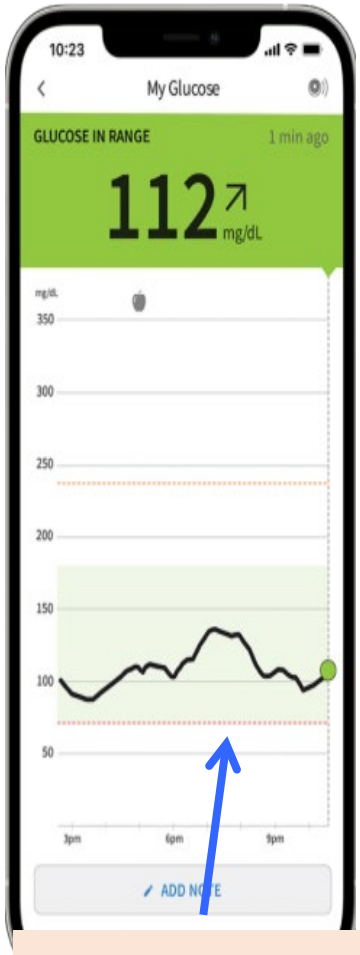
Sensor
Lasts 10d
Glucose reading every 5 min

Transmitter

Dexcom G7 sensors

- G7 smaller sensors, slimmer
- Warm up time 30 min
- Flexibility to apply to upper arms, upper buttocks
- Worn up to 10d with 12 h grace period
- Most accurate CGM in US (MARD=mean absolute relative difference) is 8.2% (9% for G6)
- Remove prior to MRI, CT or diathermy
- Will still be compatible with Tandem and Omnipod insulin pump systems

Freestyle Libre 3



LIbreLink app

- Smallest and thinnest discrete sensor (70% size reduction)
- Warm up time still 60 min
- Worn up to 14d
- No reader necessary- sends minute by minute readings to smartphone
- Remove prior to MRI, CT or diathermy
- MARD unchanged 9.2%
- Will likely not be compatible with automated insulin pump devices in the U.S.

When to Recommend CGMs (Real-time or Intermittently Scanned)

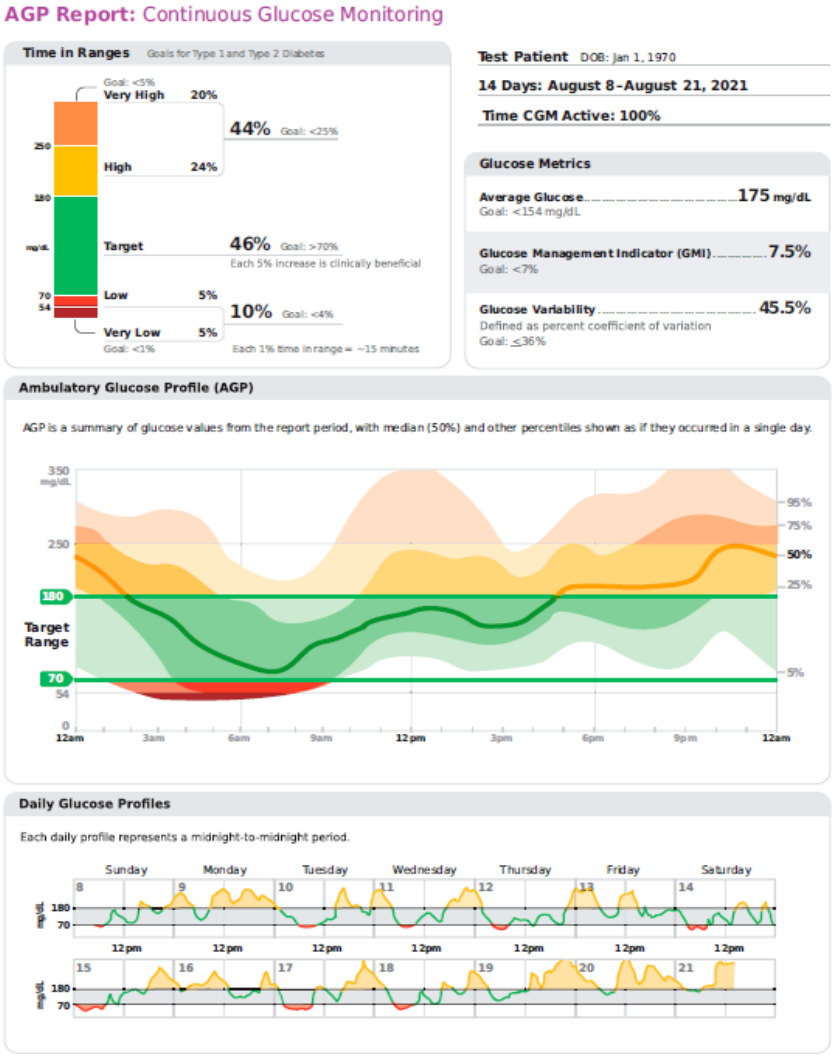
- In adults with diabetes on multiple daily injections or continuous subcutaneous insulin infusion who are capable of using devices safely (either by themselves or with a caregiver)
- In adults with diabetes on basal insulin (patient or caregiver able)
- In older adults with type 1 diabetes
- In youth with type 1 or type 2 diabetes on multiple daily injections or continuous subcutaneous insulin infusion who are capable of using the device safely (either by themselves or with a caregiver

Case – night time hypoglycemia

- 74-yr old woman with recurring nighttime hypoglycemia-alarm fatigue
- Takes rapid-acting insulin at HS and basal insulin in AM

PLAN

- Reduce or stop HS rapid-acting insulin
- Reduce basal insulin
- Later, increase rapid acting insulin with dinner



What data do we have so far on CGM use in PALTC? (1 of 2)

- **Feasibility study in older home-dwelling people with diabetes** receiving home care did not reveal major problems, although extensive training of personnel 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 2)

Glycemic Control Utilizing Continuous Glucose Monitoring vs. Point-of-Care Testing in 97 older adults with T2D in long-term care facilities

- POC subjects underwent POC testing 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 (age: 74.7±11 years, HbA1c: 8.06±2.2%)
- The mean daily glucose by POC was lower than CGM (171±45 vs. 188±45 mg/dL, $p<0.01$)
- CGM detected significant greater proportions of subjects with hypoglycemia <70 mg/dL (40% vs. 14%) and <54 mg/dL (21% vs. 1.0%); as well as hyperglycemia >250 mg/dL (77% vs. 56%) compared to POC testing, all $p<0.001$
- **Conclusion**: In older adults with T2D admitted to long-term care facilities, 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%)	

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

Payment issues for CGM in PALTC

- Coverage for CGM depends on billing structure in the nursing home
- Skilled nursing facility (SNF) per diem/d- then from per diem
- In group homes or ALFs, CGM is covered as Durable Medical Equipment by Medicare B (sensors and readers)
- Covered by Medicaid for those who are disabled or <18yrs

CPT CODES FOR CGM

	CGM Services		
	95249 Personal CGM - Startup/Training Ambulatory continuous glucose monitoring 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 continuous glucose monitoring 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 continuous glucose monitoring of interstitial tissue fluid via a subcutaneous sensor for a minimum of 72 hours; analysis, interpretation and report.
Medicare physician	$61.67	$147.07	$34.56

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