

Complex Diabetes Case Scenarios

SCPMG Diabetes Symposium

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CME Disclosure

The faculty, planners, reviewers and others who control educational content have disclosed that they do not have any relevant financial relationships with commercial interests.

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OBJECTIVES

- Utilize combination therapy of glucose-lowering medications appropriately
- Review unique glycemic control issues for patients with advanced chronic kidney disease
- Understand factors which predispose to hypoglycemia and make modifications to reduce hypoglycemia risk
- Use blood glucose patterns to adjust diabetes therapy and introduce prandial insulin where needed

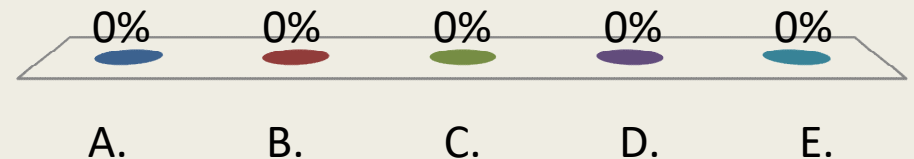


Pre Test Questions

Complex
Cases Plenary

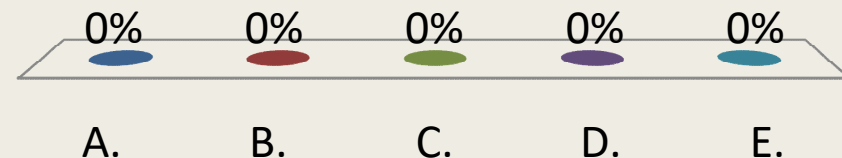
ARS 1: Regarding treatment of T2D, when eGFR is $\leq 30 \text{ ml/min/1.73m}^2$, the following medications should be stopped, EXCEPT:

- A. Metformin**
- B. SGLT2 inhibitors**
-  **C. DPP-4 inhibitors**
- D. GLP-1 RA**
- E. Thiazolidinedione (TZD)**



ARS 2: Regarding treatment of T2D, the following medications are weight neutral or cause slight weight loss, EXCEPT:

- A. Metformin**
- B. SGLT2 inhibitors**
- C. DPP-4 inhibitors**
- D. GLP-1 RA**
-  **E. Thiazolidinedione (TZD)**



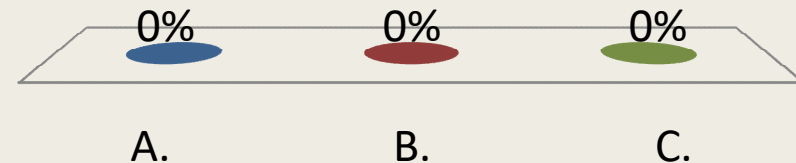
ARS 3: Advanced chronic kidney disease may tend to cause which effect on blood glucose control:

A. Worsened glycemic control

B. Better glycemic control

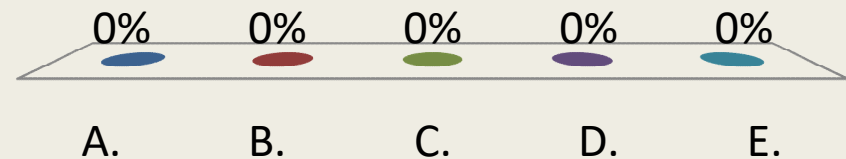


C. Either A or B

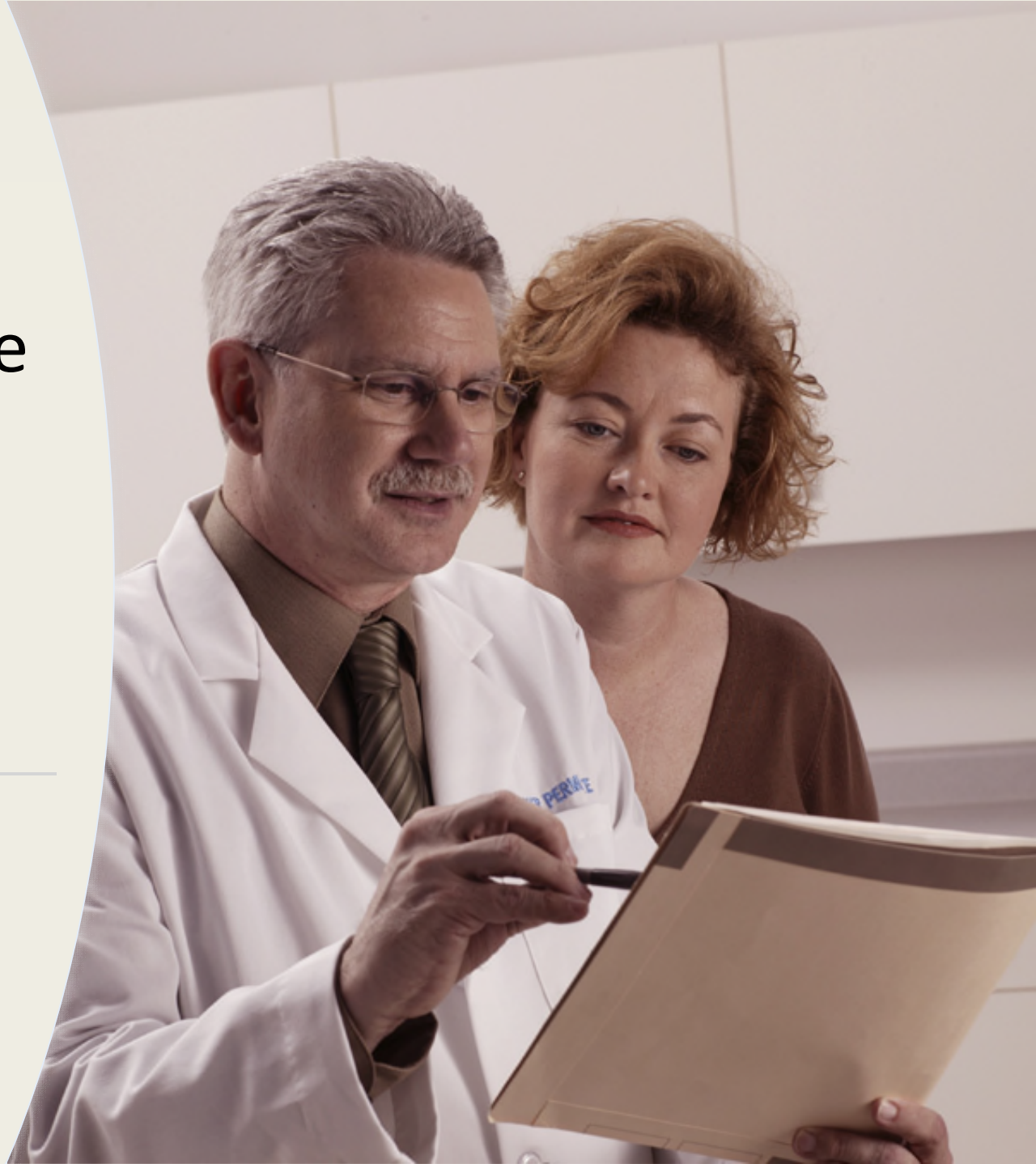


ARS 4: Which factor is least likely to contribute to problems of hypoglycemia

- A. Long-acting insulin
- B. Short-acting sulfonylurea
- C. Ketogenic diet
- ✓ D. Resistance exercise
- E. Diabetic gastroparesis



How to choose combination therapy for type 2 diabetes



What are the top two things patients most concerned about regarding their Diabetes treatment?

- **Weight Gain**
- **Hypoglycemia**

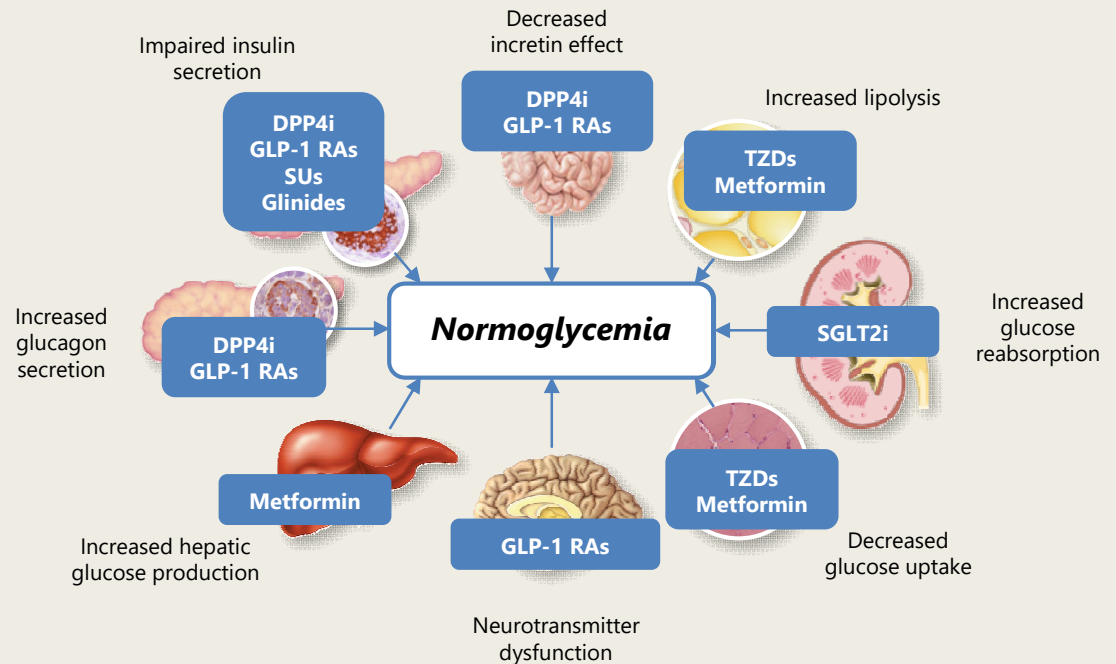
In addition to above, what other factors will help providers decide on the therapy for Diabetes?

- **A1c**
- **Renal Function**

Multifactorial Pathophysiology of T2D

To optimally manage T2D:

- Therapy should be individualized based on known pathophysiologic defects & comorbidities
- Multiple agents are necessary to target different aspects of this disorder



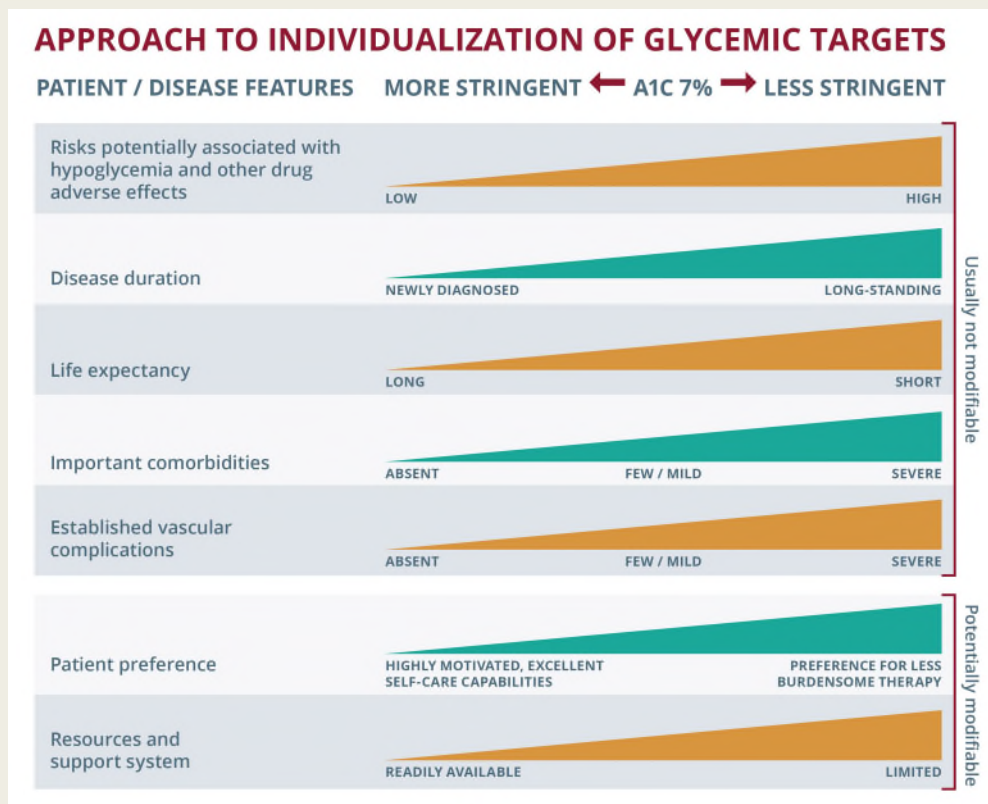
DPP4i, dipeptidyl peptidase-4 inhibitors; GLP-1 RA, glucagon-like peptide-1 receptor agonist; SGLT2i, sodium-glucose cotransporter 2 inhibitors; SU, sulfonylureas; T2D, type 2 diabetes; TZD, thiazolidinediones.
Adapted from DeFronzo RA. *Diabetes* 2009;58:773-795.

Glycemic Target Individualization for Diabetes

- Patient and disease factors used to determine optimal A1C targets
- Characteristics toward the left justify more stringent efforts to lower A1C
- Characteristics toward the right suggest less stringent efforts
- A1C 7% most patients
- A1C 8% if comorbidities / elderly
- A1C 6.5% if early T2D, healthy

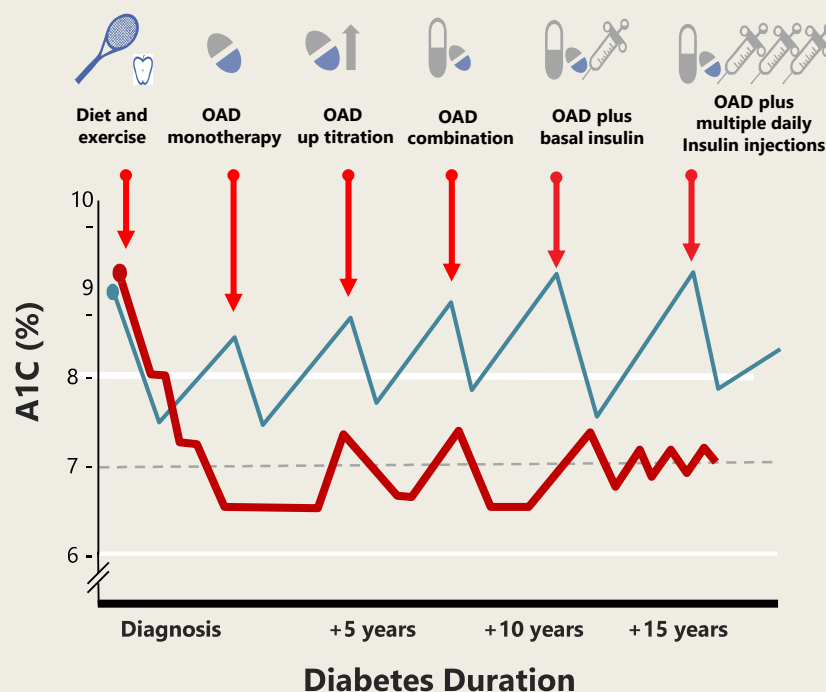
A1C, glycated hemoglobin.

American Diabetes Association. *Diabetes Care*. 2019;42:S61-S70.



Sequential Management of Hyperglycemia: “Treatment to Failure”

- A stepwise treatment approach has traditionally been used to manage patients with T2D. New treatments are added only when acute symptoms become apparent.
- Earlier intensification with combination therapy is recommended to achieve and maintain target goals among patients with high A1C levels at baseline.

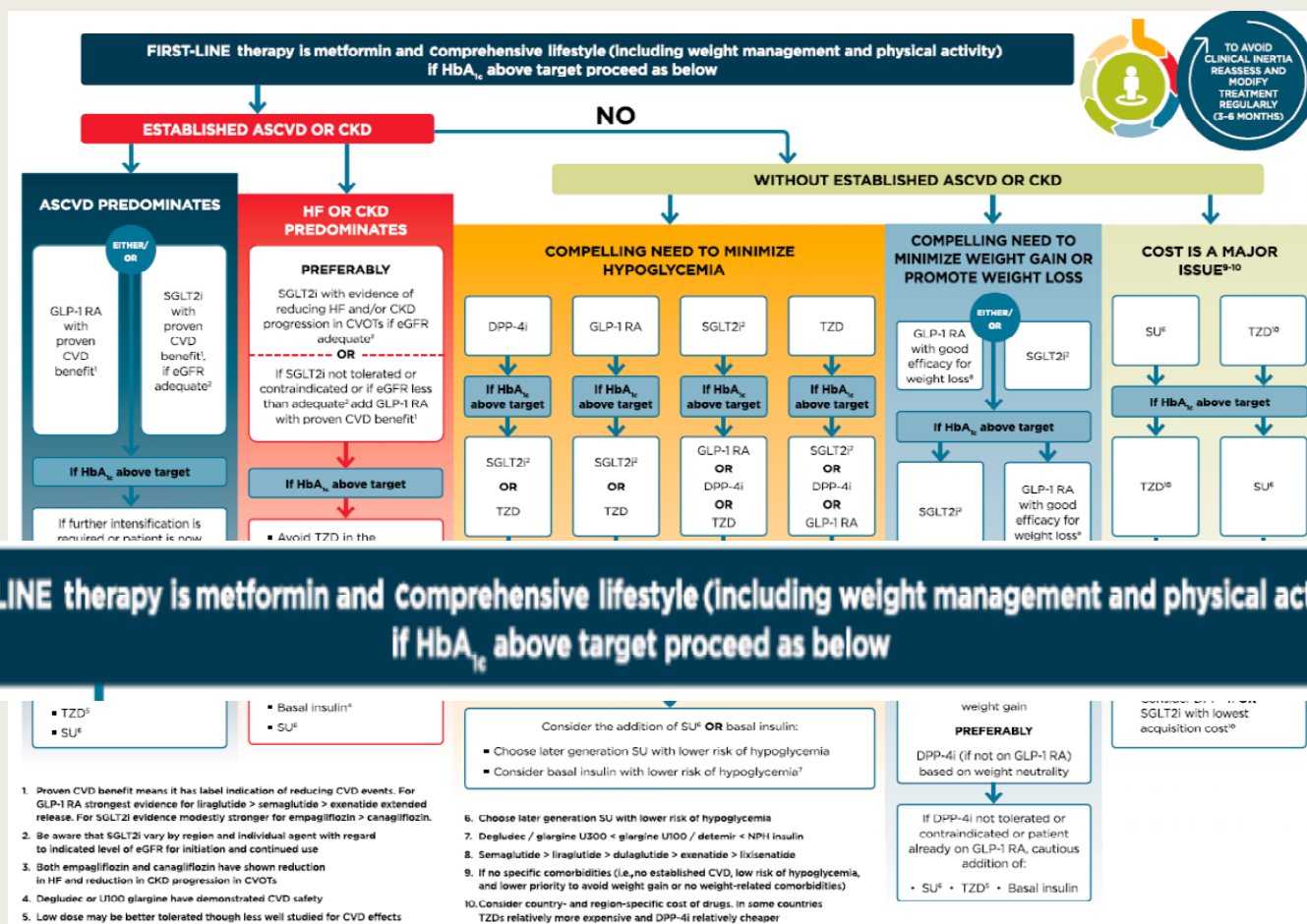


A1C, glycated hemoglobin; OAD, oral antidiabetic drug; T2D, type 2 diabetes.

1. Campbell IW. Br J Cardiol. 2000;7:625-631. 2. Del Prato S, et al. Int J Clin Pract. 2005;59:1345-1355.

3. <https://www.aace.com/disease-state-resources/diabetes/clinical-practice-guidelines-treatment-algorithms/comprehensive>





Pharmacologic Approaches to Glycemic Treatment:
Standards of Medical Care in Diabetes - 2019. Diabetes Care 2019;42(Suppl. 1):S90-S102

**FIRST-LINE therapy is metformin and comprehensive lifestyle (including weight management and physical activity)
if HbA_{1c} above target proceed as below**

Metformin

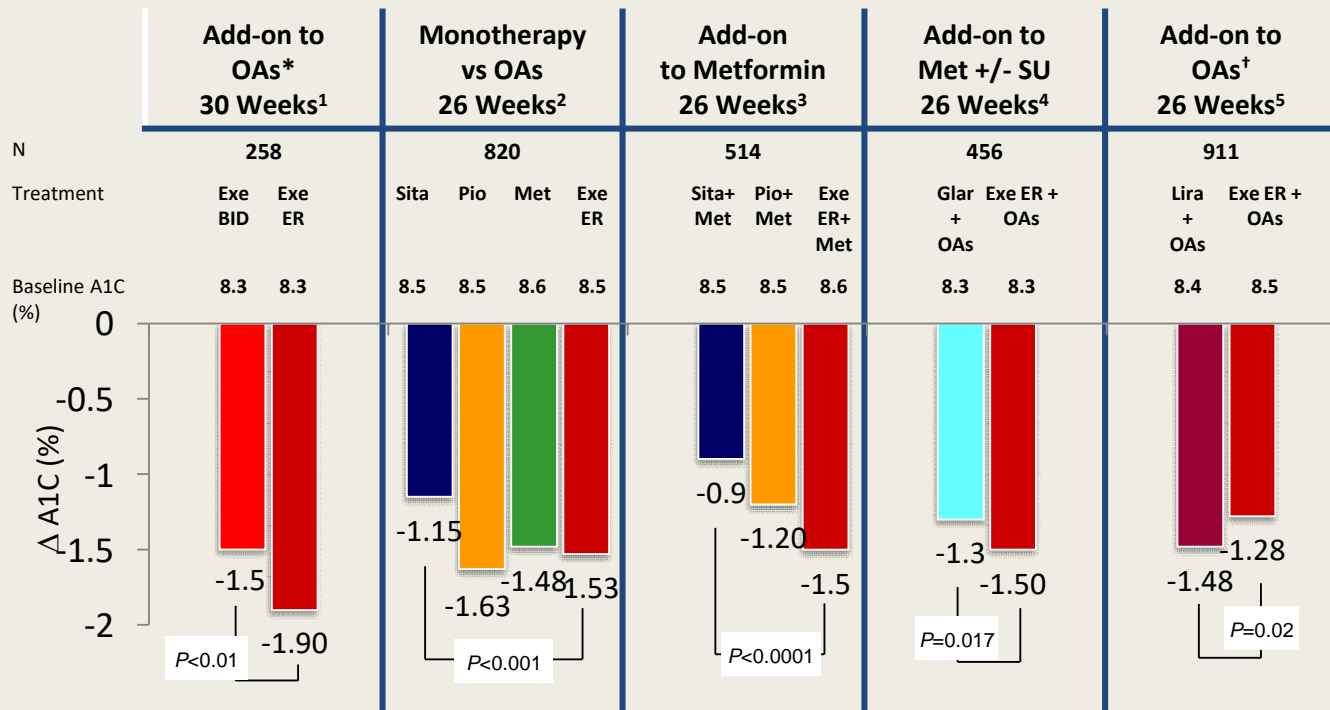
1. preferred 1st LINE medicine for type 2 diabetes
2. CONTINUED as long as it is tolerated and not contraindicated (eGFR>30)
3. other agents should be ADDED to metformin
4. long-term use may be associated with vitamin B12 deficiency, and periodic measurement of vitamin B12 levels should be considered in metformin-treated patients, especially in those with anemia or peripheral neuropathy
5. Consider Extended Release tablets to improve tolerance & adherence

Time for Combination Therapy for Type 2 Diabetes

Inadequate Glycemic control

1. INSULIN should be considered if: ongoing catabolism (weight loss), symptoms of hyperglycemia, or high A1C levels ($>10\%$ or $\geq 2\%$ above goal)
2. Consider initiating DUAL therapy in patients with newly diagnosed type 2 diabetes with A1C $\geq 1.5\%$ above their glycemic target
3. Consider Glycemic Lowering Efficacy of drugs relative to glycemic goal
4. A Patient-Centered Approach should be used to guide the choice of medicines. Considerations include comorbidities (atherosclerotic cardiovascular disease, heart failure, chronic kidney disease), hypoglycemia risk, impact on weight, cost, risk for side effects, and patient preferences

Combination Therapy: Glucose Control With GLP-1 RA (Exenatide ER)



* Metformin, sulfonylurea, thiazolidinedione, or combination of any 2 of these agents.

† Metformin, sulfonylurea, metformin + sulfonylurea, or metformin + pioglitazone.

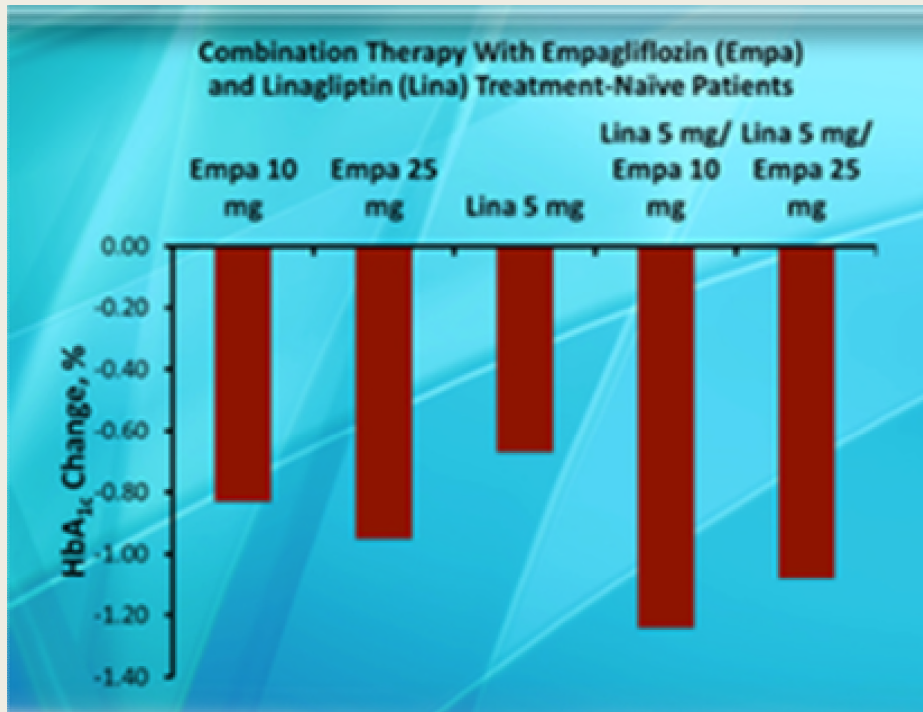
A1C, glycated hemoglobin; Exe, exenatide; ER, extended release; Glar, glargine; Lira, liraglutide; Met, metformin; OAs, oral agents; Pio, pioglitazone; Sita, sitagliptin; SU, sulfonylureas.

1. Drucker DJ, et al. *Lancet*. 2008;372:1240-1250. 2. Russell-Jones D, et al. *Diabetes Care*. 2012;35:252-258. 3. Bergenstal RM, et al. *Lancet*. 2010;376:431-439. 4. Diamant M, et al. *Lancet*. 2010;375:2234-2243.

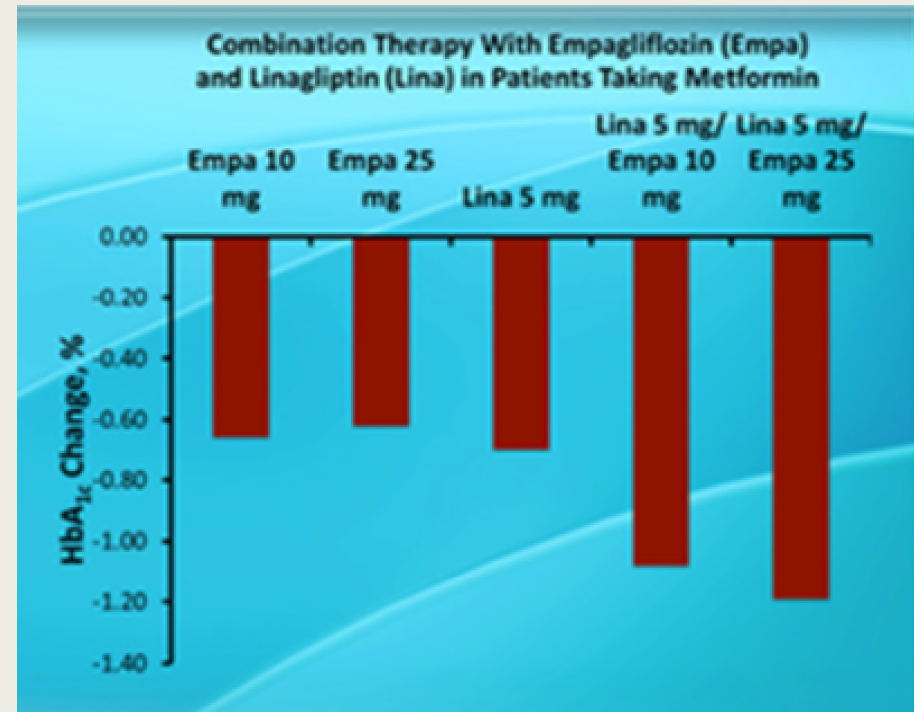
5. Buse JB, et al. *Lancet*. 2013;381:117-124.

Combination Therapy: Glucose Control With DPP-4i (Linagliptin) and SGLT2i (Empagliflozin) +/- Metformin

Empagliflozin +/- Linagliptin



Metformin & Empagliflozin +/- Linagliptin



Glycemic Efficacy of Second Therapy Added To Metformin

Combination	Reduction in A1C vs metformin monotherapy*	Weight change	Hypoglycemia risk RR (95% CI)
GLP-1 RA + metformin	-1.5%	-2.3 kg	0.2 (0.01 – 4.1)
SU/glinide + metformin	-0.68%	+2.6 kg	8.91 (1.46, 54.34)
SGLT2i + metformin	-0.47%	-2.0 kg	1.37 (0.64, 2.92)
TZD + metformin	-0.44%	+1.93 kg	1.60 (1.05, 2.46)
DPP4i + metformin	-0.44%	+0.38 kg	1.15 (0.84, 1.55)

Remember INSULIN has
unlimited glycemic reduction efficacy

*Weighted mean difference

CI, confidence interval; DPP4i, dipeptidyl peptidase-4 inhibitors; RR, relative risk; SGLT2i, sodium-glucose cotransporter 2 inhibitor; SU, sulfonylurea; TZD, thiazolidinediones.
Cai X, et al. *Diabetes Ther.* 2018;9:1995-2014.

Combination Therapy: Patients With High CV Risk

- Substantial historical evidence indicates that intensive, ongoing glucose control in newly diagnosed T2D patients may decrease long-term CVD rates¹
- In 2008, FDA guidance mandated CV safety assessment of all new antihyperglycemic agents²
 - RCT studies required to demonstrate that study drug was not associated with more major adverse CV events than placebo (noninferiority)
 - Some studies tested for superiority if noninferiority criteria were met
 - **Primary outcome:** Composite of CV death, nonfatal MI, and nonfatal stroke
 - Some studies included additional endpoints
- Several studies of SGLT-2 inhibitors and GLP-1 RA have shown superiority compared with placebo.

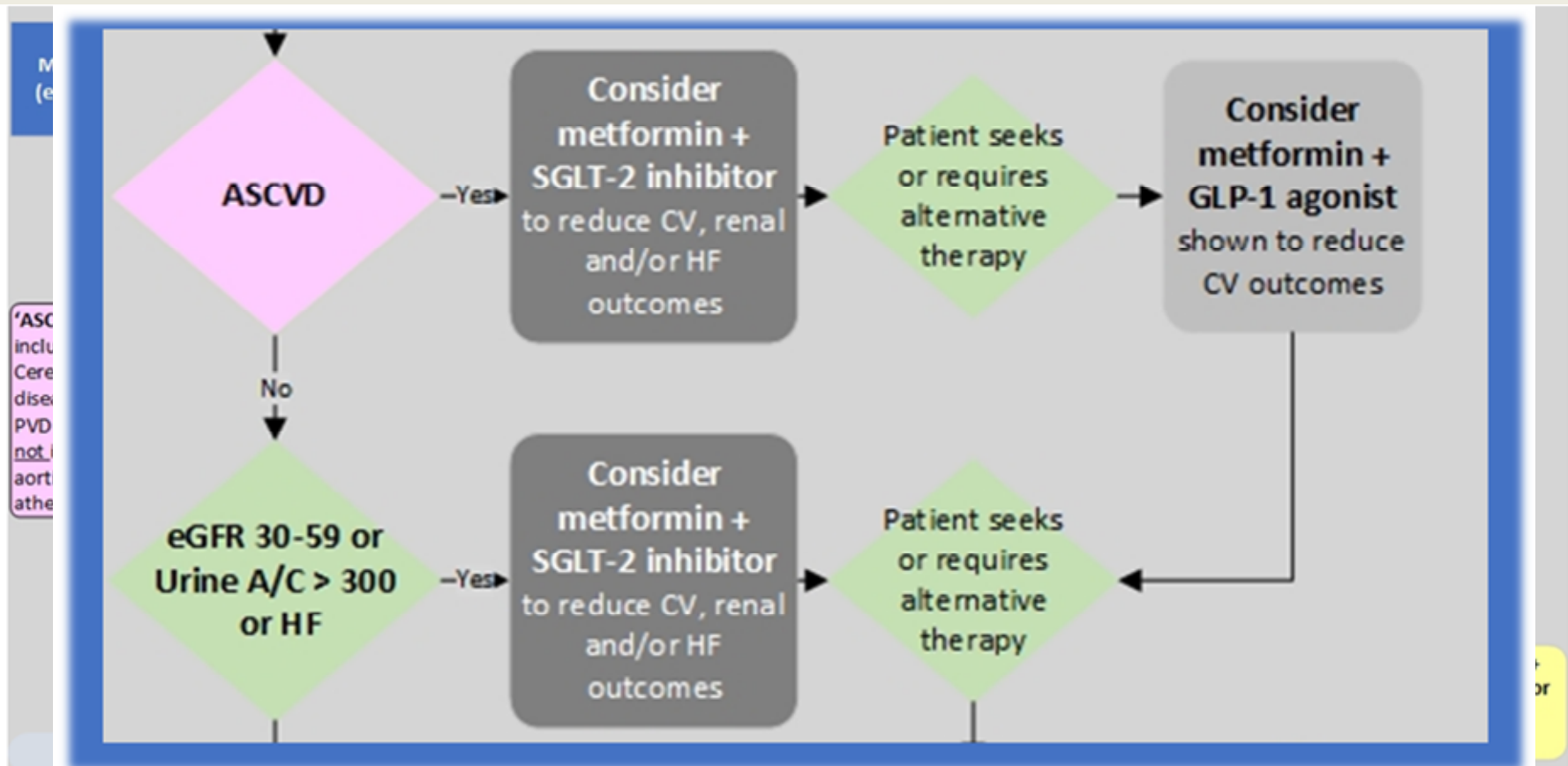
CV, cardiovascular; CVD, cardiovascular disease; FDA, US Food and Drug Administration; GLP-1 RA, glucagon-like peptide-1 receptor agonist; MI, myocardial infarction; RCT, randomized controlled trial; SGLT-2, sodium-glucose cotransporter 2; T2D, type 2 diabetes.

1. American Diabetes Association. *Diabetes Care*. 2019;42:S61-S70.

2. FDA. Guidance for industry: evaluating cardiovascular risk in new antidiabetic therapies to treat type 2 diabetes. <https://www.fda.gov/media/71297/download>.

Choice of Combination Therapy for Type 2 Diabetes

1. Established atherosclerotic cardiovascular disease (ASCVD): consider SGLT2i, or GLP-1 agonists with demonstrated cardiovascular disease benefit
2. Atherosclerotic cardiovascular disease at high risk of Heart Failure or coexisting CHF: SGLT2i are preferred.
3. Chronic kidney disease (CKD): SGLT2i or GLP-1 agonists shown to reduce risk of CKD progression, CV events, or both.
4. Fatty Liver Disease: Pioglitazone improves **Non Alcoholic SteatoHepatitis**



Note: Draft – SCPMG Diabetes Care Clinical Guidelines

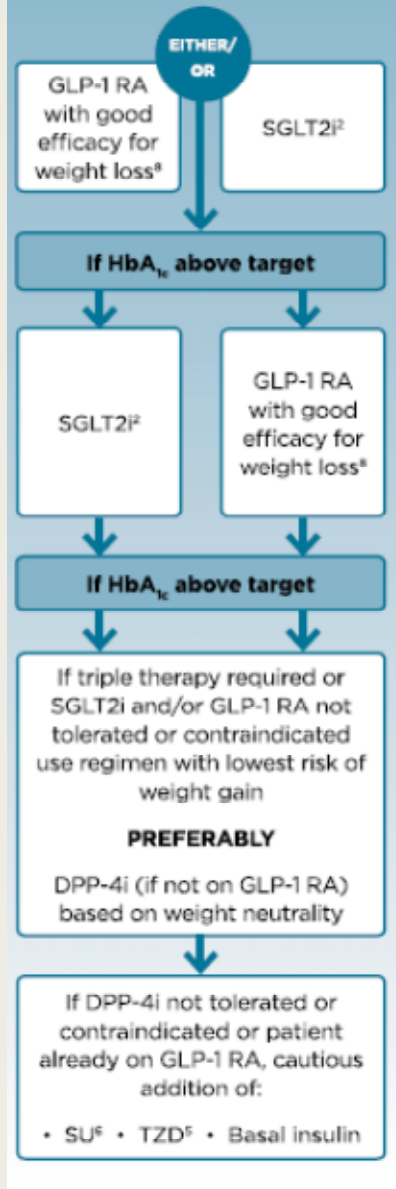
- **ASCVD Predominates:**

- Add SGLT-2 inhibitor with proven CVD benefit (if eGFR adequate), OR
- Add GLP-1 RA with proven CVD benefit

- **If HF or CKD Predominates:**

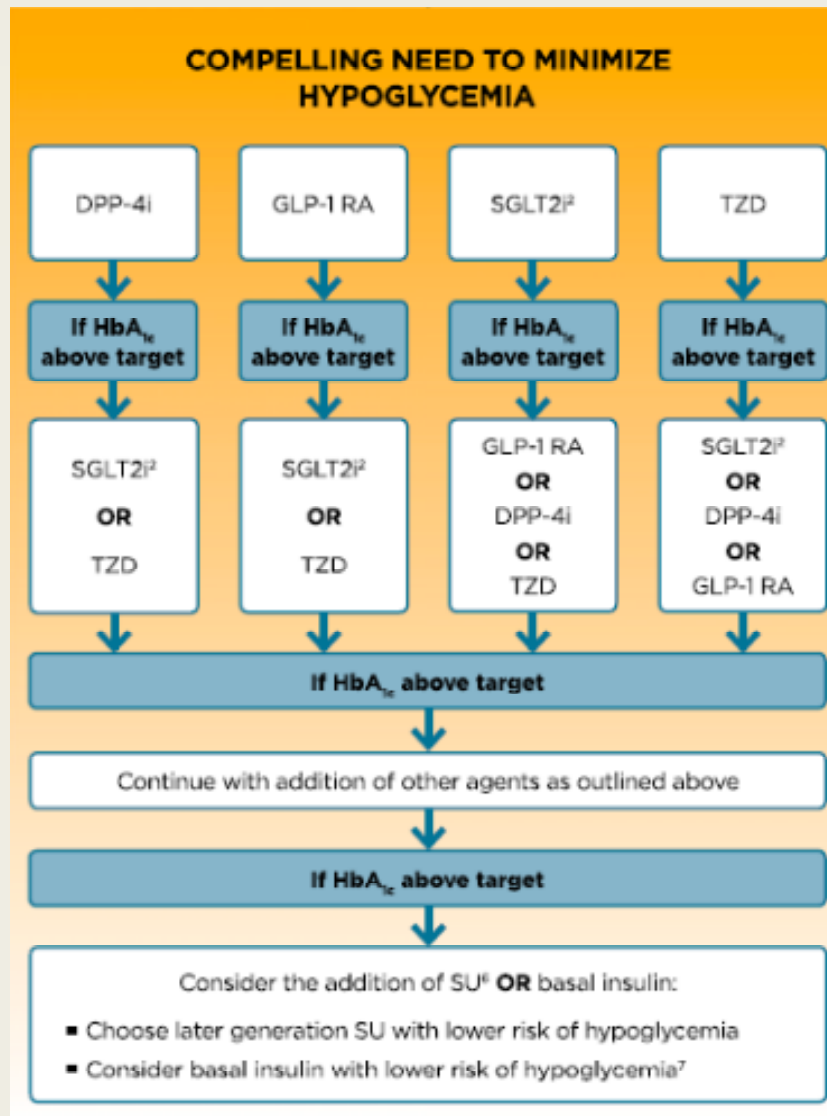
- Add SGLT-2 inhibitor with evidence of benefit
- If can't take an SGLT-2 inhibitor, use a GLP-1 RA with proven CVD benefit

**COMPELLING NEED TO
MINIMIZE WEIGHT GAIN OR
PROMOTE WEIGHT LOSS**



Weight effect of diabetes drugs

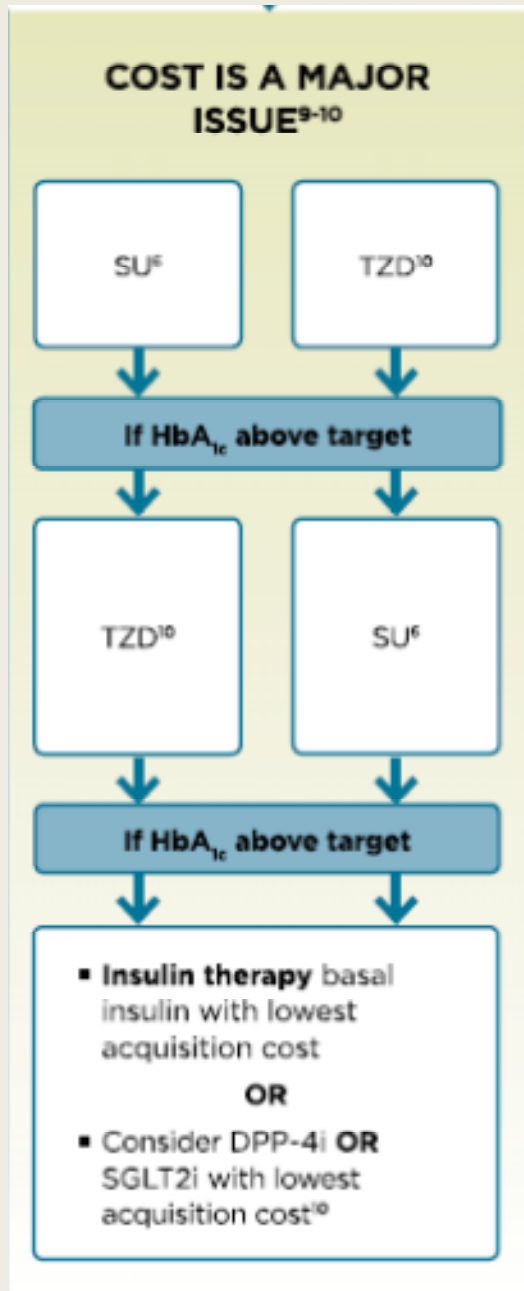
- Modest Weight loss
 - SGLT2i
 - GLP-1A
- Weight Neutral / Slight loss
 - Metformin
- Weight Neutral
 - DPP-4i
- Weight Gain
 - SU
 - TZD
 - Insulin
- Presence of Metformin may attenuate weight gain



Risk of Hypoglycemia

- Lower risk of hypoglycemia
 - DPP-4i
 - GLP-1RA
 - SGLT2i
 - TZD
- Highest risk of hypoglycemia
 - SU
 - Insulins
- Avoid use of extended release SU if CKD3+, elderly
- Choose long acting insulin analog if hypoglycemia with NPH

Cost of commonly used diabetes drugs



- Cheapest (generic available)
 - Metformin
 - SU
 - TZD
- More expensive
 - NPH / R insulins
- Most expensive
 - SGLT2i
 - DPP-4i
 - GLP-1 RA
 - Analog insulins (Glargine, Lispro)

When to take away diabetes medicines

- CKD4 / eGFR <30 – **Stop** Metformin, GLP-1 RA, TZD
- CKD3 / eGFR 30-44 – Metformin dose ↓ 50%
- CKD3 / eGFR <45 – **Stop** SGLT2i; DPP-4i ↓ dose (except Linagliptin)
- Pancreatitis / gastroparesis – **Stop** GLP-1 RA
- CHF – **Stop** TZD, DPP4i
- Macular edema / fracture – **Stop** TZD
- Genital infections / DKA / amputation / Fournier gangrene – **Stop** SGLT2i

Case #1

Meal type	Wake up	1-2 Hrs. after Breakfast	1-2 Hrs. after Lunch	1-2 Hrs after Dinner or Bed time
	8:00 A.M.	10:00 A.M.	1:00 P.M.	8:00-9:00 P.M.
normal	290	skipped	209	(106) */- concerned- (had extra carbs)
normal	201	"	240	169
normal	211	"	213	(89) */- concerned- (had extra carbs)
normal	297	216	187	111 → 77 */- concerned- (had extra carbs)
carb loaded	249	226	263	229
normal	224	skipped skipped	210	(110) */- concerned- (had extra carbs)
carb loaded	244	274	267	500 *

- 73 yo C Male
- T2DM, HTN, ASCVD w CAD sp PCI, hx of MI
- CKD3, eGFR 54-62
- On Metformin 1000mg BID, GPZ 20mg BID
- A1c 7.6%
- C/O evening hypoglycemia, high fasting BG
- What are the options?

Rx Options:

- Cause of Hypoglycemia – SU in presence of CKD3, DC evening dose
- High FBG – Consider add TZD or SGLT2i
- May add GLP-1 RA if target not reached or need to stop SU completely

Case #2

- 65 yo AA Female
- T2D for 22 yr, HTN, CKD3
- No DM complication
- Wt 160lb, BMI 28
- Intolerant of Metformin (GI) and TZD (edema)
- NPH: 10-0-0-50
- Lispro 6-5-6-0 + SS
- Exenatide: 10-0-10-0
- A1c 9%
- Admits to non-adherence esp. lunch Lispro & am NPH

Date	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bed Time
	12AM-6AM	6AM-9AM	9AM-11AM	11AM-2PM	2PM-5PM	5PM-7PM	7PM-10PM	10PM-12AM
03/09 /2015 MON	68*			418*				
03/09 /2015 MON				340*				
03/09 /2015 MON				287*				
03/08 /2015 SUN	233*		140				460*	114
03/08 /2015 SUN							204*	92
03/08 /2015 SUN							138	
03/07 /2015 SAT			188*					

Case #2 (con't)

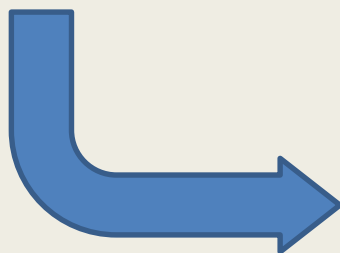
- Switch MDI insulin to VGO30
- VGO patch pump
 - Lispro 30U /Day basal
 - 4-6u or 2-3 clicks meal bolus TID
- Continued Exenatide BID
- A1c 7.4% after 3m
- Patient maintained A1c <8% on VGO30 only, she discontinued Exenatide for the following 2 years



Date	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bed Time
	12AM-6AM	6AM-9AM	9AM-11AM	11AM-2PM	2PM-5PM	5PM-7PM	7PM-10PM	10PM-12AM
04/12 /2015 SUN	82	117		117		92		
04/12 /2015 SUN		82						
04/11 /2015 SAT	78		104	128	116		104	
04/11 /2015 SAT	73							
04/10 /2015 FRI	119	102		74				109
04/10 /2015 FRI				92				
04/09 /2015 THU		101	126	65*				
04/09 /2015				87				

Case #2 (con't)

Date	12 AM - 6 AM			6 AM - 9 AM			9 AM - 11 AM			11 AM - 2 PM			2 PM - 5 PM			5 PM - 7 PM			7 PM - 10 PM			10 PM - 12 AM		
	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO
2/16/2017				119 7:32						252 12:06														
2/15/2017				140 8:47											305 17:13			263 21:03						
2/14/2017				61 7:05						300 13:53										208 22:09				
				83 7:19																				
2/13/2017	223 0:24			69 8:19																	306 23:14			
2/12/2017	252 1:27						210 9:06																	
2/11/2017	161 1:17						137 9:47																	
2/10/2017	186 0:54			99 7:50																				



- A1c 8.4% after 2 years on VGO30
- Patient Rx with Steroids for severe arthritis
- Added Actos 15mg QD
- A1c ↓ to 7.4% after 3m

	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening
Date	12MN-6A	6A-9A	9A-11A	11A-2P	2P-5P	5P-7P	7P-12MN
04/16	229 (1:40A)	73 (7:58A)					
04/15	152 (12:42A)		208 (9:16A)				138 (10:20P) 129 (10:20P)
04/14	167 (1:50A)	63 (8:42A)			235 (2:57P)		158 (9:22P)
04/13	319 (12:02A)	69 (8:51A)			107 (2:05P)		
04/12		63 (6:15A) 136 (6:55A)		114 (11:42A)	163 (3:41P)	159 (6:42P)	
04/11	87 (4:49A)	105 (8:19A)				132 (5:49P)	142 (9:10P) 195 (10:30P)
04/10		79 (7:16A)		209 (12:19P)	163 (2:31P)		153 (9:58P)

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Glycemic Control Issues in ▼ Advanced Kidney Disease

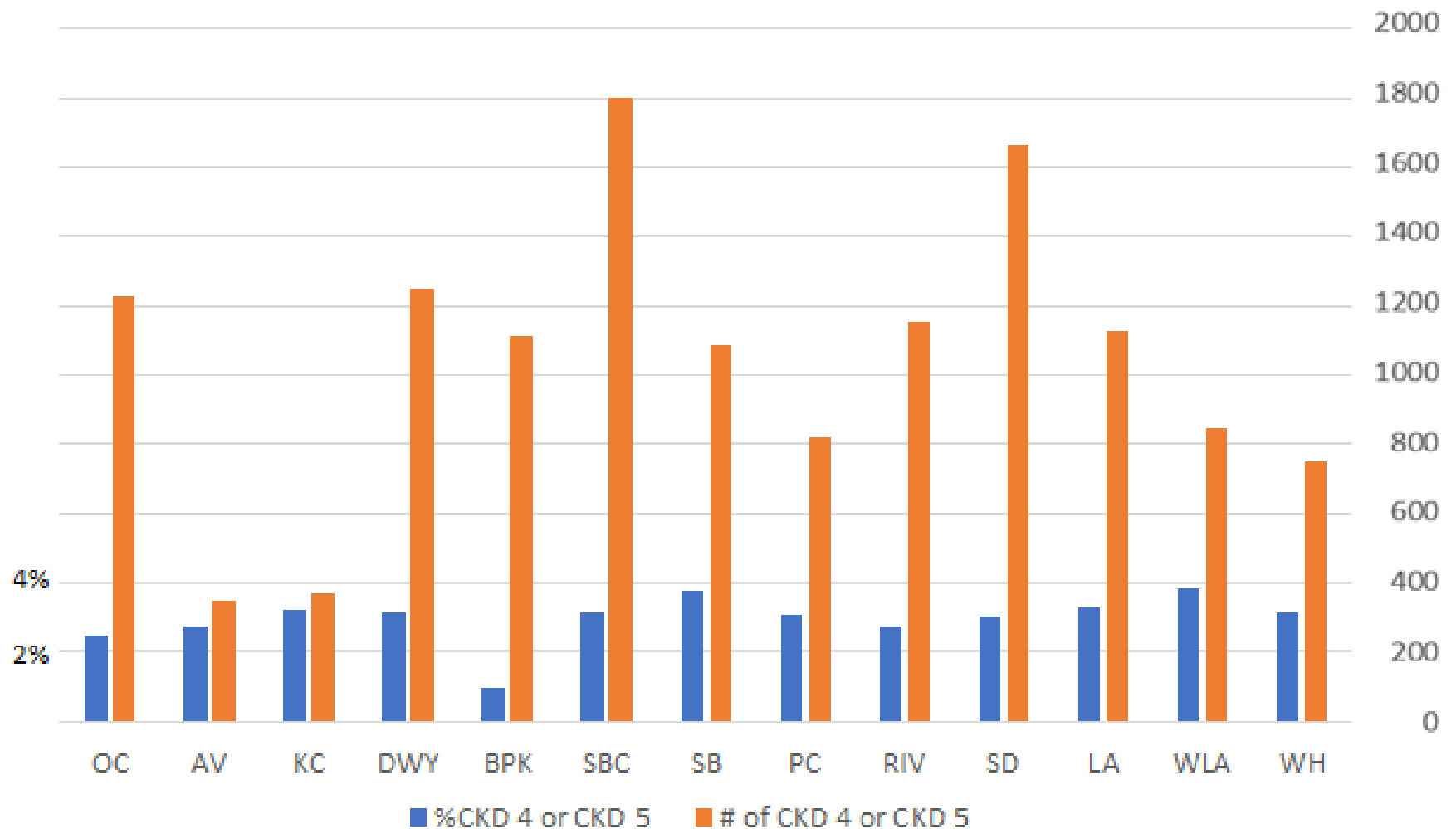
Advanced Kidney Disease (CKD4 & CKD5)

CKD Categorization by GFR & ACR (urine Albumin/Creatinine Ratio = microalbumin/creatinine)

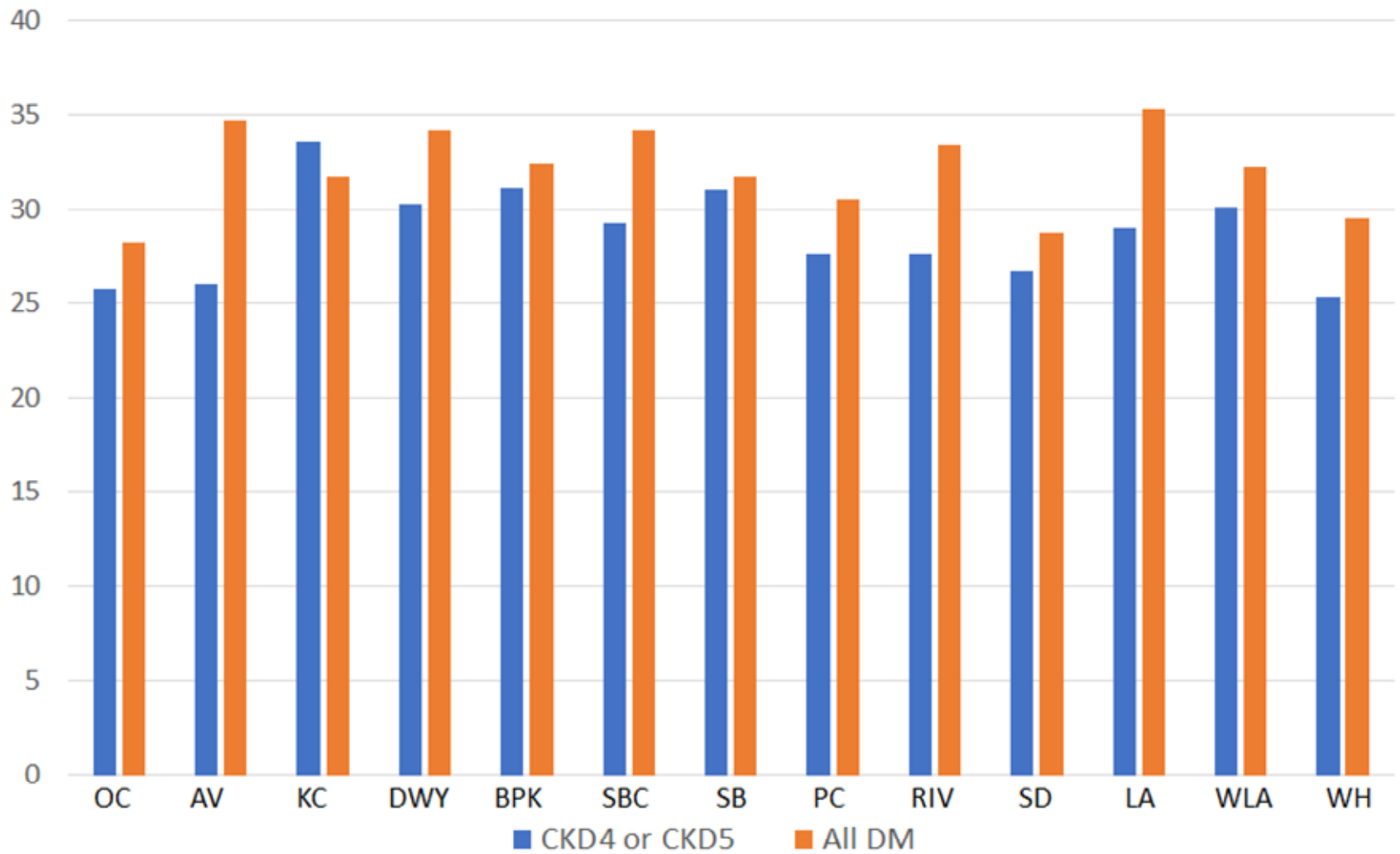
GFR >3 months =====	ACR <30(A1) =====	ACR 30-<300(A2) =====	ACR 300+(A3) =====
>=90		CKD1 A2 or *	CKD1 A3
60-<90		CKD2 A2 or *	CKD2 A3
30-<59	CKD3 A1 or *	CKD3 A2	CKD3 A3
15-<30	CKD4 A1	CKD4 A2	CKD4 A3
<15	CKD5 A1	CKD5 A2	CKD5 A3

*may label 'abnormal kidney function' or 'proteinuria' as appropriate

CKD 4 or CKD 5 patients in each Med Center



% of patients with HbA1c \geq 8



Effect of CKD on insulin action

- Reduced insulin clearance
 - Begins to occur when $GFR < 40$, significant change at GFR 15-20
 - Impaired degradation of insulin in non-renal tissues (liver, muscle) also occurs in uremic states
 - Hemodialysis can normalize insulin half-life
- Increased insulin resistance

Metabolic and nutritional changes in ESRD

- Reduced activity and physical fitness contribute to higher glucose levels
- Reduced appetite/food intake, delayed gastric emptying can make patients more prone to hypoglycemia.

Effect of dialysis on glucose levels

- Dialyzing off uremic toxins tends to improve insulin sensitivity in non-diabetic patients
- Peritoneal dialysis fluid commonly contains dextrose which is partially absorbed into the vasculature (insulin can be added to the dialysate mixture)

Limitations of DM meds in CKD-4 and CKD-5

- **Can be used**

- Insulin
- Glipizide (metabolized hepatically)
- Glimepiride (reduce dose, use with caution)
- Linagliptin (not other DPP4 inhibitors)
- Thiazolidendiones (watch fluid retention)
- Acarbose (limited data, reduce dose, use with caution)
- Liraglutide (limited data in ESRD)

- **Should not be used**

- Metformin
- Exenatide
- SGLT2 inhibitors

Case #3: Patient with progressing CKD

- 80 year old man with worsening CKD over the past year
- Metformin discontinued in Jan 2019
- March 2019 regimen: Glipizide 20 mg q AM, 10 mg q PM; ACTOS 45 mg daily, 70/30 insulin 22 units q AM

Component	CREAT	GFR	RACE
Latest Ref R	<=1.30 mg/dL	mL/min/BSA	
6/25/2018	1.66 (H)	39	Non Black
8/18/2018	1.76 (H)	36	Non Black
11/24/2018	1.53 (H)	42	Non Black
1/25/2019	2.09 (H)	29	Non Black
2/18/2019	2.20 (H)	27	Non Black
3/22/2019	2.24 (H)	27	Non Black
4/26/2019	2.66 (H)	22	Non Black
7/6/2019	5.37 (H)	9	Non Black
7/7/2019	5.09 (H)	10	Non Black
7/11/2019	5.06 (H)	10	Non Black
7/18/2019	5.40 (H)	9	Non Black
7/22/2019	6.43 (H)	7	Non Black
7/24/2019	8.13 (H)	6	Non Black
7/30/2019	7.11 (H)	7	Non Black
7/31/2019	4.16 (H)	13	Non Black

Case #3: Patient with progressing CKD

- In the weeks prior to starting hemodialysis, he was having more frequent episodes of hypoglycemia

Date ▼	Overnight 12 AM - 6 AM	Early Morning 6 AM - 9 AM	Late Morning 9 AM - 11 AM	Early Afternoon 11 AM - 2 PM	Late Afternoon 2 PM - 5 PM	Early Evening 5 PM - 7 PM	Late Evening 7 PM - 10 PM	Bedtime 10 PM - 12 AM
7/19/2019 Friday		93 6:49 AM		63 1:54 PM		119 6:58 PM		
7/18/2019 Thursday		142 8:31 AM			81 2:49 PM		267 7:54 PM	
7/17/2019 Wednesday		102 8:10 AM		111 12:35 PM				
7/16/2019 Tuesday		106 8:19 AM				120 5:29 PM		
7/15/2019 Monday		94 8:55 AM		164 1:15 PM				
7/14/2019 Sunday		110 8:23 AM		205 1:44 PM		163 6:01 PM		
7/13/2019 Saturday		92 7:57 AM		142 1:51 PM				
7/12/2019 Friday		116 8:50 AM				47 5:34 PM		
7/11/2019 Thursday			89 9:15 AM	132 12:36 PM			112 7:04 PM	

○ Pre-meal ● Post-meal ▼/▲ BG Alert Above/Below Target Hypoglycemic

Case #3: Patient with progressing CKD

- Insulin was reduced to 20 units of 70/30 q AM, and glipizide reduced to 5 mg q AM
- Hemodialysis started on July 29

Date	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bedtime
	12 AM - 6 AM	6 AM - 9 AM	9 AM - 11 AM	11 AM - 2 PM	2 PM - 5 PM	5 PM - 7 PM	7 PM - 10 PM	10 PM - 12 AM
8/7/2019 Wednesday		○ 125 7:30 AM				136 5:02 PM		
8/6/2019 Tuesday		142 7:48 AM					○ 282 8:14 PM	
8/5/2019 Monday		○ 112 7:45 AM					○ 207 9:20 PM	
8/4/2019 Sunday			○ 105 9:35 AM			○ 246 6:51 PM		
8/3/2019 Saturday		○ 131 8:12 AM					○ 114 8:30 PM	
8/2/2019 Friday		▲ 134 7:29 AM						
8/1/2019 Thursday		○ 174 8:12 AM						
7/31/2019 Wednesday		○ 168 7:44 AM						
7/30/2019 Tuesday			165 9:02 AM					

○ Pre-meal

● Post-meal

▼/▲ BG Alert

Above/Below Target

Hypoglycemic

Case #4: Patient on Peritoneal Dialysis

- 61 year old woman with DM type 2.
- Progressed to CKD4 in July 2018. Metformin stopped, remained on glimepiride 4 mg BID. AM NPH dose added and bedtime NPH dose increased
- Lost to follow-up from Sept 2018 to Feb 2019
- February 2019 Peritoneal Dialysis started with fluid exchanges starting 8 PM and ending 5 AM

3/14 ac - 323 934 am

3/13 ac - 172 721 pm

3/13 ac 318 757 am

3/12 ac 307 430 pm

Case #4: Patient on Peritoneal Dialysis

- Additional BG testing showed high bedtime BG, so Reg insulin was added at dinner to the NPH insulin q AM and bedtime, Glimepiride.

Date	12MN-6A	6A-9A	9A-11A	11A-2P	2P-5P	5P-7P	7P-12MN	
06/02		343 (8:05A)		290 (1:54P)				BEFORE MEAL (8:05A)
05/31		295 (7:51A)					328 (10:15P)	
05/30		279 (8:13A)				157 (6:53P)		BEFORE MEAL (8:13A) AFTER MEAL, 22 u nph in am (6:53P)
05/29			228 (9:51A)				292 (8:05P)	BEFORE MEAL (9:51A)
05/28			278 (9:33A)				257 (10:40P)	BEFORE MEAL (9:33A)
05/27			260 (10:06A)				249 (10:30P)	BEFORE MEAL (10:06A)
05/26			241 (9:38A)				278 (8:43P)	BEFORE MEAL (9:38A) AFTER MEAL (8:43P)

Case #4: Patient on Peritoneal Dialysis

- Diet improvements and further insulin titration have improved her BG control over a few months (up to 44 units NPH at bedtime)
- Some days she uses two bags of dialysate that have 2.5% dextrose (instead of 1 bag of 1.5 % and 1 bag of 2.5%) when she has more fluid retention

Date	12MN-6A	6A-9A	9A-11A	11A-2P	2P-5P	5P-7P	7P-12MN	
09/12		151 (8:40A)		114 (1:33P)		75 (5:26P)	79 (9:41P)	BEFORE MEAL (8:40A) BEFORE MEAL, 2 cheese sticks, 1/4 c cashews, veggie tray with dip, 5 olives (1:33P) BEFORE MEAL, Sb entree (5:26P) 38 u nph (9:41P)
09/11			171 (9:29A)		99 (4:03P) 69 (4:51P)		154 (8:03P)	BEFORE MEAL, No reg insulin. 3 hardshell turkey tacos and broccoli (4:51P) 44u nph @2100 (8:03P)
09/10		204 (7:19A)				178 (5:30P)	91 (10:23P)	BEFORE MEAL, 20 reg (5:30P) 38 nph (10:23P)
09/09		148 (8:40A)		205 (12:41P)	174 (2:12P)		148 (8:03P)	BEFORE MEAL, Had sb omelet and pancake with sugarfree syrup (8:40A) BEFORE MEAL (12:41P)

Post-Transplant issues for DM

Table 1
Effects of immunosuppressive drugs on glucose

Drug	Effect on glucose
Glucocorticoids	↑↑↑
Calcineurin inhibitors:	
Cyclosporine	↔ or ↑
Tacrolimus (FK506)	↑↑
Azathioprine	↔
mTOR inhibitors:	
Sirolimus	↔ or ↑
Everolimus	? ↔
Mycophenolate mofetil	↔

Abbreviations: ↑, increased; ↓, decreased; ↔, unchanged.

Restored options after Renal Txp?

- Limited data available
- Both metformin and SGLT-2 inhibitors appear to be safe and effective for use after renal transplant
- Be vigilant regarding infection side effects when using SGLT-2i for immunocompromised patients

The background of the slide features a series of concentric circles in a light blue-grey color. A dashed line of the same color forms a circular path around the text. The overall color palette is muted, with a light beige background and blue-grey accents.

Hypoglycemia

▼ Concerns

Hypoglycemia concerns

- A significant problem that affects our patients and our ability to care for them
 - 1 in 4 emergency hospitalizations for adverse drug events is related to hypoglycemia.
 - Severe hypoglycemia is associated with falls, auto accidents, cardiovascular autonomic dysfunction and ventricular arrhythmia, dementia, and death
 - Patients report fear of hypoglycemia can dissuade them from starting new insulin therapy.
 - Hypoglycemia is a strongly predictive of poorer health-related quality of life and more diabetes distress.

Hypoglycemia concerns

- **Recognition of signs/symptoms**
 - Education is important
 - Early symptoms
 - Hunger
 - Dizziness
 - Anxiety
 - Headache
 - Sweating
 - Irritability/moodiness

Hypoglycemia concerns

– Severe symptoms

- Drowsiness
- Confusion
- Muscle weakness
- Clumsiness
- Difficulty speaking or slurred speech
- Vision changes
- Seizures
- Unconsciousness
- Death

Hypoglycemia concerns

– Nocturnal hypoglycemia symptoms

- Damp sheets or bedclothes due to perspiration
- Nightmares
- Tiredness, irritability, confusion, or headache upon waking

Hypoglycemia classification

Level	Glycemic criteria/description
Level 1	Glucose <70 mg/dL (3.9 mmol/L) and glucose ≥ 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

ADA Recommendations regarding hypoglycemia

- Individuals at risk for hypoglycemia should be asked about symptomatic and asymptomatic hypoglycemia at each encounter
- Glucagon should be prescribed for all individuals at increased risk of level 2 hypoglycemia, defined as blood glucose <54 mg/dL, so it is available should it be needed. Caregivers, school personnel, or family members of these individuals should know where it is and when and how to administer it. Glucagon administration is not limited to health care professionals. [Intranasal formulation now available]

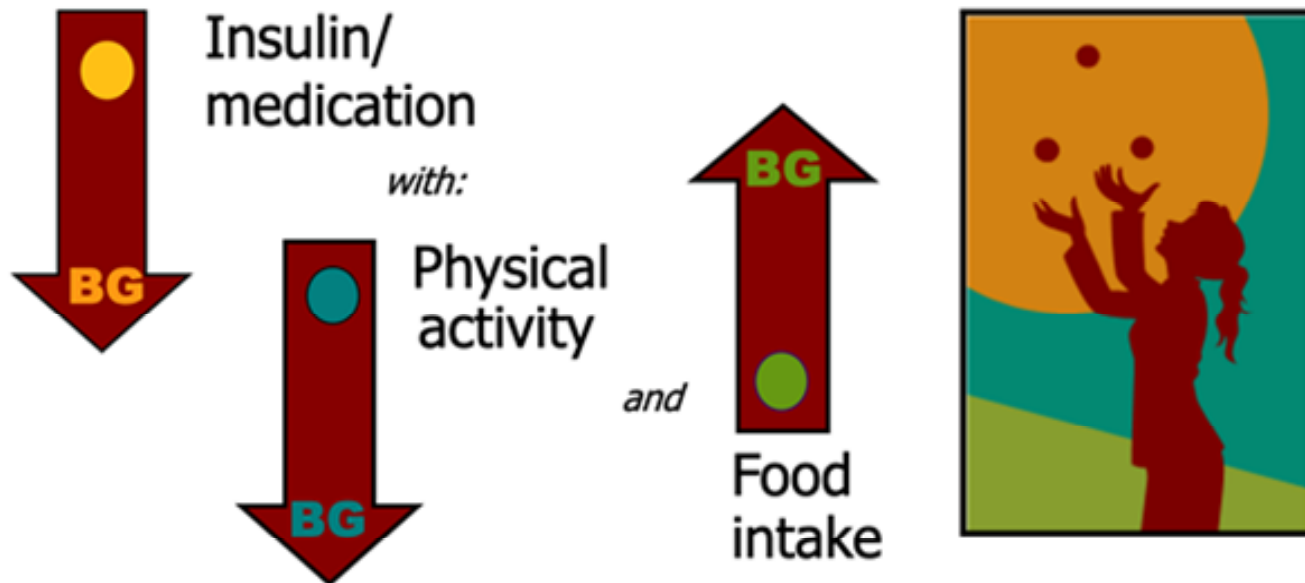
ADA Recommendations regarding hypoglycemia

- Hypoglycemia unawareness or one or more episodes of level 3 hypoglycemia should trigger reevaluation of the treatment regimen
- Insulin-treated patients with hypoglycemia unawareness or an episode of level 2 hypoglycemia should be advised to raise their glycemic targets to strictly avoid hypoglycemia for at least several weeks in order to partially reverse hypoglycemia unawareness and reduce risk of future episodes

How to Treat Low Blood Sugar (Hypoglycemia)

1.  **Eat/Drink 15 g Carbs**
2.  **Wait 15 Minutes**
3.  **Check Blood**
4.  **Less than 70 mg/dl?
Repeat Steps 1-4**

Diabetes Management Constant Juggling - 24/7



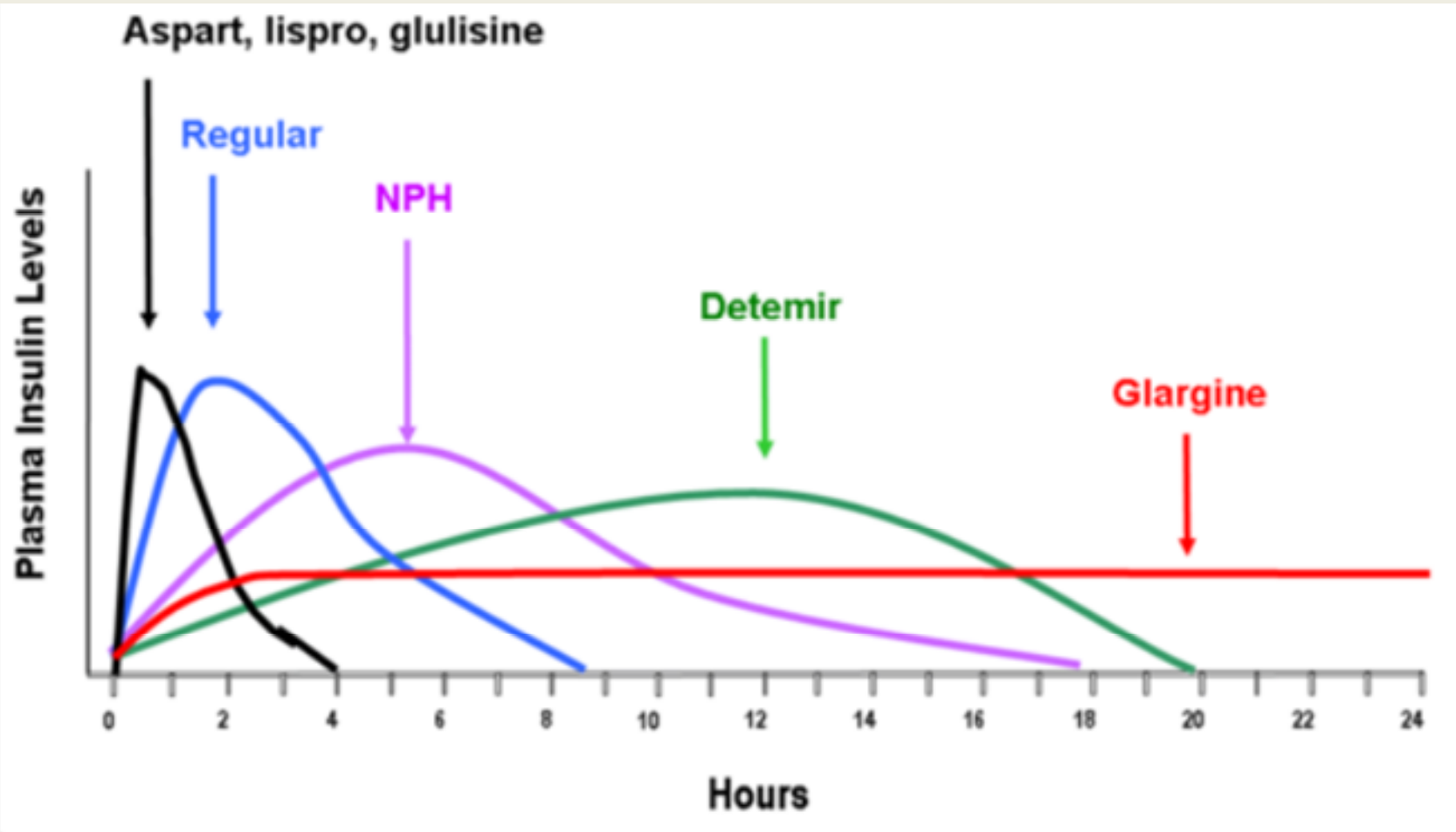
Managing the balance of food, activity, medications

- Food
 - Avoid missing meals
 - Eat relatively consistent amounts
 - Alcohol should be consumed with food
 - Gastroparesis may alter meal absorption
- Activity
 - May lead to hypoglycemia when taking insulin or SU
 - Add snack if BG<90 pre-exercise
 - Resistance exercise may mitigate glucose-lowering effect of aerobic exercise
 - Hypoglycemia may occur up to several hours after exercise
- Medication
 - Dosing and timing of insulin and SU meds should be taken to match meal intake
 - Adjust therapy based on the time of action of meds

Action of Formulary Sulfonylureas

- Glipizide standard: 2-4 hour duration of action
- Glipizide extended release: Max concentration 6-12 hours after dosing. With continued use, drug levels maintained throughout 24-hour period
- Glimepiride: 5-8 hour duration of action

Action of Insulin Preparations



Proposed BPA for high-risk hypoglycemia when insulin or sulfonylurea ordered

Disease Management Reminder (1)

DISEASE MANAGEMENT

Patient has Type 2 Diabetes and meets one of the following criteria for high risk of significant hypoglycemia:

- 1-2 previous emergency visits or hospital admissions with primary diagnosis of hypoglycemia in the past 2 years and taking insulin
- ≥ 3 previous emergency visits or hospital admissions with primary diagnosis of hypoglycemia in the past 2 years

Appropriate steps to reduce hypoglycemia risk may include a change in medication dose, a change in medication type, review of adherence to medication directions and lifestyle measures, and additional patient education.

ACTION:


- Click "Accept" to remove order or
- Click "Dismiss" to retain or modify order as clinically indicated

Last HGA1C: Not on file

Remove the following orders?

Remove

Keep

 **Insulin Glargine (LANTUS) 100 unit/mL SubQ Soln**
INJECT *** UNITS SUBCUTANEOUSLY *** AS DIRECTED TO CONTROL BLOOD SUGAR,
Disp-30, R-3, Subcutaneous, starting 2/28/2019 until 2/27/2023, Fill Later • Long-term

✓ Accept

Dismiss

Medication can still be ordered

Primarily a reminder to consider potential other medications or education to reduce risk of hypoglycemia.

Proposed BPA for high-risk hypoglycemia when insulin or sulfonylurea ordered

Disease Management Reminder (1)

DISEASE MANAGEMENT

Patient has Type 2 Diabetes and meets one of the following criteria for high risk of significant hypoglycemia:

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- ≥ 3 previous emergency visits or hospital admissions with primary diagnosis of hypoglycemia in the past 2 years


Appropriate steps to reduce hypoglycemia risk may include a change in medication dose, a change in medication type, review of adherence to medication directions and lifestyle measures, and additional patient education.

ACTION:

- Click "Accept" to remove order or
- Click "Dismiss" to retain or modify order as clinically indicated

Last HGA1C: Not on file

Remove the following orders?

	Remove	Keep
<p> glipiZIDE (GLUCOTROL) 5 mg Oral Tab 0.5 TAB PO BID BEFORE MEALS. CHECK FBS BEFORE BREAKFAST DAILY. IF FBS ABOVE 120 AFTER 14 DAYS, INCREASE TO 1 TAB BID. IF FBS STILL ABOVE 120 AFTER ANOTHER 14 DAYS, INCREASE TO 2 TABS BID. CALL MD IF FBS FALLS BELOW 80 OR STAYS ABOVE 120, Disp-100, R-3, Oral, starting 3/4/2019 until 3/3/2023, Fill Later • Long-term</p>		

☒ **Accept** ☐ **Dismiss**

Medication can still be ordered

Primarily a reminder to consider potential other medications or education to reduce risk of hypoglycemia.

Case # 5: Nocturnal hypoglycemia

- 49 year old woman with DM type 1:
- Regimen of Lantus insulin 40 units q AM and bedtime, mealtime Humalog insulin 26-28 units each meal
- HbA1c 8.6% in February 2018

Case # 5: Nocturnal hypoglycemia

- Patient advised to test some routine 3AM BG levels after finding of lower early AM BG associated with night sweats.

Date	12MN-6A	6A-9A	9A-11A	11A-2P	2P-5P	5P-7P	7P-12MN	
04/03	207 (5:40A)							
04/02	79 (4:55A)			201 (11:48A)			102 (7:24P) 142 (10:01P)	
04/01			192 (10:36A)				128 (7:09P) 216 (9:45P)	
03/31			297 (9:45A)					
03/30			200 (9:07A)				236 (7:16P) 159 (11:46P)	

Case # 5: Nocturnal hypoglycemia

- Some additional episodes noted, so she is advised to reduce Lantus dose to 38 units BID

	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Comments
Date	12MN-6A	6A-9A	9A-11A	11A-2P	2P-5P	5P-7P	7P-12MN	
04/09	219 (5:38A)			272 (12:04P)				
04/08	175 (3:32A)		129 (9:41A)			248 (6:42P)	272 (8:43P)	
04/07	84 (2:15A) 198 (3:32A)		361 (9:06A)				175 (8:58P) 158 (10:31P)	
04/06	154 (5:49A)			286 (12:28P)			159 (9:59P)	

Case # 5: Nocturnal hypoglycemia

- She forgets to reduce her dosage, so there are still some problems with nocturnal hypoglycemia and high rebound morning BG levels

05/1 2		220 (8:28A)		78 (1:33P)			121 (7:54P) 188 (11:51P)	
05/1 1	252 (5:46A)			249 (12:20P)	77 (3:07P)		334 (9:03P) 340 (10:10P)	
05/1 0	339 (5:37A)			171 (11:55A)			223 (7:10P) 238 (8:55P)	
05/0 9	56 (3:07A)							
05/0 8	259 (5:42A)			263 (12:08P)			88 (7:03P) 144 (8:46P)	

Case # 5: Nocturnal hypoglycemia

- In 2019 pt is more aware of nocturnal hypoglycemia issues, still has HbA1c 8.9% due to poor diet issues, but she is safer regarding hypoglycemia

Date	12MN-6A	6A-9A	9A-11A	11A-2P	2P-5P	5P-7P	7P-12MN	
05/20		92 (8:47A)						
05/19			247 (9:32A)				290 (8:07P)	
05/18			198 (9:15A)		223 (3:05P)			
05/17			149 (9:18A)		135 (2:31P)		179 (7:56P) 213 (11:06P)	
05/16	227 (12:03A)	150 (6:34A)		158 (12:31P)		168 (6:49P)		
05/15			310 (9:08A)	267 (12:35P)			261 (7:26P)	
05/14			139 (9:17A)			238 (6:15P)		

Case # 6: Adjusting insulin vs sulfonylurea

- 71 year old woman with DM type 2 on metformin 500 mg TID, glipizide 20 mg BID, 70/30 insulin 7 units q AM and NPH 10 units q PM

Date ▼	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bedtime
	12 AM - 6 AM	6 AM - 9 AM	9 AM - 11 AM	11 AM - 2 PM	2 PM - 5 PM	5 PM - 7 PM	7 PM - 10 PM	10 PM - 12 AM
7/17/2019 Wednesday	65 12:43 AM			128 11:33 AM				
	117 3:22 AM			122 1:53 PM				
7/16/2019 Tuesday	90 1:12 AM			128 11:51 AM	61 4:29 PM	70 5:02 PM	95 8:19 PM	74 10:29 PM
	71 2:56 AM			134 1:46 PM		70 5:26 PM		
	93 3:45 AM							
7/15/2019 Monday	54 1:34 AM	135 7:28 AM	123 9:59 AM	51 12:56 PM	129 2:55 PM		98 8:29 PM	
	129 2:27 AM			72 1:20 PM				
7/14/2019 Sunday	64 2:27 AM	129 8:37 AM		136 11:13 AM	112 4:29 PM	103 5:21 PM	87 8:03 PM	
	130 3:22 AM			116 12:42 PM				



Pre-meal



Post-meal



BG Alert

Above/Below Target

Hypoglycemic

Case # 6: Adjusting insulin vs sulfonylurea

- Insulin doses reduced to 4 units 70/30 in AM and 5 units NPH at night. Pt was still having evening hypoglycemia.
- PM Glipizide reduced to 10 mg instead of 20 mg.

Date	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bedtime
	12 AM - 6 AM	6 AM - 9 AM	9 AM - 11 AM	11 AM - 2 PM	2 PM - 5 PM	5 PM - 7 PM	7 PM - 10 PM	10 PM - 12 AM
8/28/2019 Wednesday	51 1:06 AM	109 6:29 AM	152 10:10 AM	159 12:26 PM		104 5:45 PM	130 7:01 PM	104 10:45 PM
	119 2:08 AM	124 7:16 AM		130 1:35 PM			61 8:52 PM	
8/27/2019 Tuesday	95 12:05 AM		137 9:27 AM	81 12:22 PM	154 4:45 PM	131 5:34 PM	62 8:40 PM	
	97 12:48 AM					86 6:50 PM	98 9:43 PM	
	111 1:25 AM							
	114 4:53 AM							
8/26/2019 Monday	122 12:23 AM	125 6:42 AM		131 12:46 PM	212 3:28 PM		59 7:08 PM	
	111 1:57 AM						181 8:06 PM	
	98 5:54 AM							

○ Pre-meal
● Post-meal
▼/▲ BG Alert
Above/Below Target
Hypoglycemic

Case # 6: Adjusting insulin vs sulfonylurea

- Continued early evening and late night low glucose readings
- Dinner glipizide dose discontinued

Date	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bedtime
	12 AM - 6 AM	6 AM - 9 AM	9 AM - 11 AM	11 AM - 2 PM	2 PM - 5 PM	5 PM - 7 PM	7 PM - 10 PM	10 PM - 12 AM
9/19/2019 Thursday			165 10:18 AM					
9/18/2019 Wednesday	79 3:01 AM	151 7:39 AM		135 11:24 AM	255 2:17 PM	56 5:29 PM	158 7:11 PM	
	132 5:23 AM				93 4:17 PM		175 8:45 PM	
							146 9:40 PM	
9/17/2019 Tuesday	141 4:23 AM			147 11:11 AM	84 2:15 PM	89 5:04 PM	142 8:09 PM	
						159 6:41 PM	83 9:53 PM	
9/16/2019 Monday	60 12:07 AM	152 7:51 AM		98 1:12 PM	164 4:55 PM	135 6:03 PM	69 8:31 PM	
	130 1:22 AM							
	134 3:03 AM							

○ Pre-meal

● Post-meal

▼/▲ BG Alert

Above/Below Target

Hypoglycemic

Case # 6: Adjusting insulin vs sulfonylurea

- Overnight glucose levels in safer range after dinner glipizide discontinued

Date ▼	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bedtime
	12 AM - 6 AM	6 AM - 9 AM	9 AM - 11 AM	11 AM - 2 PM	2 PM - 5 PM	5 PM - 7 PM	7 PM - 10 PM	10 PM - 12 AM
9/22/2019 Sunday		145 8:58 AM		204 11:26 AM	72 2:04 PM	103 6:33 PM	159 7:49 PM	
							164 8:05 PM	
9/21/2019 Saturday	84 12:38 AM	174 8:52 AM		165 12:24 PM			133 8:33 PM	112 11:00 PM
	116 1:21 AM							
9/20/2019 Friday	134 12:35 AM	149 6:33 AM		173 11:19 AM	154 2:55 PM	129 5:04 PM	128 8:09 PM	75 11:23 PM
				185 1:08 PM				
9/19/2019 Thursday			165 10:18 AM	159 12:42 PM	102 2:29 PM	120 5:43 PM	99 8:45 PM	110 10:08 PM
9/18/2019 Wednesday	79 3:01 AM	151 7:39 AM		135 11:24 AM	255 2:17 PM	56 5:29 PM	158 7:11 PM	
	132 5:23 AM				93 4:17 PM		175 8:45 PM	

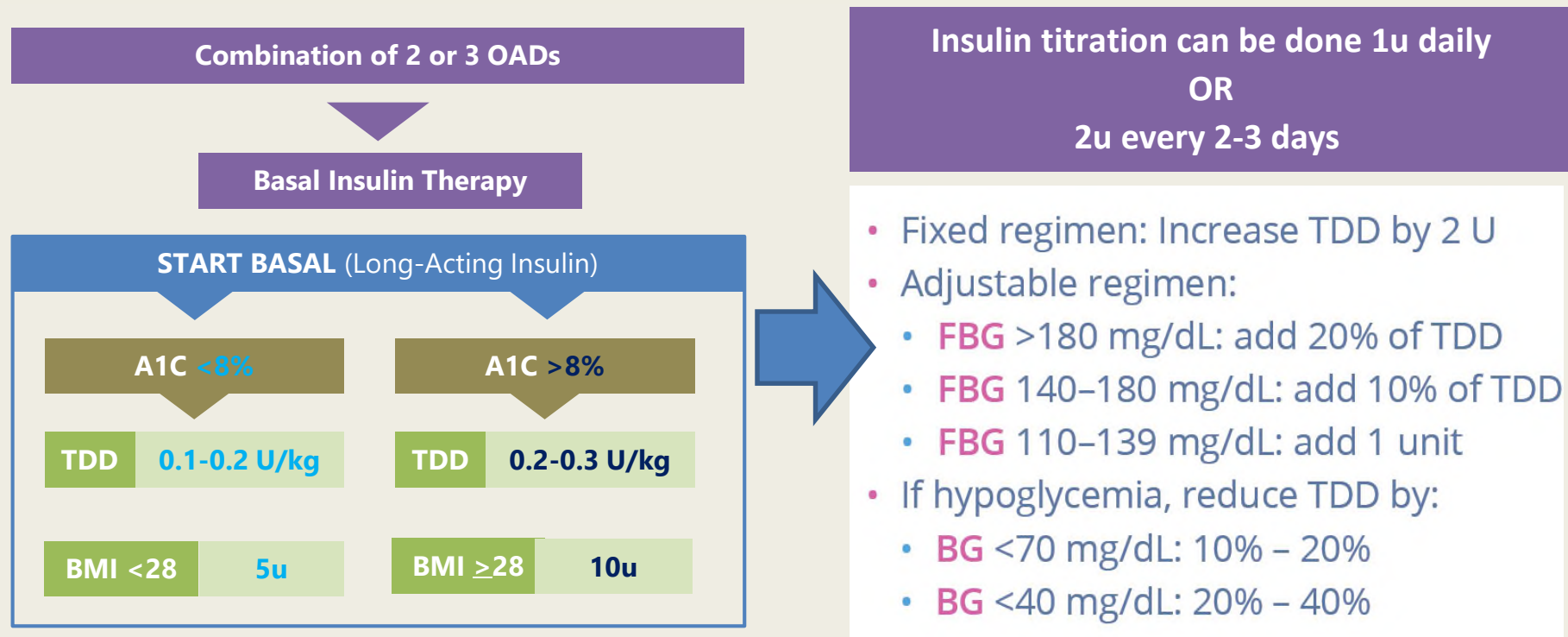
○ Pre-meal

▼/▲ BG Alert

Above/Below Target

Hypoglycemic

Add-on Basal Insulin to Oral Antidiabetic Drugs

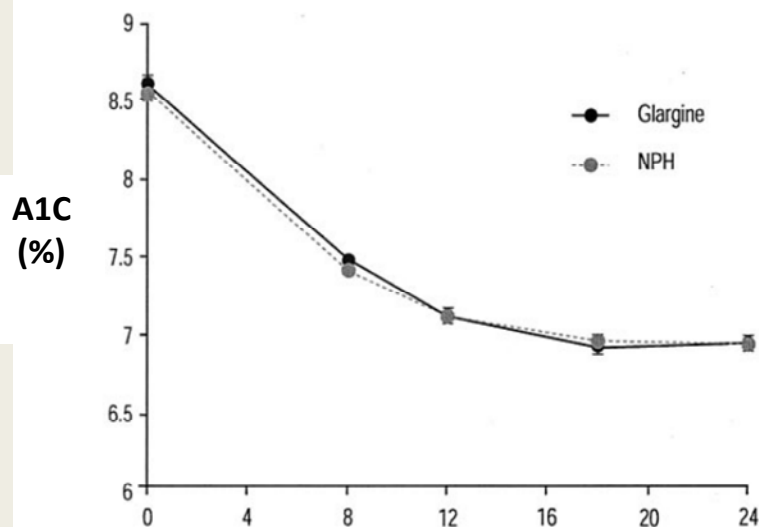


If Basal Insulin exceeds 50u QD, consider splitting TDD into BID dosing

Basal Insulin Added to OADs Improves Glycemic Control: “Treat to Target” Trials

N=756

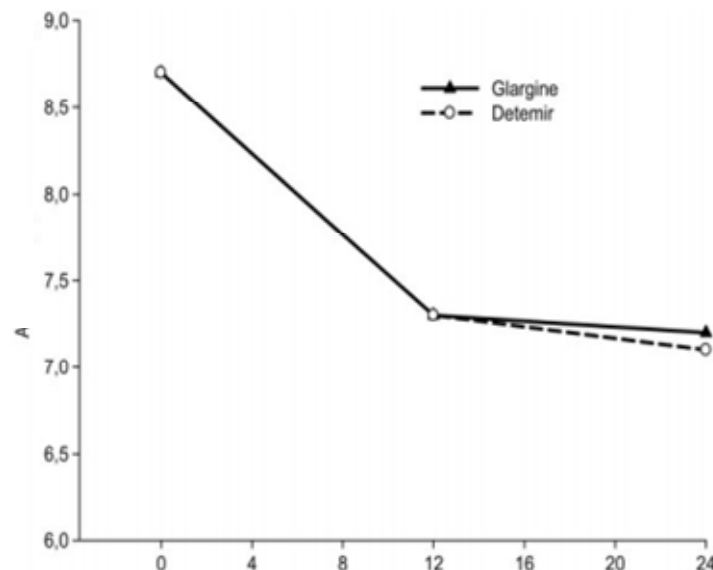
Baseline A1C 7.5% to 10.0%
Treated with 1 or 2 OADs (MET, SU, or TZD)



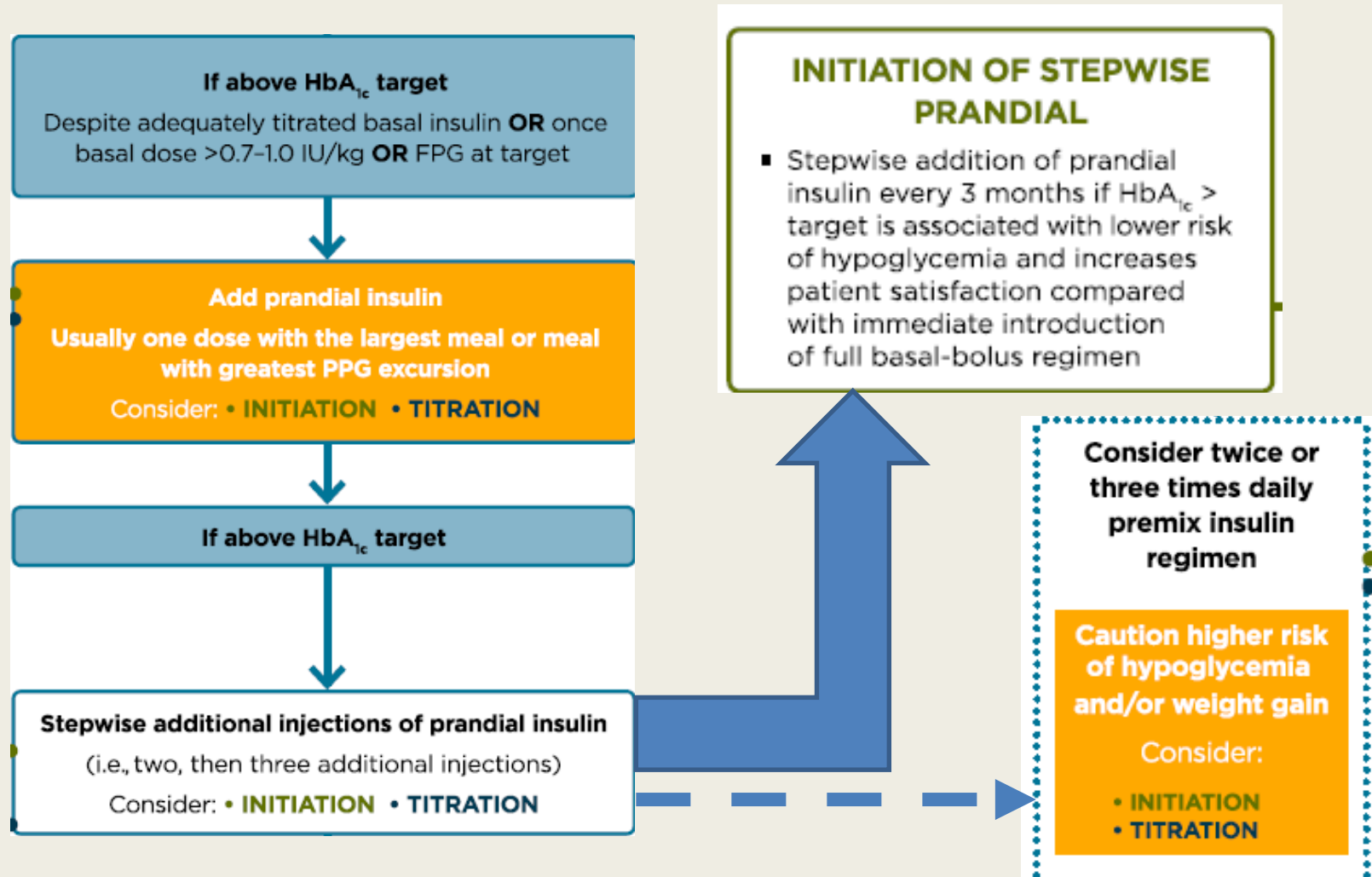
24 Weeks of Treatment

N=973

Baseline A1C 7.0% to 10.5%
Treated with OADs, including MET



Adding Prandial Insulin to Basal



Titration of Prandial Insulins e.g. Regular, Lispro

HOW TO START MEALTIME (BOLUS) INSULIN

Add 4 units of mealtime insulin to the basal dose before the largest meal or the meal that is agreed upon.

HOW TO ADJUST YOUR BOLUS INSULIN

When Mealtime Insulin Is Taken:	When To Test Blood Sugar:	If The Blood Sugar Results Are:	Then You Should:	When:
At Breakfast	Before Lunch	Under 80	Subtract 2 Units From the Mealtime Dose	Before Breakfast the Next Day
		80–130	Do Not Adjust Mealtime Insulin Dose	
		Over 130	Add 2 Units to Your Mealtime Dose	
At Lunch	Before Dinner	Under 80	Subtract 2 Units from Mealtime Dose	Before Lunch the Next Day
		80–130	Do Not Adjust Mealtime Insulin Dose	
		Over 130	Add 2 Units to Mealtime Dose	
At Dinner	Before Bed	Under 125	Subtract 2 Units from Mealtime Dose	Before Dinner the Next Day
		125–150	Do Not Adjust Mealtime Insulin Dose	
		Over 150	Add 2 Units to Your Mealtime Dose	

If blood sugar is under 70, drink 1/2 cup of juice or soda or eat something that contains sugar. You can also take glucose tablets to bring your blood sugar into normal range. Let your physician/care team know that you had low blood sugar.

Case #7

- 84 yo A male
- T2DM for 30 yr; Wt 140lb, BMI 22
- Proteinuria, CKD2/3, HTN, Dyslipidemia, Parkinson's - progressive
- Metformin 850mg TID, Linagliptin 5mg QD, Lispro 2-3u with dinner
- A1c 7.1-7.8% for 3+ yr

Date	Overnight			Early Morning			Late Morning			Early Afternoon			Late Afternoon			Early Evening			Late Evening			Bedtime		
	12 AM - 9 AM			9 AM - 9 AM			9 AM - 11 AM			11 AM - 2 PM			2 PM - 5 PM			5 PM - 7 PM			7 PM - 10 PM			10 PM - 12 AM		
	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO
3/15/2019	147 2:31																							
	144 4:38																							
3/14/2019	124 1:25																							
3/13/2019	160 4:59																							
3/12/2019	154 5:00																							
3/11/2019	138 4:45																							
3/8/2019	120 0:53																							
3/6/2019	107 2:05																		307 21:59					
3/2/2019																			194 21:07					
Avg.	136																		251					

Case #7 (con't)

- Fell and fractured ribs, stopped exercise for 1m; ? depressed
- Patient noted worsening of BG; self increased Lispro to 5-6u TID AC
- A1c **9.5%**; FBG above target

Rx:
Start
bedtime
NPH 5u

	Overnight			Early Morning			Late Morning			Early Afternoon			Late Afternoon			Early Evening			Late Evening			Bedtime		
Date	12 AM - 6 AM			6 AM - 9 AM			9 AM - 11 AM			11 AM - 2 PM			2 PM - 5 PM			5 PM - 7 PM			7 PM - 10 PM			10 PM - 12 AM		
	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO	Gluc.	Med.	CHO
6/21/2019	164 5:59																							
6/20/2019	146 5:54															238 18:59			276 21:19					
6/19/2019	178 5:53									188 12:31			192 15:17											
6/18/2019	165 5:51									238 13:00			117 16:44						288 21:44					
6/17/2019	173 1:10						208 10:51												191 19:06					
	175 5:47																		203 21:06					
6/16/2019										269 11:00														
6/14/2019	191 5:38																					242 22:00		
6/13/2019	238 5:41																							
Avg.	174						172			208			232			155			238			240		

Case #7 (Con't)

Date	Overnight 12 AM - 6 AM	Early Morning 6 AM - 9 AM	Late Morning 9 AM - 11 AM	Early Afternoon 11 AM - 2 PM	Late Afternoon 2 PM - 5 PM	Early Evening 5 PM - 7 PM	Late Evening 7 PM - 10 PM	Bedtime 10 PM - 12 AM
9/3/2019 Tue		109 6:08 AM						
9/2/2019 Mon		129 6:12 AM				131 6:17 PM	170 9:26 PM	
9/1/2019 Sun		143 6:14 AM					207 9:30 PM	
8/31/2019 Sat		96 6:19 AM	212 10:38 AM				253 9:19 PM	
8/30/2019 Fri	48 1:56 AM 130 3:38 AM	212 6:03 AM			113 4:05 PM		211 9:41 PM	
8/29/2019 Thu		146 6:15 AM					124 9:01 PM	
8/28/2019 Wed		123 6:30 AM					162 7:01 PM	
8/27/2019 Tue	114 1:07 AM 135 5:53 AM				174 4:16 PM	290 6:42 PM	248 9:13 PM	
8/26/2019 Mon	164 5:45 AM						60 9:49 PM	52 10:25 PM
8/25/2019 Sun	84 5:46 AM					153 6:35 PM	172 9:52 PM	106 11:07 PM
8/24/2019 Sat	96 5:56 AM						242 9:32 PM	
8/23/2019 Fri	85 5:55 AM					148 6:38 PM	141 9:43 PM	
8/22/2019 Thu		104 6:02 AM					159 7:05 PM	

- On NPH 6u, FBG avg 133
- Hypoglycemia noted some evenings and overnight
- NPH reduced back to 5u
- Overall BG avg 148
- A1c **9.1%** unchanged
- Evaluate with Professional Diagnostic CGM (Libre Pro)

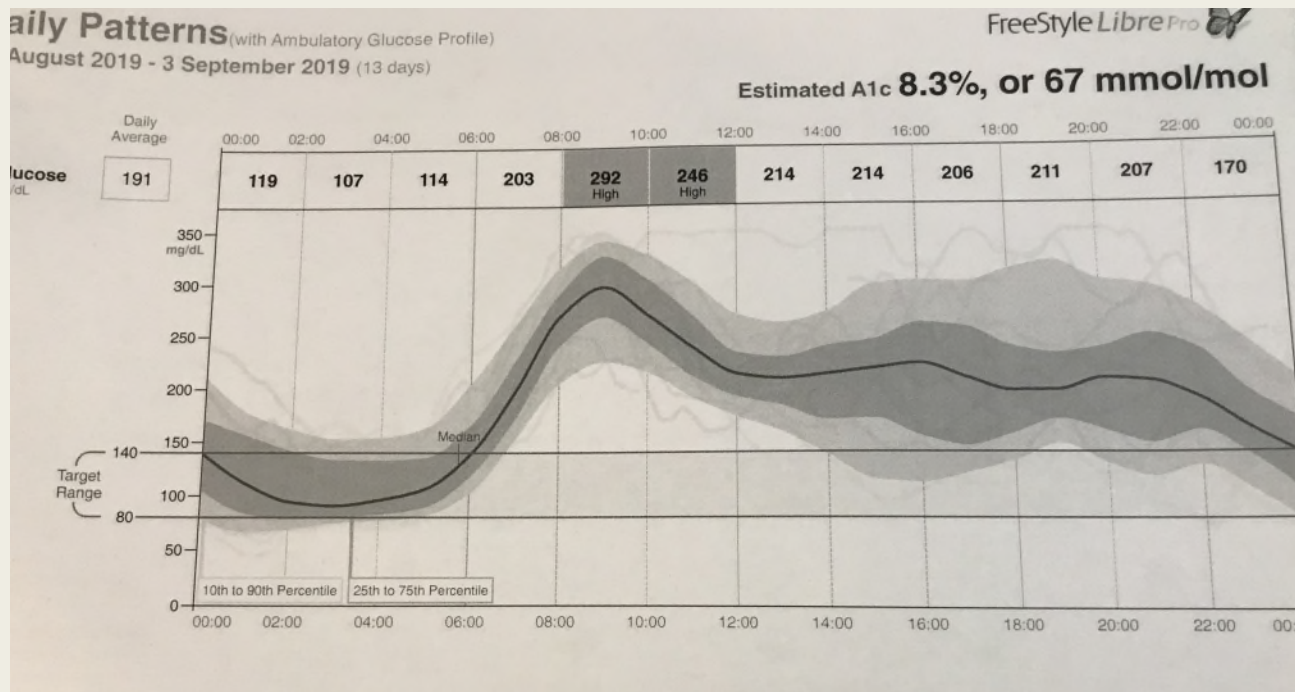
Freestyle Libre Pro

- Professional CGM
- Blinded to the patient
- 14 days of data



Case #7 (Con't)

- Diagnostic CGM revealed significant morning hyperglycemia
- Patient reported he wakes at 6am to take Carbidopa, on empty stomach, then feels nauseated with GI symptoms, eats crackers
- Later at 8am, he eats breakfast with Lispro
- CGM showed hyperglycemia between 6-7am due to crackers
- Verified Carbidopa can be taken with or after meal so patient eats breakfast with Lispro before Carbidopa to avoid GI symptoms and high BG



Case #8

Date	Overnight	Early Morning	Late Morning	Early Afternoon	Late Afternoon	Early Evening	Late Evening	Bedtime
	12 AM - 6 AM	6 AM - 9 AM	9 AM - 11 AM	11 AM - 2 PM	2 PM - 5 PM	5 PM - 7 PM	7 PM - 10 PM	10 PM - 12 AM
9/26/2019 Thu		119 6:53 AM						
9/25/2019 Wed		77 7:53 AM						
9/24/2019 Tue			64 9:13 AM				206 7:44 PM	
9/23/2019 Mon			100 9:44 AM				93 8:34 PM	
9/22/2019 Sun			84 9:35 AM					
9/21/2019 Sat		75 7:47 AM						
9/20/2019 Fri		92 7:17 AM					114 8:12 PM	
9/19/2019 Thu		116 7:42 AM					162 7:22 PM	
9/18/2019 Wed		134 7:34 AM						
9/17/2019 Tue			76 9:47 AM					210 11:50 PM
9/16/2019 Mon		76 8:10 AM					87 7:44 PM	
9/15/2019 Sun		122 8:18 AM				114 6:43 PM		
9/14/2019 Sat		111 7:06 AM					120 9:10 PM	
9/13/2019 Fri		95 7:43 AM					147 7:41 PM	
9/12/2019 Thu		65 8:10 AM	175 10:11 AM				120 8:19 PM	
9/11/2019 Wed		91 8:17 AM					160 7:28 PM	
9/10/2019 Tue		72 8:03 AM					127 8:53 PM	
9/9/2019 Mon			81 10:24 AM				54 9:48 PM	128 10:21 PM
9/8/2019 Sun		68 8:11 AM					150 7:54 PM	
		182 8:39 AM					188 9:39 PM	

- 75yo A female
- T2DM since 2006, c/b HTN, PDR, osteoporosis w/ vertebral fracture
- CKD4, eGFR 22, Cr 2.11
- NPH 20u QAM, 8u QHS
- Glipizide 10mg BID AC
- AM symptomatic hypoglycemia
- A1c 7.8% = eAG 178

Case #8

Glucose Statistics - mg/dL (Plasma)

	Overall	Overnight 12 AM - 6 AM	Early Morning 6 AM - 9 AM	Late Morning 9 AM - 11 AM	Early Afternoon 11 AM - 2 PM	Late Afternoon 2 PM - 5 PM	Early Evening 5 PM - 7 PM	Late Evening 7 PM - 10 PM	Bedtime 10 PM - 12 AM
Highest	242		182	175	119		114	208	242
Median	105.5		79.0	81.0				120.0	189.5
Mean	111.4		92.9	92.3	119.0		114.0	127.5	187.3
Standard Deviation	43.1		28.5	34.2				42.3	49.5
Lowest	54		60	64	119		114	54	128
No. of Tests	62		26	9	1		1	21	4
% Hypoglycemic	12.9		15.4	22.2	0.0		6.2	9.5	0.0
% Above Target	25.8		15.4	11.1	0.0		0.0	38.1	75.0
Pre-meal Median	105.5		92.0	84.0				117.0	
Post-meal Median	124.0							154.0	

- Hypoglycemia in AM → decrease NPH HS dose
- May need to consider lower NPH AM or Glipizide AM doses
- Mean BG ≠ A1c → missing BG midday / pre dinner
- Consider Libre Pro CGM
- Consider replace Glipizide with DPP-4i Linagliptin due to CKD

Key Points in Management of T2D

- Early intensification with combination therapy to reach and maintain glycemic target
- Consider individual comorbidities in selection of diabetes therapy e.g. ASCVD, CHF, CKD, risk of hypoglycemia, obesity, NASH
- Metformin should be continued long term if possible, other therapies added to it

Key Points in Management of T2D

- CKD 4 and CKD 5 states can affect internal physiology that can both raise and lower glucose levels. Medication options may be limited.
- Awareness by the patient and the treating providers of the nutritional, pharmaceutical and activity-related factors contributing to glycemic levels are essential to recognize, treat, and prevent hypoglycemia

Questions?

