

Type 2 Diabetes: Latest Drug Approvals and Use of the Newer Agents: a 2018 Update

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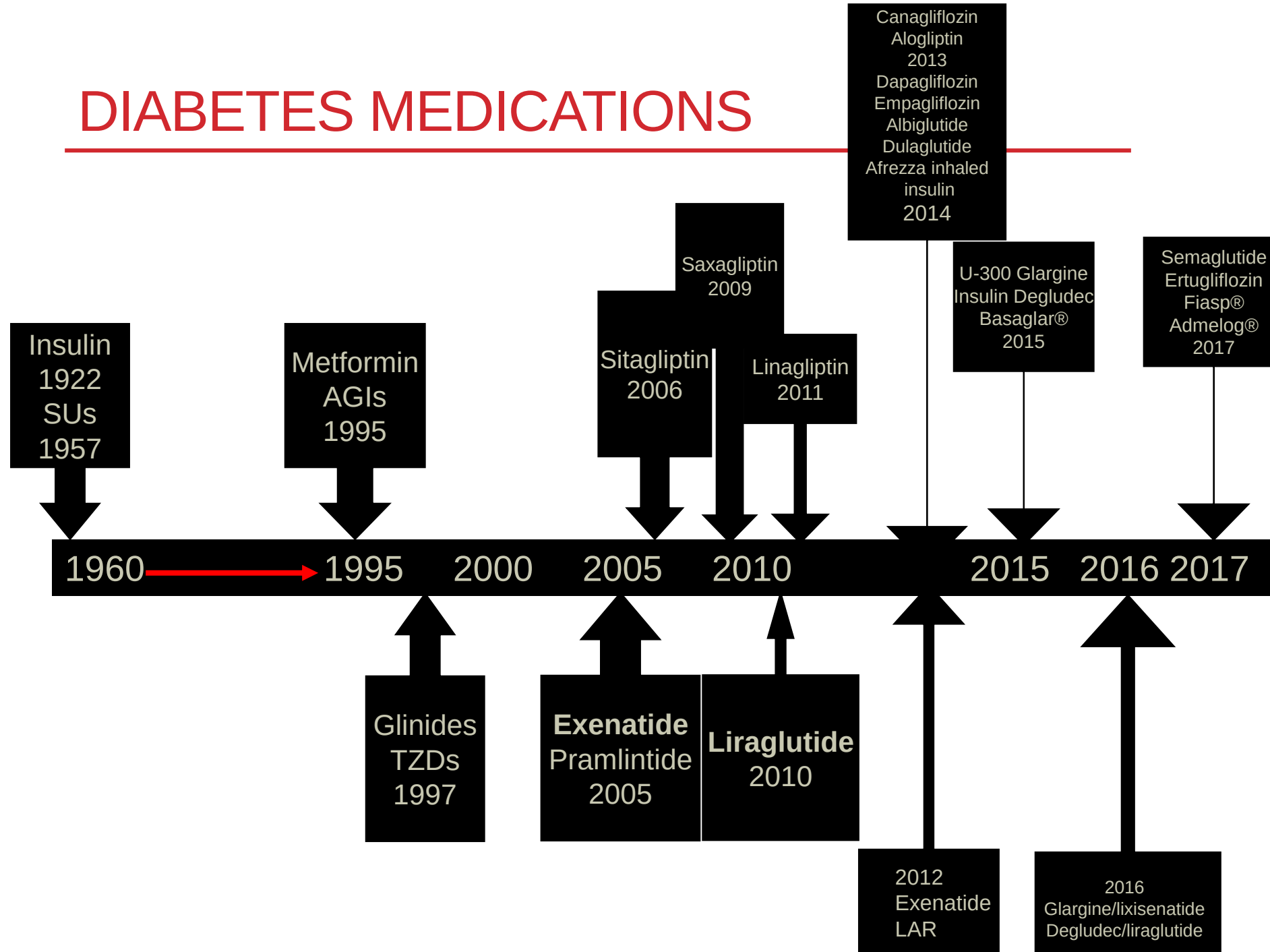
OBJECTIVES

- Describe the most recent drug approvals for type 2 diabetes and the cardiovascular outcome data supporting the newer drug classes
- Describe the 2018 Treatment recommendations from the American Diabetes Association
- Given a patient case, utilize a patient-centered approach when selecting pharmacotherapy options for a patient with type 2 diabetes

UPDATED ADA GUIDELINES

- Standards of Medical Care in Diabetes 2018.
Diabetes Care 2018;41(Suppl 1)

DIABETES MEDICATIONS



TYPES OF INSULIN

- Rapid Acting
 - Humalog®, **Admelog**® (lispro) (U-100 and U-200-Humalog® only)
 - Novolog ®, **Fiasp**® (aspart)
 - Apidra ® (glulisine)
- Short Acting-Regular Insulin (R)
 - Novolin® R
 - Humulin® R
- Intermediate Acting-NPH (N)
 - Novolin® N
 - Humulin ® N
- Long Acting – Basal Insulin
 - Levemir® (detemir)
 - Lantus®/**Basaglar** ® (U-100 glargine)
 - **Toujeo**® (U-300 glargine)
 - **Tresiba**®(Degludec U-100 and U-200)

INSULIN DEGLUDEC (TRESIBA®)

- Ultra-Long-acting basal insulin
- Duration up to 42 hours
- Injected once a day at any time of day
- U-100 and U-200 strengths
- Available only as a FlexTouch® Pen



DEVOTE: EFFICACY AND SAFETY OF DEGLUDEC VS. GLARGINE IN TYPE 2 DIABETES

- **Primary Outcome:** first occurrence of cardiovascular death, non-fatal MI, or non-fatal stroke
- **Secondary:** number of **severe hypoglycemic episodes**
 - time from randomization to MACE + time to hospitalization for unstable angina pectoris, number of serious adverse events, AEs leading to discontinuation of treatment drug.

DEVOTE: EFFICACY AND SAFETY OF DEGLUDEC VS. GLARGINE IN TYPE 2 DIABETES

- Duration of follow-up: 1.99 years
- Mean patient age: 65 years
- Diabetes duration: 16.4 years
- **Key inclusion criteria:**
 - **adult patients with type 2 diabetes, age ≥ 50 years with predefined previous CVD or renal disease**
 - **OR age ≥ 60 years with at least one predefined CV risk factor**
 - A1C $\geq 7.0\%$ or A1C $< 7.0\%$ and current insulin treatment corresponding to ≥ 20 units basal insulin per day; and patients on one or more oral or injectable antidiabetic agent(s).

DEVOTE: EFFICACY AND SAFETY OF DEGLUDEC VS. GLARGINE IN TYPE 2 DIABETES

Outcome	Degludec (no./100 pt years)	Glargine (no./100 pt year)	Ratio (95% CI), P- value	NNT
Primary Composite	4.29	4.71	HR 0.91(0.78-1.06) P<0.001 for non- inferiority	
Severe Hypoglycemia	3.7	6.25	RR 0.60(0.48-0.76) p<0.001 for superiority	39

INSULIN LISPRO (ADMELOG®): APPROVED DECEMBER 2017

- First **follow-on** insulin lispro
 - Similar to insulin lispro (Humalog®)
- Available in U-100 vials and the Solostar® Pen
- No dose conversions when switching from other rapid acting insulins



FASTER ACTING INSULIN ASPART (FIASP®): APPROVED 9/2017

- Insulin aspart + added niacinamide to speed absorption + L-arginine as a stabilizing agent
- Faster aspart vs. insulin aspart in type 1 patients pooled analysis¹
 - 5 min earlier onset of insulin exposure
 - 2 x higher early insulin exposure
 - Offset of exposure and glucose lowering effect 12-14 min earlier with faster aspart
- Inject at **start of meal** or up to 20 minutes after the start of a meal
 - Novolog® approved to inject 5-10 minutes **before** the meal



GLP-1 Receptor Agonists

GLP-1 PHYSIOLOGY

GLP-1 Effects in Humans Understanding the Natural Role of Incretins

**GLP-1 secreted upon
the ingestion of food**

Promotes satiety and
reduces appetite

Alpha cells:
↓ Postprandial
glucagon secretion

Liver:
↓ Glucagon reduces
hepatic glucose output

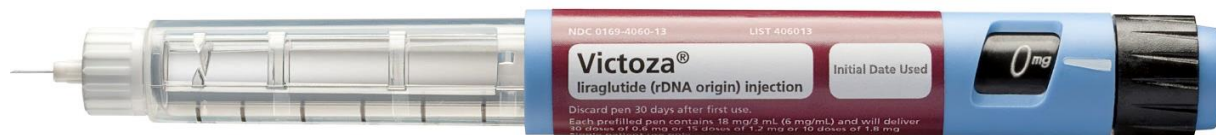
Beta cells:
Enhances glucose-dependent
insulin secretion

Stomach:
Helps regulate
gastric emptying

Adapted from Flint A, et al. *J Clin Invest*. 1998;101:515-520
Adapted from Larsson H, et al. *Acta Physiol Scand*. 1997;160:413-422
Adapted from Nauck MA, et al. *Diabetologia*. 1996;39:1546-1553
Adapted from Drucker DJ. *Diabetes*. 1998;47:159-169

GLP-1 RECEPTOR AGONISTS

- **Exenatide (Byetta®)** BID dosing timed within 1 hour before breakfast and dinner
- **Liraglutide (Victoza®)** Once daily dosing
- **Dulaglutide (Trulicity®)** Once weekly dosing
- **Exenatide Long Acting (Bydureon®)** Once weekly dosing
- **Semaglutide (Ozempic®)** Once weekly dosing-**newly approved December 2017**
- *Lixisenatide (Adlyxin®)- once daily. FDA approved but not yet available in US as monotherapy*
- *Albiglutide (Tanzeum®)- Will be removed from the market in 2018*



GLP-1 AGONIST ADVERSE EFFECTS/PRECAUTIONS

• Adverse Effects

- Nausea and vomiting – most common AE
- Cases of acute pancreatitis

• Contraindications/Precautions

- eGFR <30, do not use exenatide
- Gastroparesis
- History of pancreatitis
- FDA Boxed Warning: History of medullary thyroid carcinoma OR
- Multiple endocrine neoplasia syndrome 2

GLP-1 AGONIST BENEFITS

- Low risk of hypoglycemia
 - Slightly higher risk when used with sulfonylureas or insulin
- Weight loss!
- Potential for once daily or once weekly dosing
- Studies have shown addition to a basal insulin can be as effective as starting a pre-meal insulin – see *ADA insulin dosing algorithm*

GLP-1 RA CV Safety and Renal Outcome Trials

LEADER: LIRAGLUTIDE EFFECT AND ACTION IN DIABETES: EVALUATION OF CARDIOVASCULAR OUTCOME RESULTS

- Evaluated liraglutide vs. placebo + standard of care in patients with type 2 diabetes and high risk of CV disease or with established CV disease
 - Median follow-up 3.8 years
 - Primary outcome: first occurrence of death from CV cause, non-fatal MI or non-fatal stroke
- **Primary outcome occurred in 13.0% liraglutide vs. 14.9% in placebo group (p<0.001 for non-inferiority; p=0.01 for superiority)**
 - Granted FDA indication to reduce risk of CV death, nonfatal MI or nonfatal stroke

LEADER: LIRAGLUTIDE EFFECT AND ACTION IN DIABETES: EVALUATION OF CARDIOVASCULAR OUTCOME RESULTS

- **Secondary Analysis of Renal Outcomes**
 - Composite of new onset persistent macroalbuminuria, persistent doubling of SCr level, end-state renal disease, or death due to renal disease
 - Renal outcome occurred in fewer patients in liraglutide group (5.7% vs. 7.2% HR, 0.78; $p=0.003$)

SUSTAIN-6: SEMAGLUTIDE CV SAFETY TRIAL

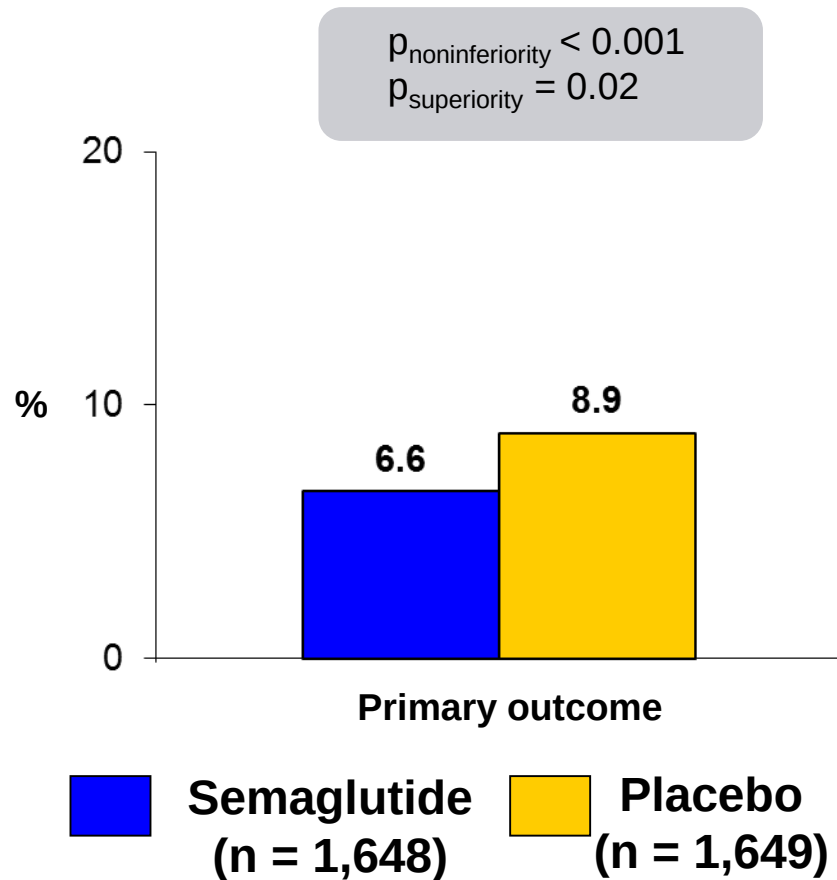
Trial design: Patients with DM2 at high risk for CV events were randomized in a 1:1:1:1 fashion to either semaglutide 0.5 mg, semaglutide 1 mg, or matching placebo. They were followed for a median of 2.1 years.

Results

- Primary outcome- **CV death/MI/stroke: semaglutide vs. placebo: 6.6% vs. 8.9%, HR 0.74, 95% CI 0.58-0.95, $p < 0.001$ for noninferiority; $p = 0.02$ for superiority**
- CV death: 2.7% vs. 2.8%, $p = 0.92$; all MI: 2.9% vs. 3.9%, $p = 0.12$; all stroke: 1.6% vs. 2.7%, $p = 0.04$
- HbA1c at week 104: 7.6% vs. 7.3% vs. 8.3%

Conclusions

- **Injectable once a week semaglutide (GLP-1 agonist) was superior to placebo in improving glycemic control and ↓ CV events in high-risk patients with diabetes**



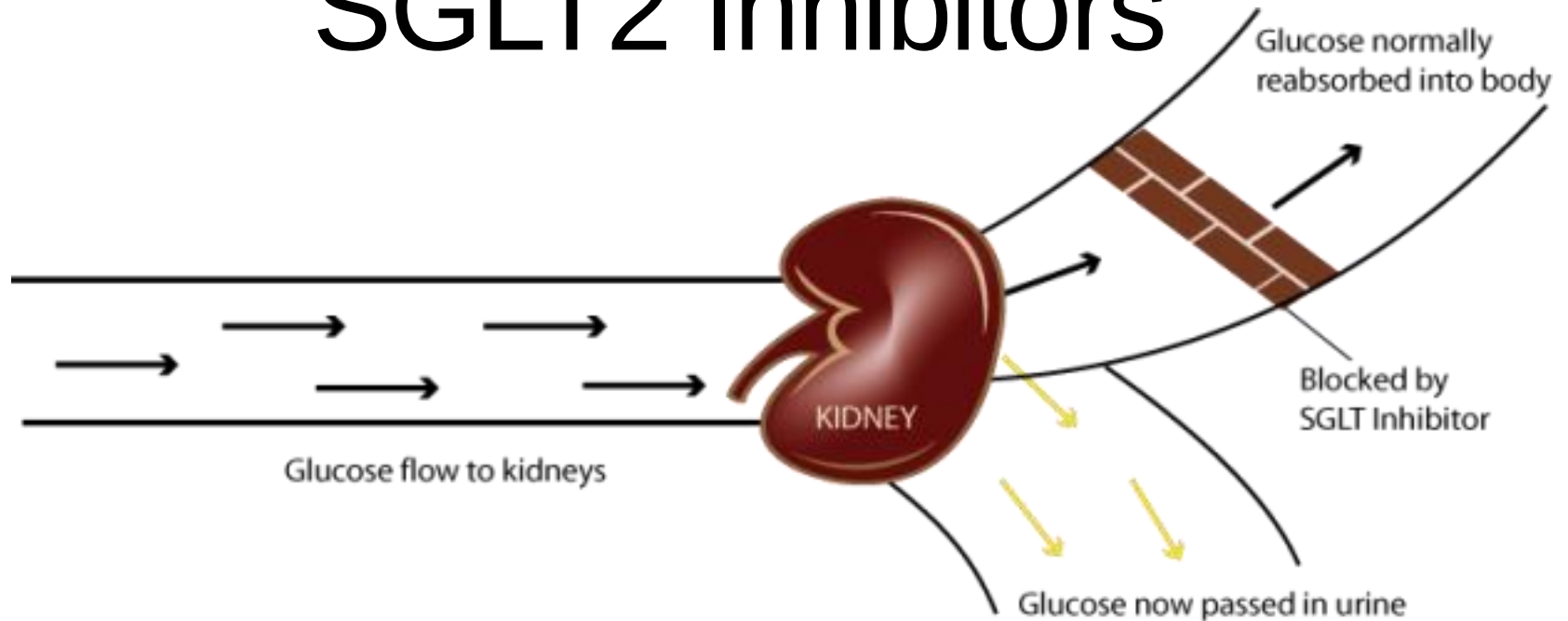
GLP-1 RA CV STUDIES DEMONSTRATING NON-INFERIORITY

- ELIXA¹-lixisenatide
- EXSCEL²- exenatide LAR

1. Pfeffer MA, et al. NEJM. 2015;373(23):2247-57

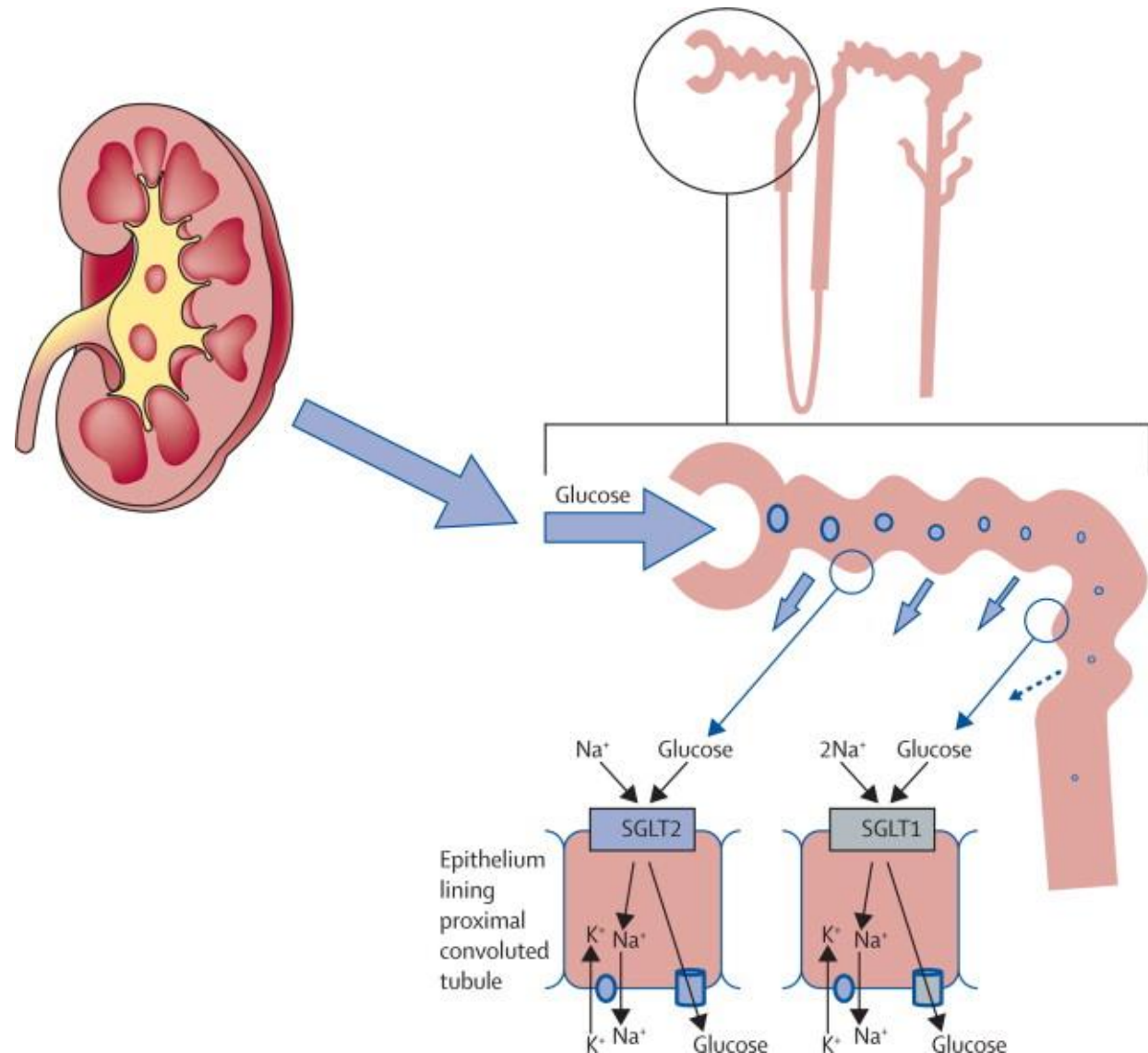
2. Holman RR, et al. NEJM. 2017 Sept 14; epub ahead of print

SGLT2 Inhibitors



SGLT2 INHIBITORS

- Sodium-glucose co-transporter inhibitors (SGLT2)
- Increase urinary glucose excretion



SGLT2 INHIBITORS

Canagliflozin
(Invokana™)

Dapagliflozin
(Farxiga™)

Empagliflozin
(Jardiance™)

Ertugliflozin
(Steglatro™)-
*Newly
approved 12-
2017*

SGLT2 INHIBITORS

Side Effects/Precautions

- Genital mycotic infections
- UTI
- Increased urination
- Hypotension due to volume depletion
- Hyperkalemia
- Euglycemic ketoacidosis
 - Rare but recent FDA warning
- Possible fracture risk-
Canagliflozin
- Amputation risk with
canagliflozin

Benefits

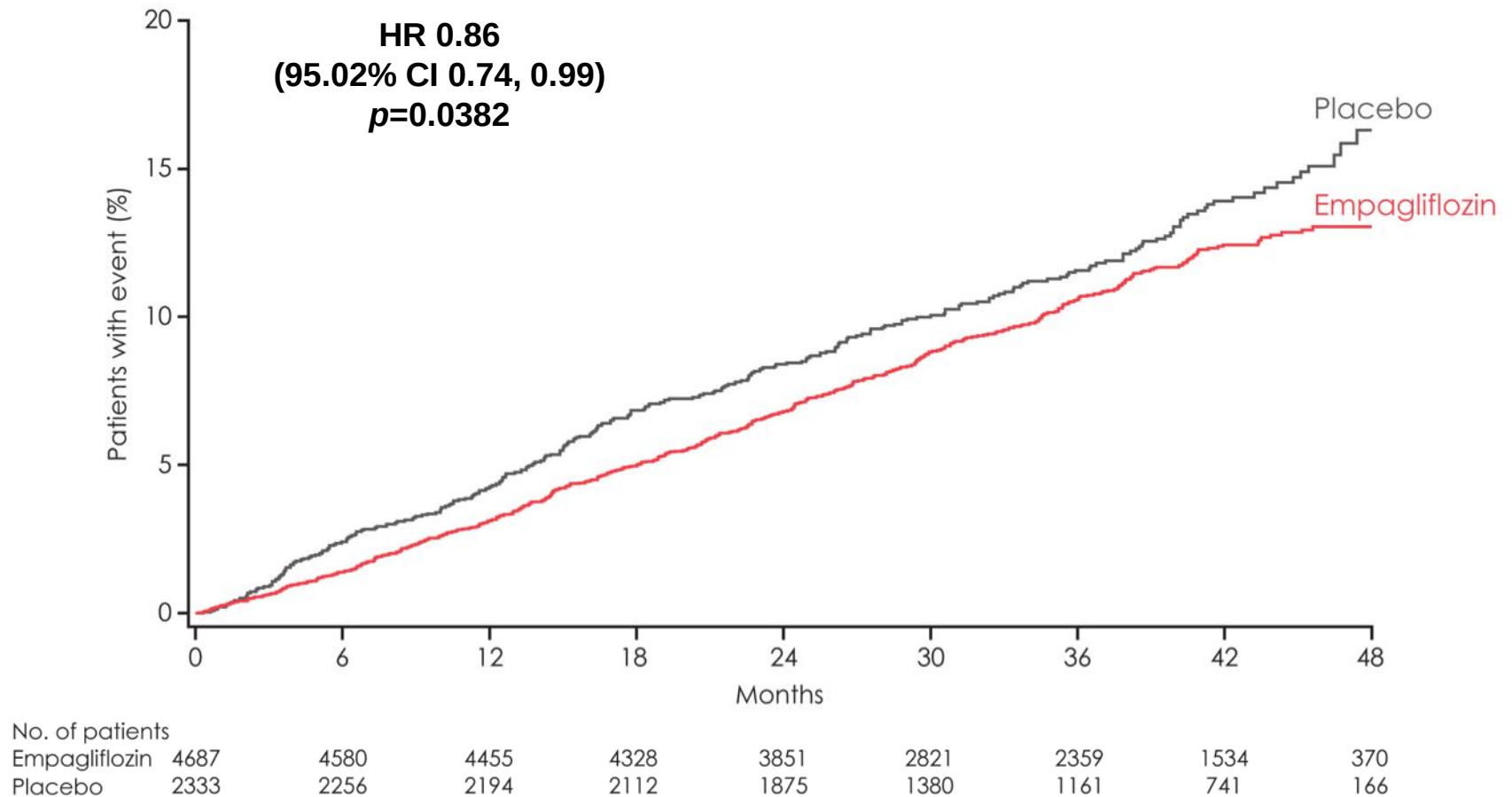
- Once daily oral agents
- Insulin independent action
- Small weight loss in studies
- Low risk of hypoglycemia

SGLT2 Inhibitor CV Safety Trials

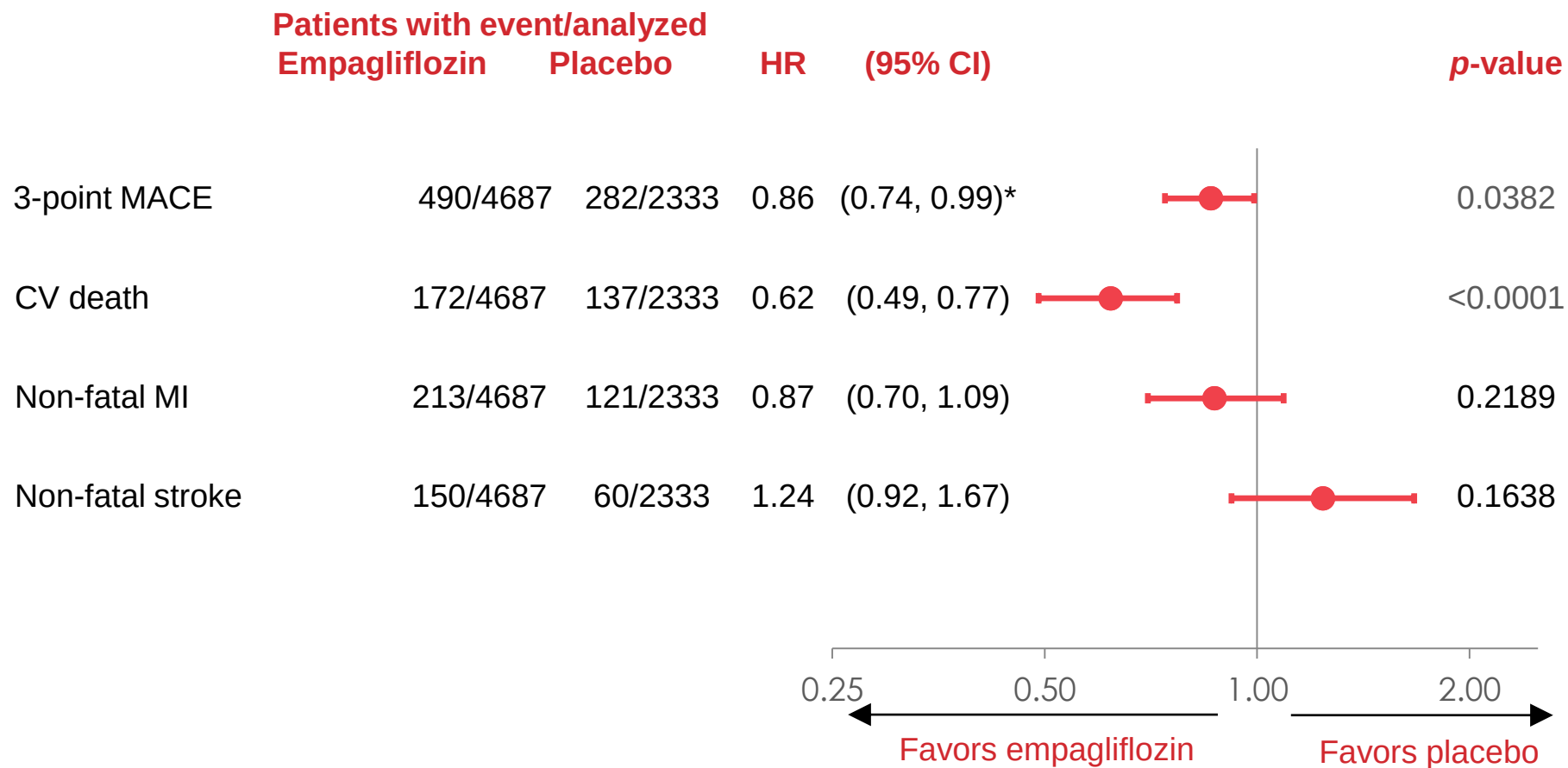
EMPA-REG OUTCOME STUDY

- 7020 patients with **established CVD** randomized to empagliflozin or placebo
 - Primary composite outcome: death from CV cause, nonfatal MI, or nonfatal stroke
 - **10.5% in empagliflozin group vs. 12.1% placebo $p=0.04$ for superiority**
 - Death from CV causes:
 - 3.7% empagliflozin 5.9% in placebo
 - 38% relative risk reduction
 - **Granted FDA indication for reduction of CV mortality in adults with Type 2 DM and established CV Disease**

EMPA-REG: PRIMARY OUTCOME:3-POINT MACE

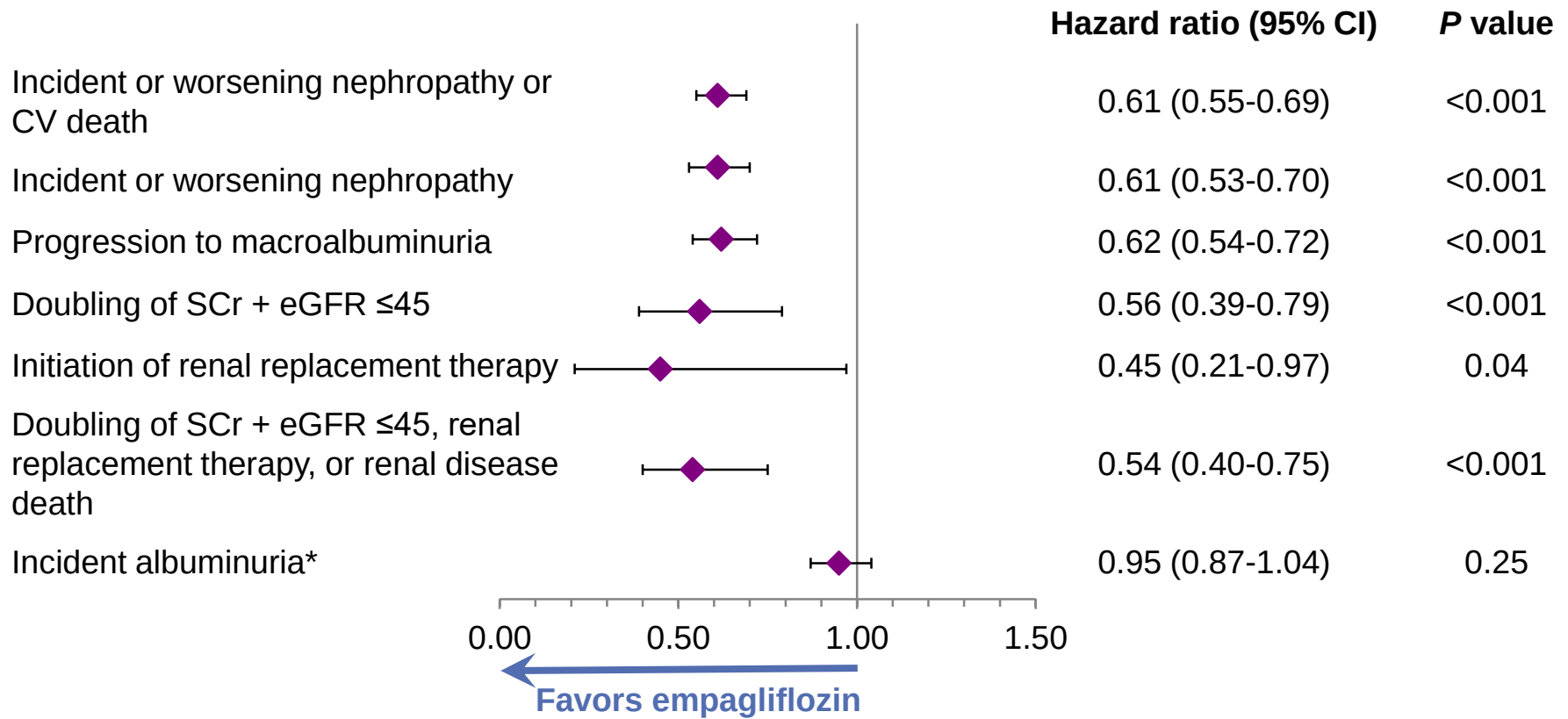


EMPA-REG:CV DEATH, MI AND STROKE



RENAL OUTCOMES WITH EMPAGLIFLOZIN OVER 3.2 YEARS

EMPA-REG RENAL (N=7020)

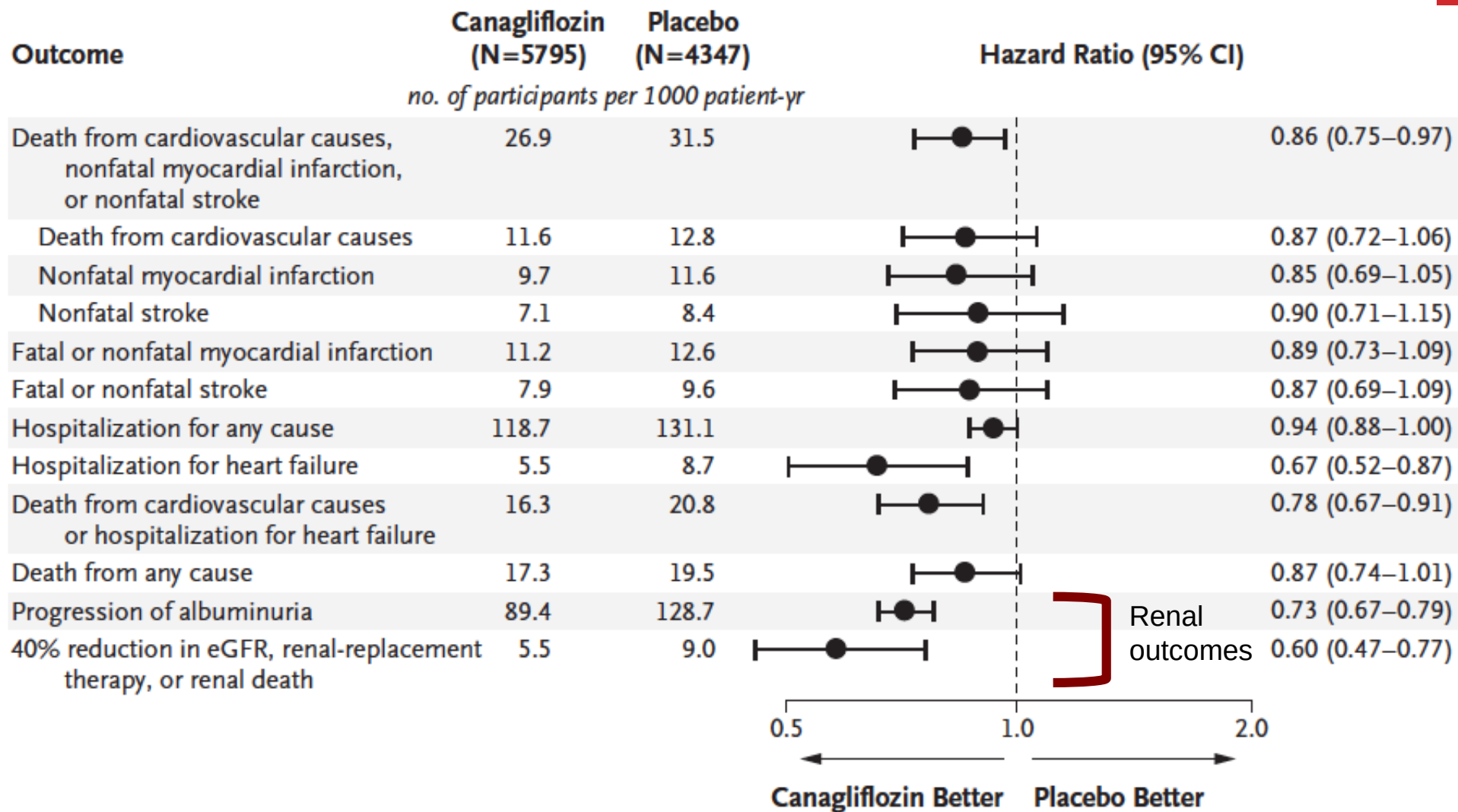


*In patients with normal albuminuria at baseline.

CANVAS AND CANVAS-R

- Canagliflozin CV safety and renal outcome study
- Included patients >30 years with established ASCVD or >50 years with 2 or more risk factors
- Primary outcome: composite of death from CV cause, non-fatal MI or non-fatal stroke

CANVAS AND CANVAS-R



CANVAS AND CANVAS-R SAFETY ENDPOINTS

- Newly identified amputation risk in the canagliflozin group
 - 6.3 vs. 3.4 events/1000 pt years (HR 1.97 [CI 1.41-2.75])
 - Mechanism unknown
- Possible increased risk of fracture
- Other side effects were similar to other SGLT2 inhibitor trials

SGLT2-I CV SAFETY TRIALS IN PROGRESS

- Dapagliflozin: DECLARE-TIMI58
 - Estimated completion July 2018
- Ertugliflozin: Vertis CV Study
 - Estimated completion October 2019

ADA Management of Hyperglycemia in Type 2 Diabetes

Juliann Horne, PharmD, PhC, BCACP

UNM North Valley Center
for Family & Community Medicine

Standards of Medical Care in Diabetes.
Diabetes Care 2018;41(Suppl 1)

ANTIHYPERGLYCEMIC THERAPY IN ADULTS WITH T2DM

At diagnosis, initiate lifestyle management, set A1C target, and initiate pharmacologic therapy based on A1C:

A1C is less than 9%, **consider Monotherapy.**

A1C is greater than or equal to 9%, **consider Dual Therapy.**

A1C is greater than or equal to 10%, blood glucose is greater than or equal to 300 mg/dL, or patient is markedly symptomatic, **consider Combination Injectable Therapy** (See Figure 8.2).

Monotherapy

Lifestyle Management + Metformin

Initiate metformin therapy if no contraindications* (See Table 8.1)

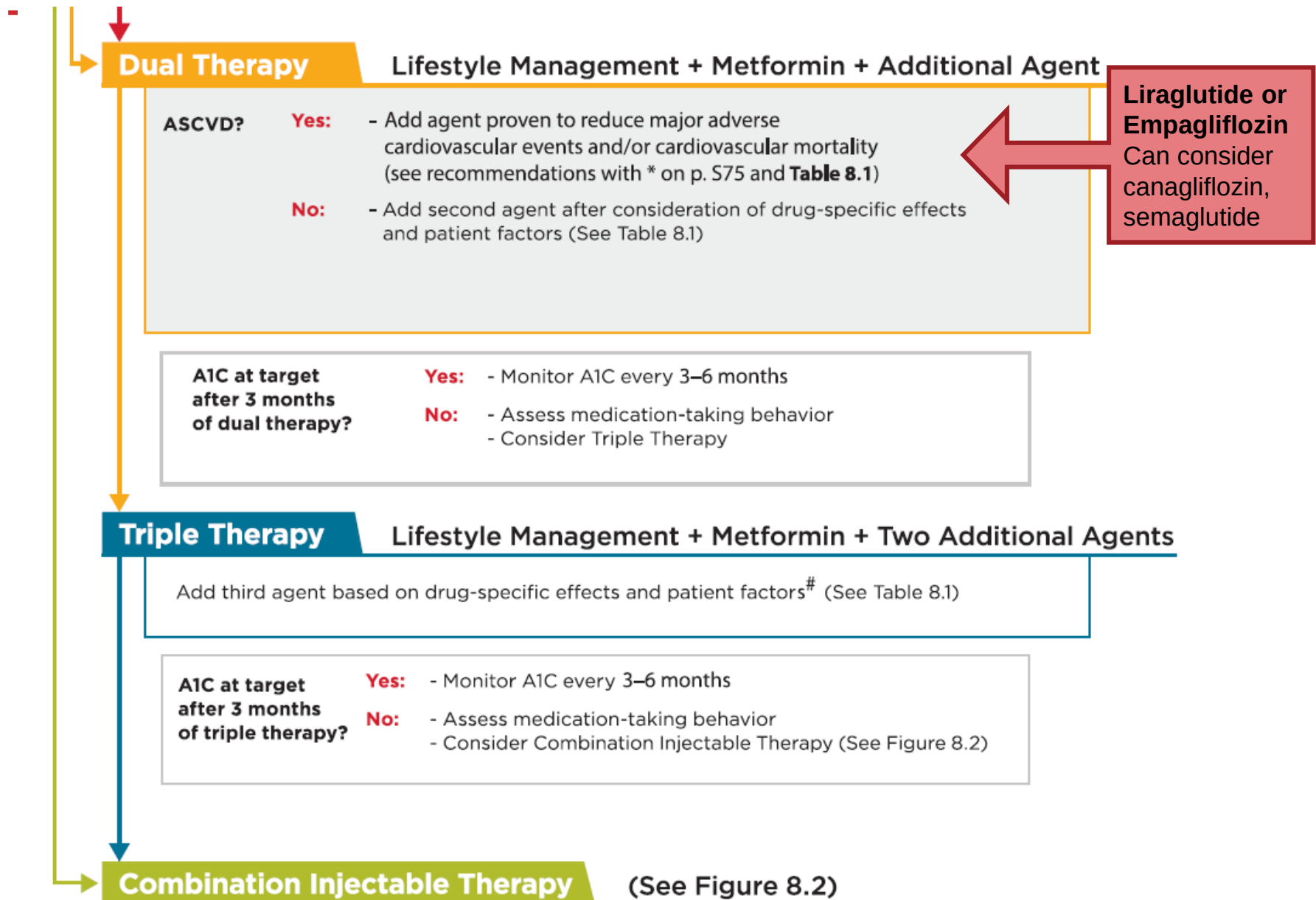
**A1C at target
after 3 months
of monotherapy?**

- Yes:** - Monitor A1C every 3–6 months
- No:** - Assess medication-taking behavior
- Consider Dual Therapy

Dual Therapy

Lifestyle Management + Metformin + Additional Agent

ANTIHYPERGLYCEMIC THERAPY IN ADULTS WITH T2DM

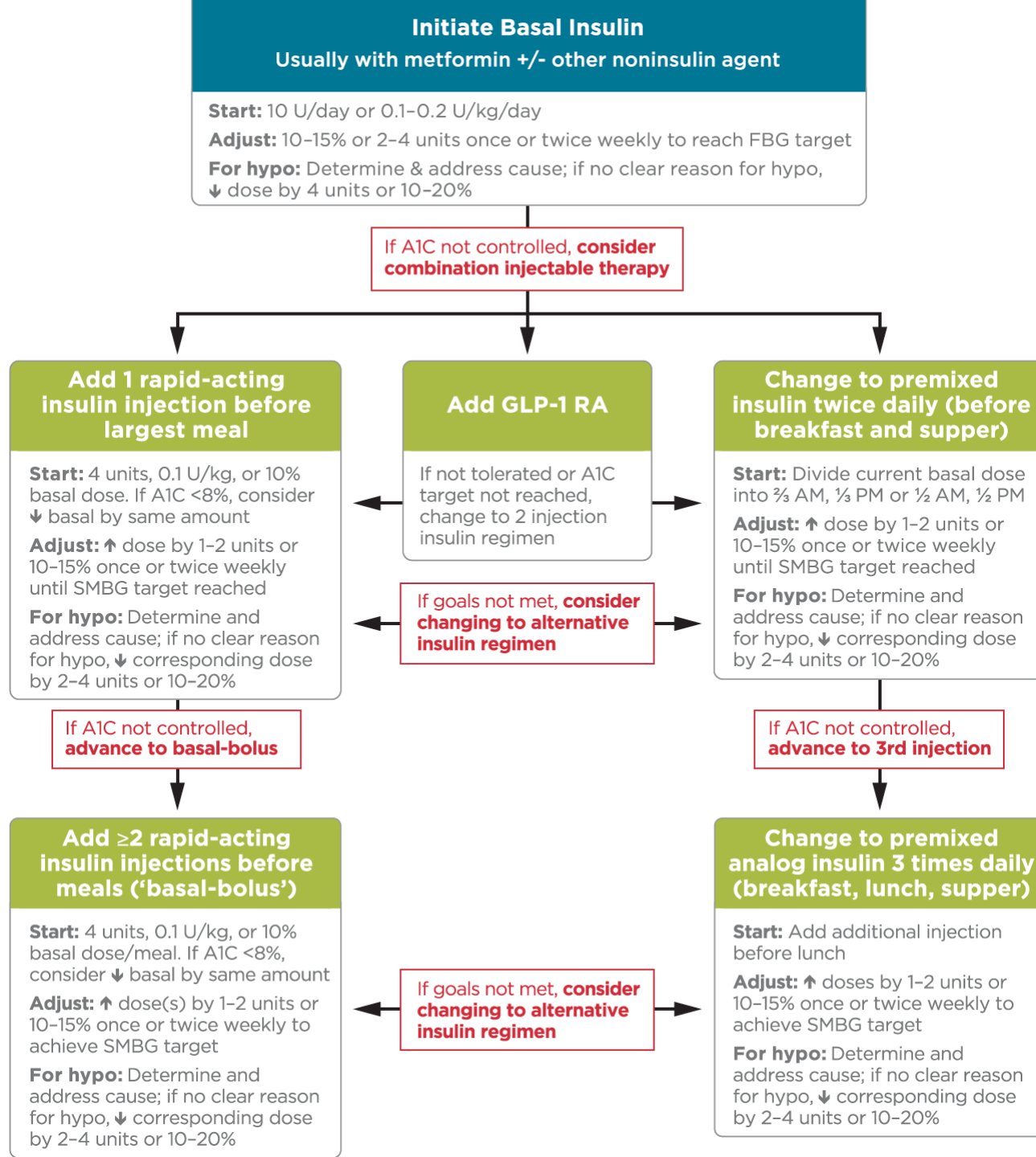


DRUG FACTORS TO CONSIDER

		Efficacy*	Hypoglycemia	Weight Change	CV Effects		Cost	Oral/SQ	Renal Effects		Additional Considerations
					ASCVD	CHF			Progression of DKD	Dosing/Use considerations	
Metformin		High	No	Neutral (Potential for Modest Loss)	Potential Benefit	Neutral	Low	Oral	Neutral	Contraindicated with eGFR <30	- Gastrointestinal side effects common (diarrhea, nausea) - Potential for B12 deficiency
SGLT-2 Inhibitors		Intermediate	No	Loss	Benefit: canagliflozin, empagliflozin†	Benefit: canagliflozin, empagliflozin	High	Oral	Benefit: canagliflozin, empagliflozin	- Canagliflozin: not recommended with eGFR <45 - Dapagliflozin: not recommended with eGFR <60; contraindicated with eGFR <30 - Empagliflozin: contraindicated with eGFR <30	- FDA Black Box: Risk of amputation (canagliflozin) - Risk of bone fractures (canagliflozin) - DKA risk (all agents, rare in T2DM) - Genitourinary infections - Risk of volume depletion, hypotension ↑LDL cholesterol
GLP-1 RAs		High	No	Loss	Neutral: Exenatide, exenatide extended release Benefit: liraglutide†	Neutral	High	SQ	Benefit: liraglutide	- Exenatide: not indicated with eGFR <30 - Lixisenatide: caution with eGFR <30 - Increased risk of side effects in patients with renal impairment	- FDA Black Box: Risk of thyroid C-cell tumors (liraglutide, albiglutide, dulaglutide, exenatide extended release) - Gastrointestinal side effects common (nausea, vomiting, diarrhea) - Injection site reactions ?Acute pancreatitis risk
DPP-4 Inhibitors		Intermediate	No	Neutral	Neutral	Potential Risk: saxagliptin, alogliptin	High	Oral	Neutral	Renal dose adjustment required; can be used in renal impairment	- Potential risk of acute pancreatitis - Joint pain
Thiazolidinediones		High	No	Gain	Potential Benefit: pioglitazone	Increased Risk	Low	Oral	Neutral	- No dose adjustment required - Generally not recommended in renal impairment due to potential for fluid retention	- FDA Black Box: Congestive heart failure (pioglitazone, rosiglitazone) - Fluid retention (edema; heart failure) - Benefit in NASH - Risk of bone fractures - Bladder cancer (pioglitazone) ↑LDL cholesterol (rosiglitazone)
Sulfonylureas (2nd Generation)		High	Yes	Gain	Neutral	Neutral	Low	Oral	Neutral	- Glyburide: not recommended - Glipizide & glimepiride: initiate conservatively to avoid hypoglycemia	FDA Special Warning on increased risk of cardiovascular mortality based on studies of an older sulfonylurea (tolbutamide)
Insulin	Human Insulin	Highest	Yes	Gain	Neutral	Neutral	Low	SQ	Neutral	Lower insulin doses required with a decrease in eGFR; titrate per clinical response	- Injection site reactions - Higher risk of hypoglycemia with human insulin (NPH or premixed formulations) vs. analogs
	Analog						High	SQ			

DRUG FACTORS TO CONSIDER

Class	Effect on A1c	Hypo	Weight	CV Events		Cost	Oral/ SQ	Renal Effects		Other considerations
				ASCVD	CHF			CKD	Dosing/ use	
SGLT-2 Inh.	Med	no	loss	Benefit: cana <u>empa</u>	Benefit: cana empa	high	oral	Benefit: cana empa	GFR adjustments for all agents	• GU infection • Volume depletion • Hypotension • Cana risk of amputation & bone fx
GLP-1 RA	High	no	loss	Benefit: <u>lira</u> sema	neutral	high	SQ	Benefit: lira sema	Exenatide C.I. if GFR<30	• FDA Box warning: thyroid C-cell tumors • GI side effects • Injection site reaction • Pancreatitis?



INSURANCE ISSUES

- Commercial
 - SGLT2s \$0 copay card
 - GLP1s \$25 per month copay card
- Medicaid
 - Most plans cover ONE formulary SGLT2 inhibitor and GLP1 agonist
 - Prior auths may work for patients with CAD (liraglutide, empagliflozin)
- Medicare
 - Dual Medicare/Medicaid: usually covered with low copay
 - Medicare patients: could be considered as an alternative to prandial insulin, but otherwise not generally affordable due to coverage gap

Case Scenarios

CASE 1: ASCVD RISK REDUCTION

62 year old male

PMH: DM, history of MI (2 years ago), hypertension

Point of care A1c 8.5%, not having any hypoglycemia

DM Meds: Metformin 1000 mg BID, Lantus® 20 units QHS

He has commercial insurance

What would you add (all on his insurance formulary)?

- A. Glipizide (sulfonylurea)
- B. Sitagliptin (DPP4 inhibitor)
- C. Empagliflozin (SGLT2 inhibitor)
- D. Insulin aspart (rapid-acting insulin)
- E. Dulaglutide (once weekly GLP1 agonist)

CASE 1 CONTINUED

You decide to start him on empagliflozin (Jardiance™). On lisinopril 40 mg, carvedilol 12.5 mg BID and HCTZ 12.5 mg, his clinic blood pressures typically run 110s/60s.

How would you dose empagliflozin and would you adjust any of his other medications?

- Empagliflozin 10 mg once a day (may increase to 25 mg if 10 mg well-tolerated)
- Discontinue HCTZ, encourage fluids
- Continue same dose Lantus® 20 units

CASE 2: FACILITATING WEIGHT LOSS

55 year old female

PMH: Diabetes x 3 years, dyslipidemia, recurrent UTI, knee pain

Meds: Metformin 1000 mg BID, Levemir[®] (insulin detemir) 45 units BID, atorvastatin 10 mg daily, aspirin 81 mg daily

Recent A1c 7.2%. She has mild hypoglycemia (60s-70s) twice a month.

BMI 41kg/m².

She wants to lose weight and is exercising and trying to reduce her portions. What would you recommend? She has a Medicaid plan that covers the following options:

- A. Pioglitazone (TZD)
- B. Alogliptin (DPP4 inhibitor)
- C. Canagliflozin (SGLT2 inhibitor)
- D. Liraglutide (once daily GLP1 agonist)

CASE 2 CONTINUED

- How would you start liraglutide (Victoza[®]) and would you adjust any of her other medications?
- Victoza[®] 0.6 mg daily for 1 week. Increase after 1 week if tolerated to 1.2 mg daily.
- Reduce portion sizes!
- Decrease insulin detemir from 45 to 40 units twice a day (10%).
- Will likely need further reductions of insulin as liraglutide is increased to 1.8 mg and as she successfully loses weight.

CASE 2 CONTINUED

She returns to your clinic stating that is very pleased with the liraglutide. She has lost 4 kg in the last month! When you ask about nausea, she states she is vomiting almost every day in the mornings after taking liraglutide. She is using 1.2 mg on most days, but admits she sometimes forgets for a few days in a row.

What would you tell her?

- Important to take the medicine consistently to avoid nausea/vomiting.
- Try backing down to 0.6 mg until well tolerated.



CASE 3: INCONSISTENT INSULIN TIMING

67 year old female

PMH: T2DM, CKD, neuropathy, gastroparesis

A1c 8.7%, eGFR 29 ml/min

Meds: Glipizide 10 mg BID, Lantus[®] 45 units once a day

Silverscript Medicare

She often forgets her medicine. She gets busy taking care of grandkids and remembers later in the day but skips the dose.

Silverscript no longer covers Lantus. Which of these Tier 2 formulary options would you choose?

- Basaglar[®] (insulin glargine)
- Levemir[®] (insulin detemir)
- Tresiba[®] (insulin degludec)

CASE 4: PRANDIAL INSULIN ADHERENCE

- 68 year old female
- PMH: DM2, HTN, neuropathy, CKD
- A1c 8.5%, eGFR 32
- DM Meds: Lantus® 60 units QAM, Humalog® 10-20 units with meals. Trouble remembering mealtime insulin despite multiple attempts at strategies. As a result, glucose levels are sometimes at goal and sometimes 300s.
- Coverage: Medicare Part D
- What would you do?
 - D/C Humalog®
 - Start GLP1 receptor agonist once daily or once weekly
 - Titrate basal insulin as needed

Questions

