



DPP-4 Inhibitors

Their Place in Type 2 Diabetes Treatment

&

New Guidelines

Objectives

- DPP-4 inhibitors in ADA guideline
- DPP-4 inhibitors Mechanism of Action
- Sitagliptin Efficacy
- Linagliptin Efficacy
- Diabetes Guidelines (ADA 2021 and AACE)
- Conclusion

FIRST-LINE Therapy is Metformin and Comprehensive Lifestyle (including weight management and physical activity)

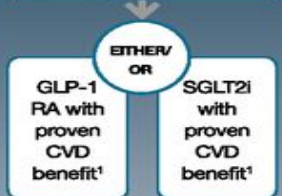


INDICATORS OF HIGH-RISK OR ESTABLISHED ASCVD, CKD, OR HF†

CONSIDER INDEPENDENTLY OF BASELINE A1C, INDIVIDUALIZED A1C TARGET, OR METFORMIN USE*

+ASCVD/Indicators of High Risk

- Established ASCVD
- Indicators of high ASCVD risk (age ≥55 years with coronary, carotid, or lower-extremity artery stenosis >50%, or LVH)



If A1C above target

If further intensification is required or patient is unable to tolerate GLP-1 RA and/or SGLT2i, choose agents demonstrating CV benefit and/or safety:

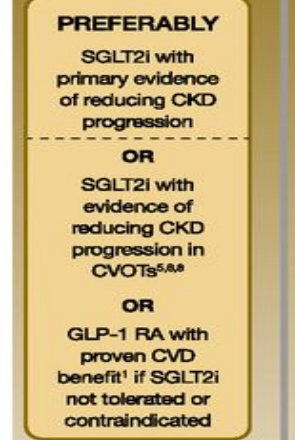
- For patients on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit and vice versa¹
- TZD²
- DPP-4i if not on GLP-1 RA
- Basal insulin³
- SU⁴

+HF

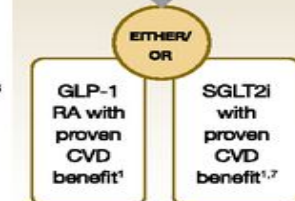
- Particularly HFrEF (LVEF <45%)
- SGLT2i with proven benefit in this population^{5,6,7}

+CKD

DKD and Albuminuria⁹



For patients with T2D and CKD⁹ (e.g., eGFR <60 mL/min/1.73 m²) and thus at increased risk of cardiovascular events

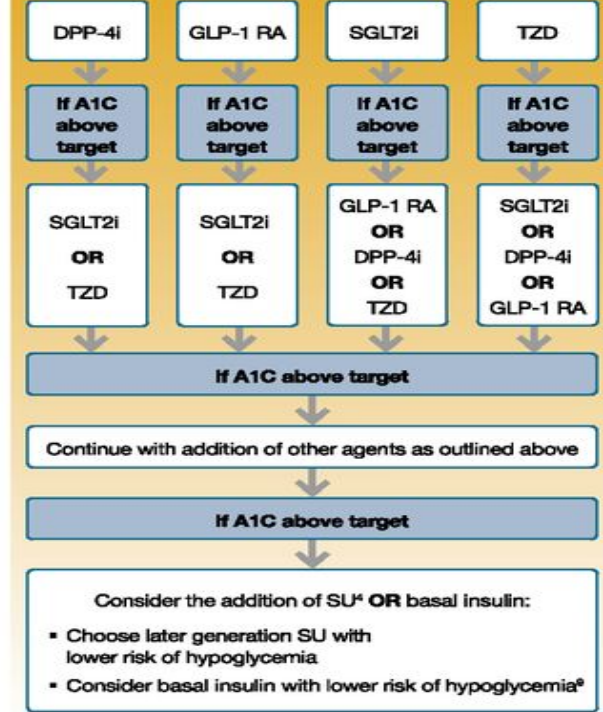


- Proven CVD benefit means it has label indication of reducing CVD events
- Low dose may be better tolerated though less well studied for CVD effects
- Degludec or U-100 glargine have demonstrated CVD safety
- Choose later generation SU to lower risk of hypoglycemia; glimepiride has shown similar CV safety to DPP-4i
- Be aware that SGLT2i labelling varies by region and individual agent with regard to indicated level of eGFR for initiation and continued use
- Empagliflozin, canagliflozin, and dapagliflozin have shown reduction in HF and to reduce CKD progression in CVOTs. Canagliflozin and dapagliflozin have primary renal outcome data. Dapagliflozin and empagliflozin have primary heart failure outcome data.

NO

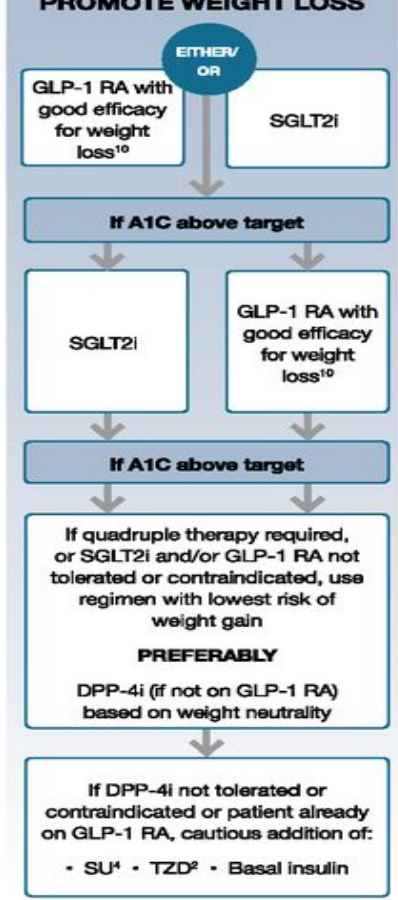
IF A1C ABOVE INDIVIDUALIZED TARGET PROCEED AS BELOW

COMPELLING NEED TO MINIMIZE HYPOGLYCEMIA



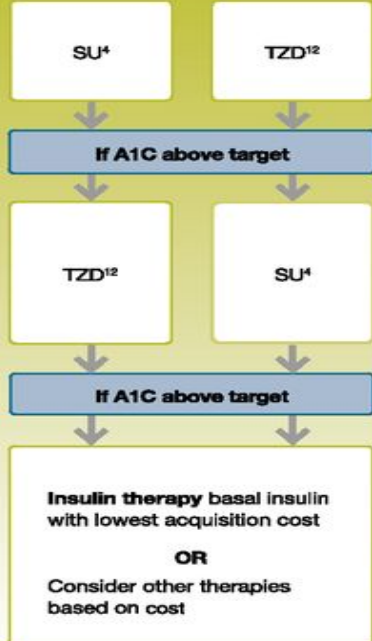
- Proven benefit means it has label indication of reducing heart failure in this population
- Refer to Section 11: Microvascular Complications and Foot Care
- Degludec / glargine U-300 < glargine U-100 / detemir < NPH Insulin
- Semaglutide > liraglutide > dulaglutide > exenatide > lixisenatide
- If no specific comorbidities (i.e., no established CVD, low risk of hypoglycemia, and lower priority to avoid weight gain or no weight-related comorbidities)
- Consider country- and region-specific cost of drugs. In some countries TZDs are relatively more expensive and DPP-4i are relatively cheaper.

COMPELLING NEED TO MINIMIZE WEIGHT GAIN OR PROMOTE WEIGHT LOSS



† Actioned whenever these become new clinical considerations regardless of background glucose-lowering medications.
* Most patients enrolled in the relevant trials were on metformin at baseline as glucose-lowering therapy.

COST IS A MAJOR ISSUE^{11,12}

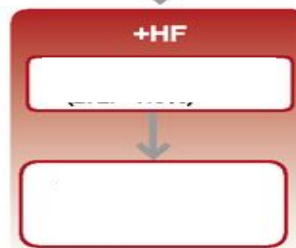


FIRST-LINE Therapy is Metformin and Comprehensive Lifestyle (including weight management and physical activity)



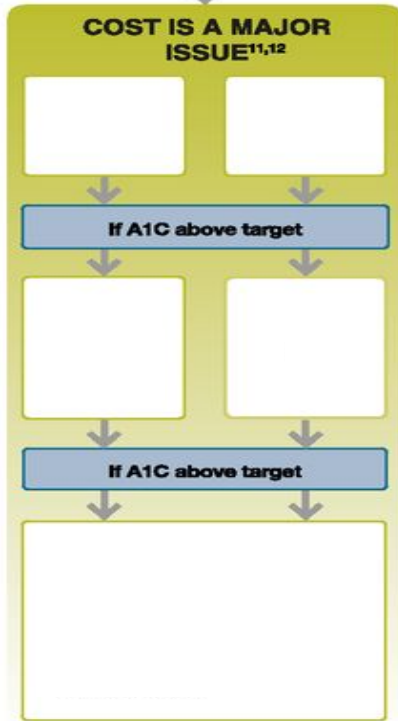
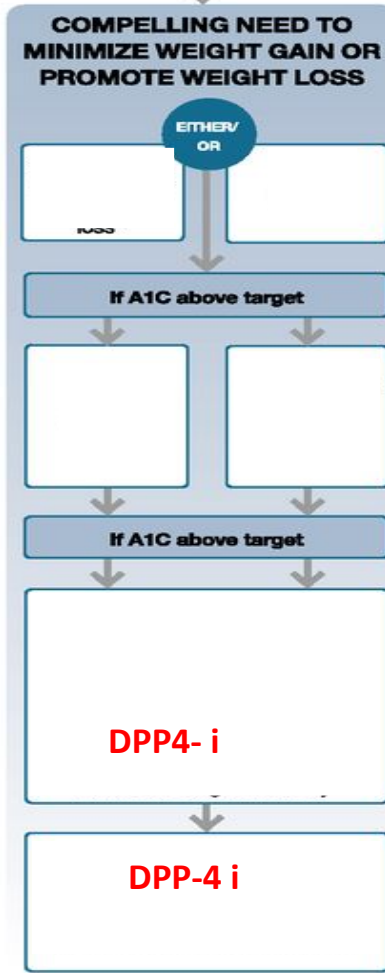
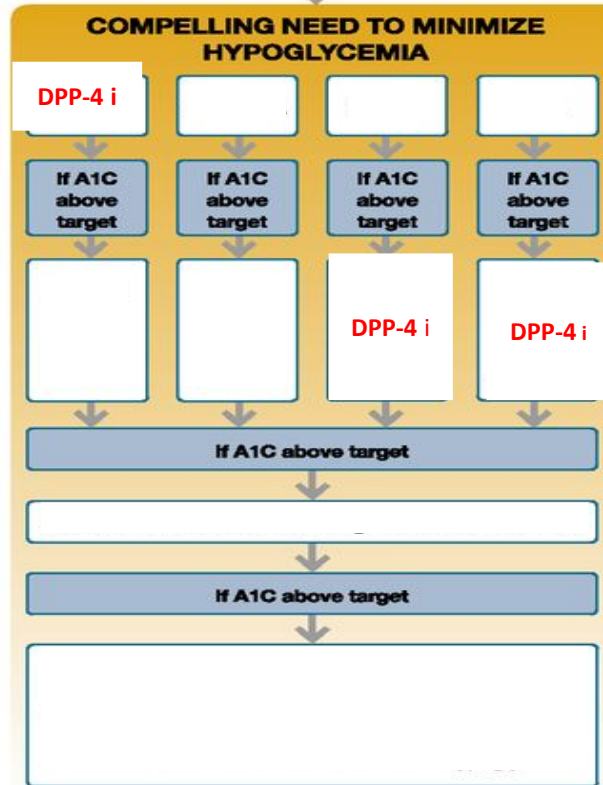
INDICATORS OF HIGH-RISK OR ESTABLISHED ASCVD, CKD, OR HF†

CONSIDER INDEPENDENTLY OF BASELINE A1C, INDIVIDUALIZED A1C TARGET, OR METFORMIN USE*



NO

IF A1C ABOVE INDIVIDUALIZED TARGET PROCEED AS BELOW



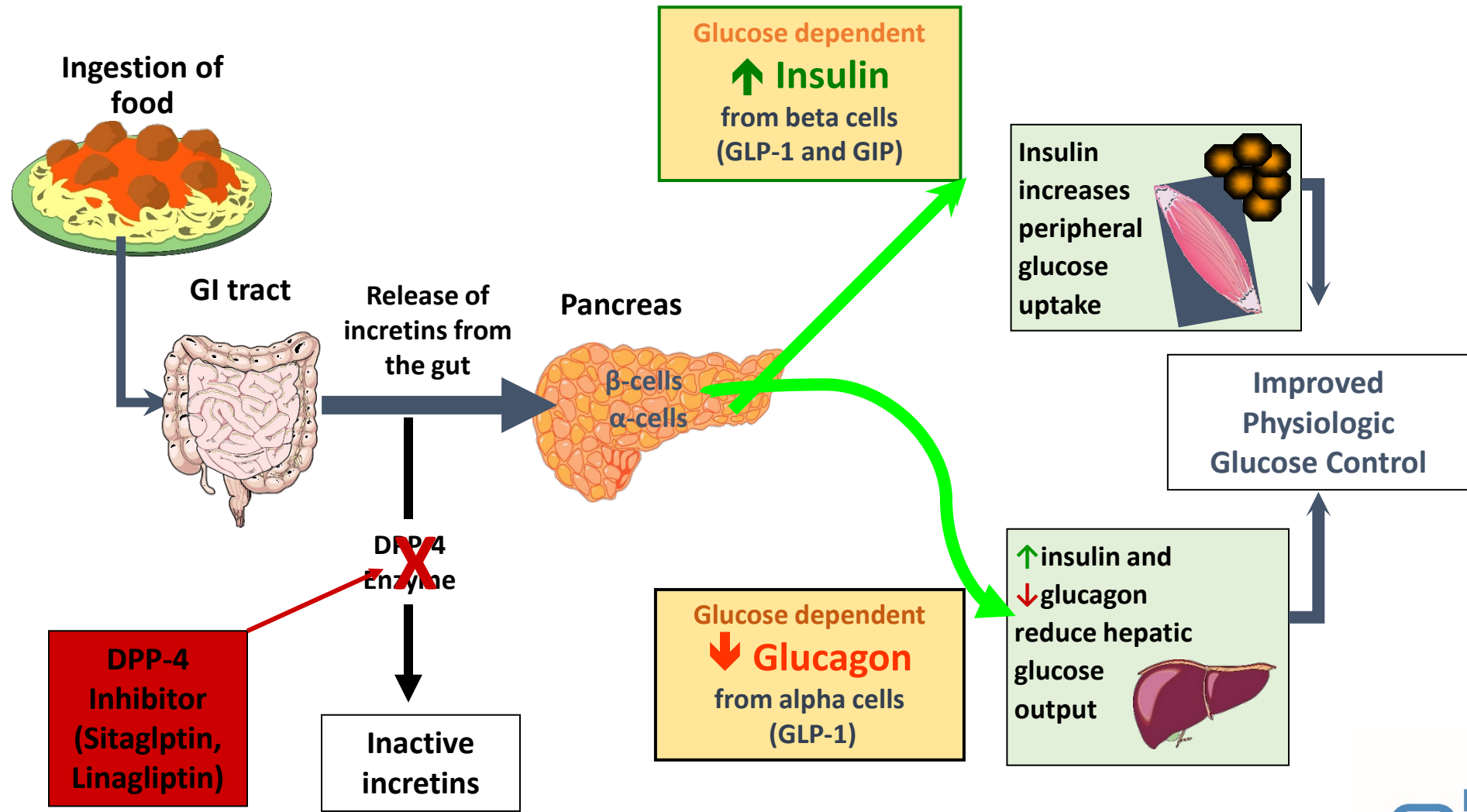
1. Proven CVD benefit means it has label indication of reducing CVD events
2. Low dose may be better tolerated though less well studied for CVD effects
3. Degludec or U-100 glargine have demonstrated CVD safety
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5. Be aware that SGLT2i labelling varies by region and individual agent with regard to indicated level of eGFR for initiation and continued use
6. Empagliflozin, canagliflozin, and dapagliflozin have shown reduction in HF and to reduce CKD progression in CVOTs. Canagliflozin and dapagliflozin have primary renal outcome data. Dapagliflozin and empagliflozin have primary heart failure outcome data.

7. Proven benefit means it has label indication of reducing heart failure in this population
8. Refer to Section 11: Microvascular Complications and Foot Care
9. Degludec / glargine U-300 < glargine U-100 / detemir < NPH Insulin
10. Semaglutide > liraglutide > dulaglutide > exenatide > lixisenatide
11. If no specific comorbidities (i.e., no established CVD, low risk of hypoglycemia, and lower priority to avoid weight gain or no weight-related comorbidities)
12. Consider country- and region-specific cost of drugs. In some countries TZDs are relatively more expensive and DPP-4i are relatively cheaper.

† Actioned whenever these become new clinical considerations regardless of background glucose-lowering medications.
* Most patients enrolled in the relevant trials were on metformin at baseline as glucose-lowering therapy.

- **DPP-4 inhibitors Mechanism of Action**

DPP-4 Inhibitors Improve Glucose Control by Increasing Incretin Levels in Type 2 Diabetes¹⁻⁴

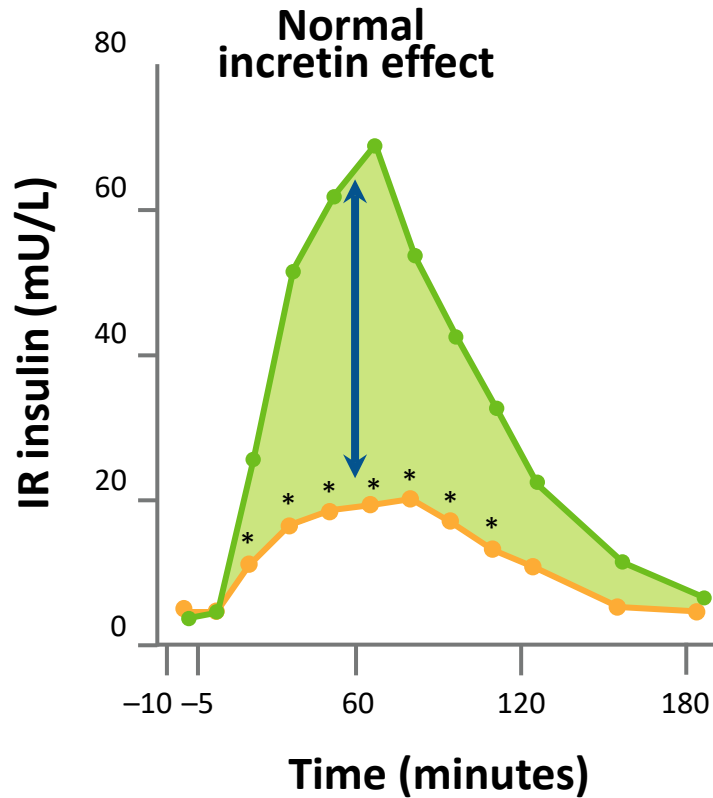


DPP-4 = dipeptidyl peptidase 4

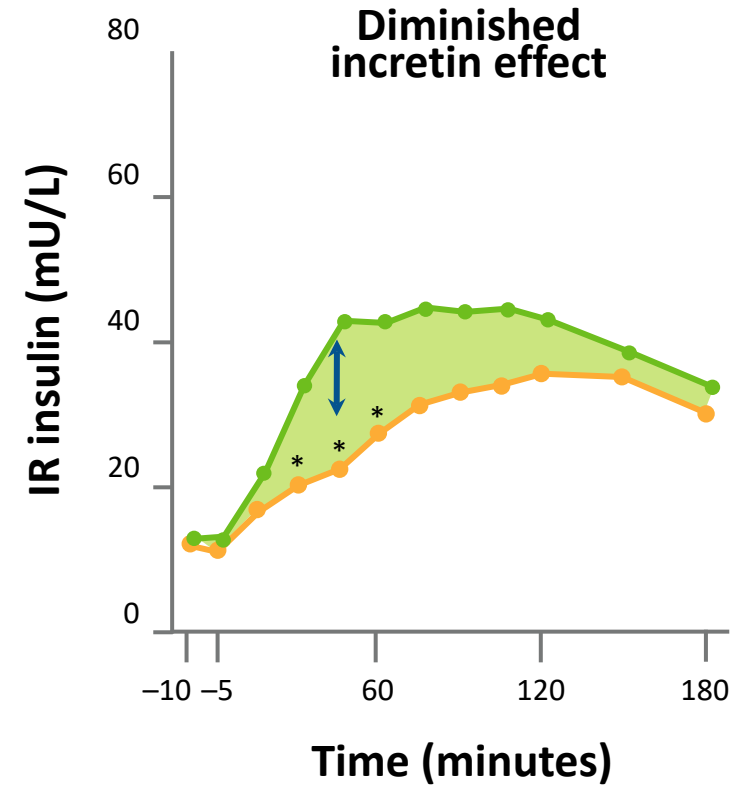
1-Endocrinology. 2004 ;145(6):2653-9. 2- Lancet. 2002 ;359(9309):824-30; 3-Curr Diab Rep. 2003;3(5):365-72; 4-Buse JB et al. In *Williams Textbook of Endocrinology*. 10th ed., 2003:1427-1483.

The Effect of Incretins in Type 2 Diabetes and Non-Diabetics¹

Healthy controls



Type 2 diabetes

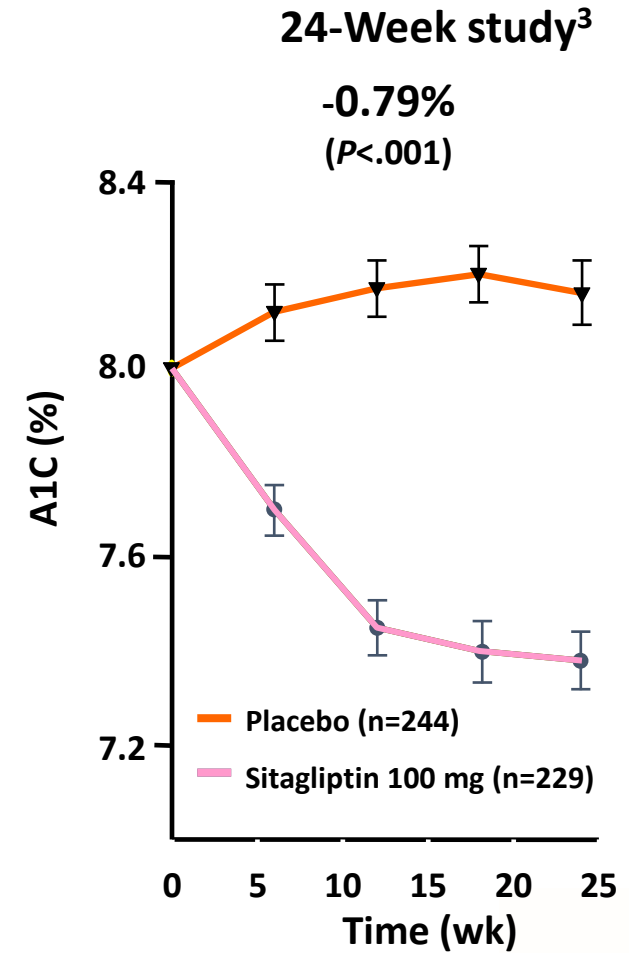
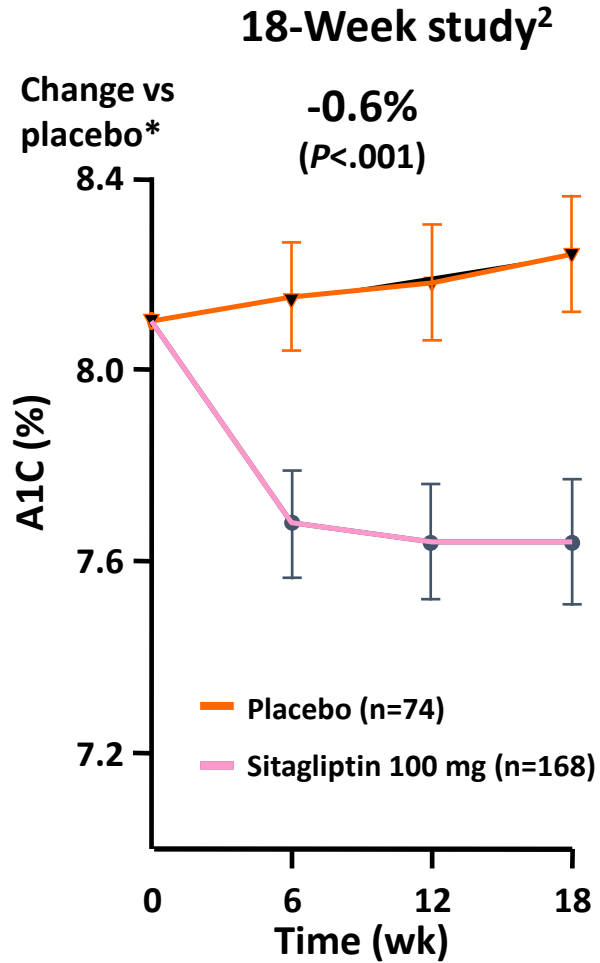
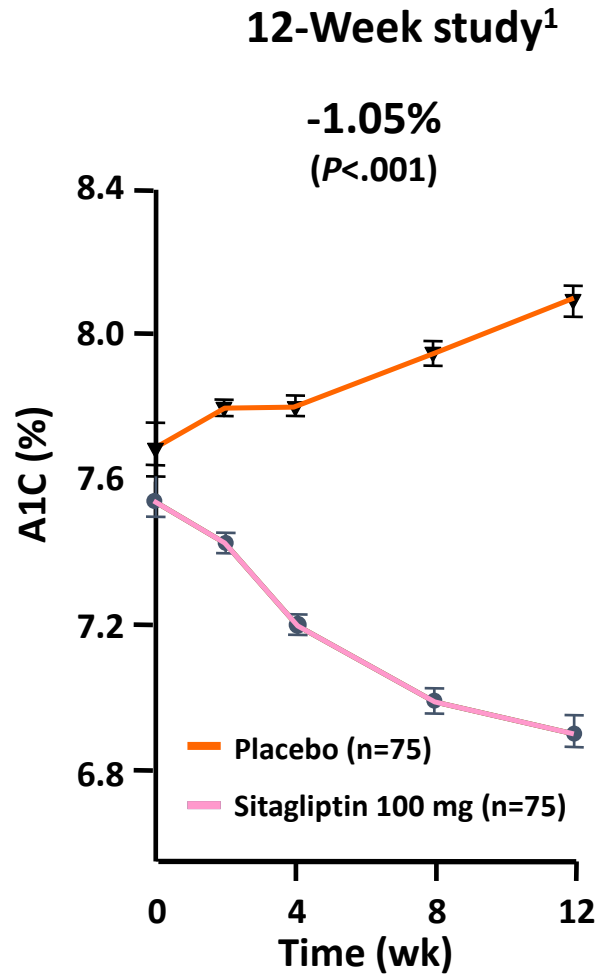


● Oral glucose load

● Intravenous (IV) glucose infusion

- **Sitagliptin Efficacy**

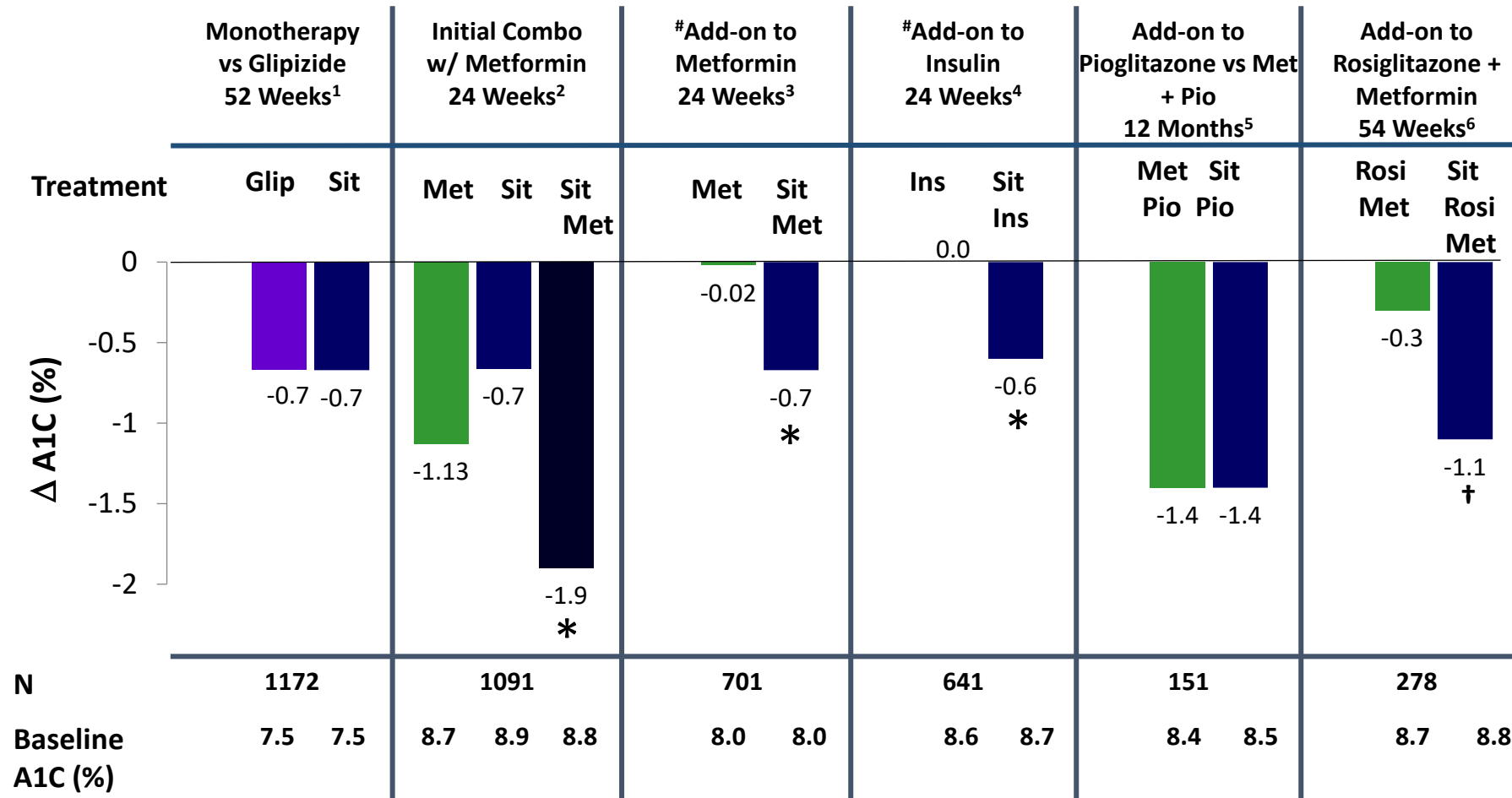
Sitagliptin Consistently and Significantly Lowers A1C With Once-Daily Dosing in Monotherapy



*Between group difference in LS means.

1. Diabetes Care. 2006;29(12):2632-7. 2- Diabetes Res Clin Pract. 2008 ;79(2):291-8 . 3. Diabetologia. 2006 ;49(11):2564-71.

Glucose Control With Sitagliptin in Different Studies



* $P < 0.001$ vs active comparator monotherapy. † $P < 0.001$ vs active comparator dual therapy. # Compare to placebo. Met: Metformin; Sit= Sitagliptin; Glip=Glipizide; Ins=Insulin; Pio=Pioglitazone, Rosi=Rosiglitazone .

1. Diabetes Obes Metab. 2007 ;9(2):194-205; 2. Diabetes Care. 2007 ;30(8):1979-87. 3. Diabetes Care. 2006;29(12):2638-43.;4. Diabetes Obes Metab. 2010;12(2):167-77.

5. Metabolism. 2010 ;59(6):887-95.; 6. J Diabetes. 2013r;5(1):68-79

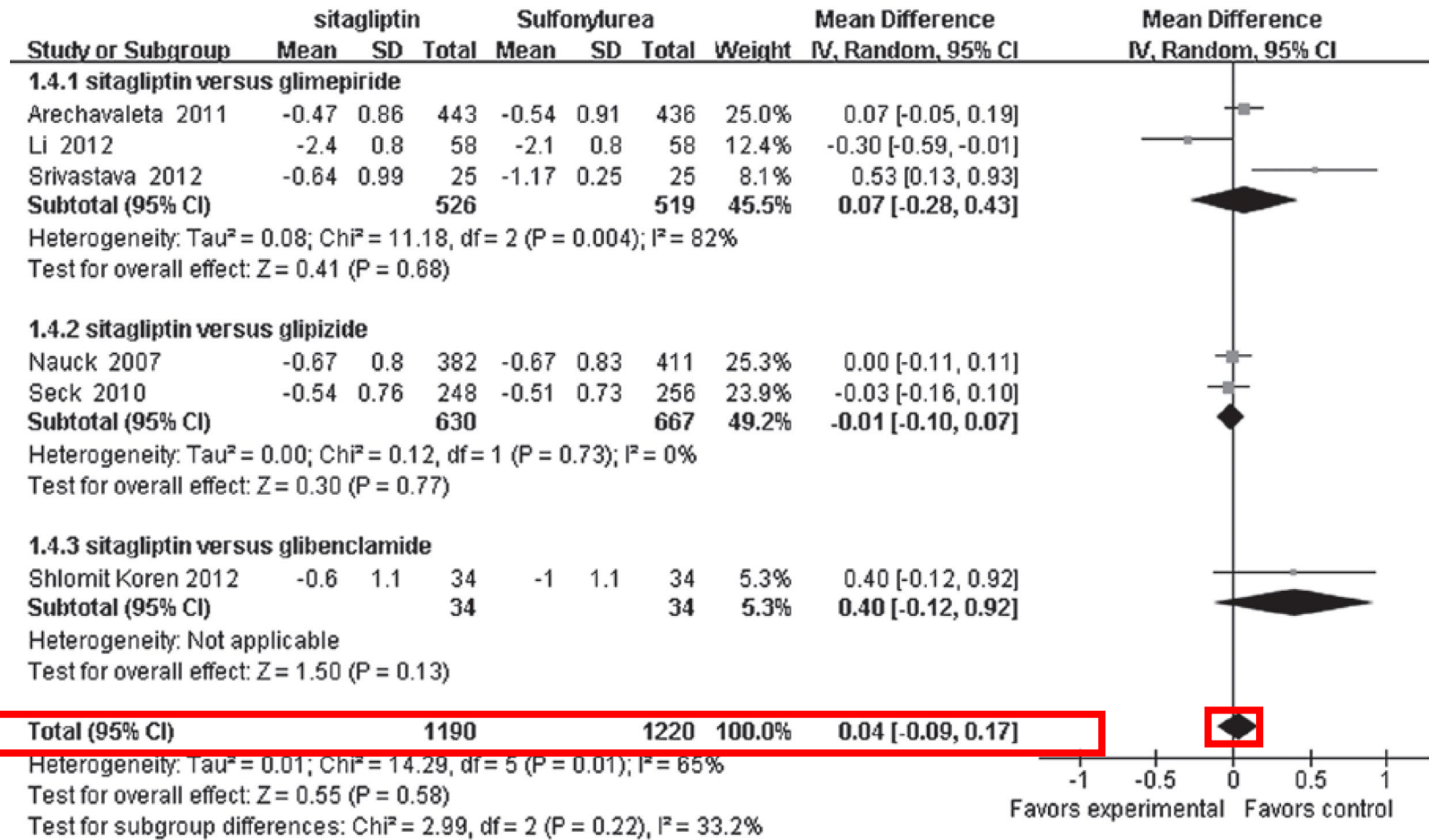
Efficacy and safety of sitagliptin compared with sulfonylurea therapy in patients with type 2 diabetes showing inadequately controlled glycosylated hemoglobin with metformin monotherapy: A meta-analysis

LIQIONG HOU, TIEYUN ZHAO, YUNHUI LIU and YIYI ZHANG

Department of Endocrinology and Metabolism, West China Hospital of Sichuan University,
Chengdu, Sichuan 610000, P.R. China

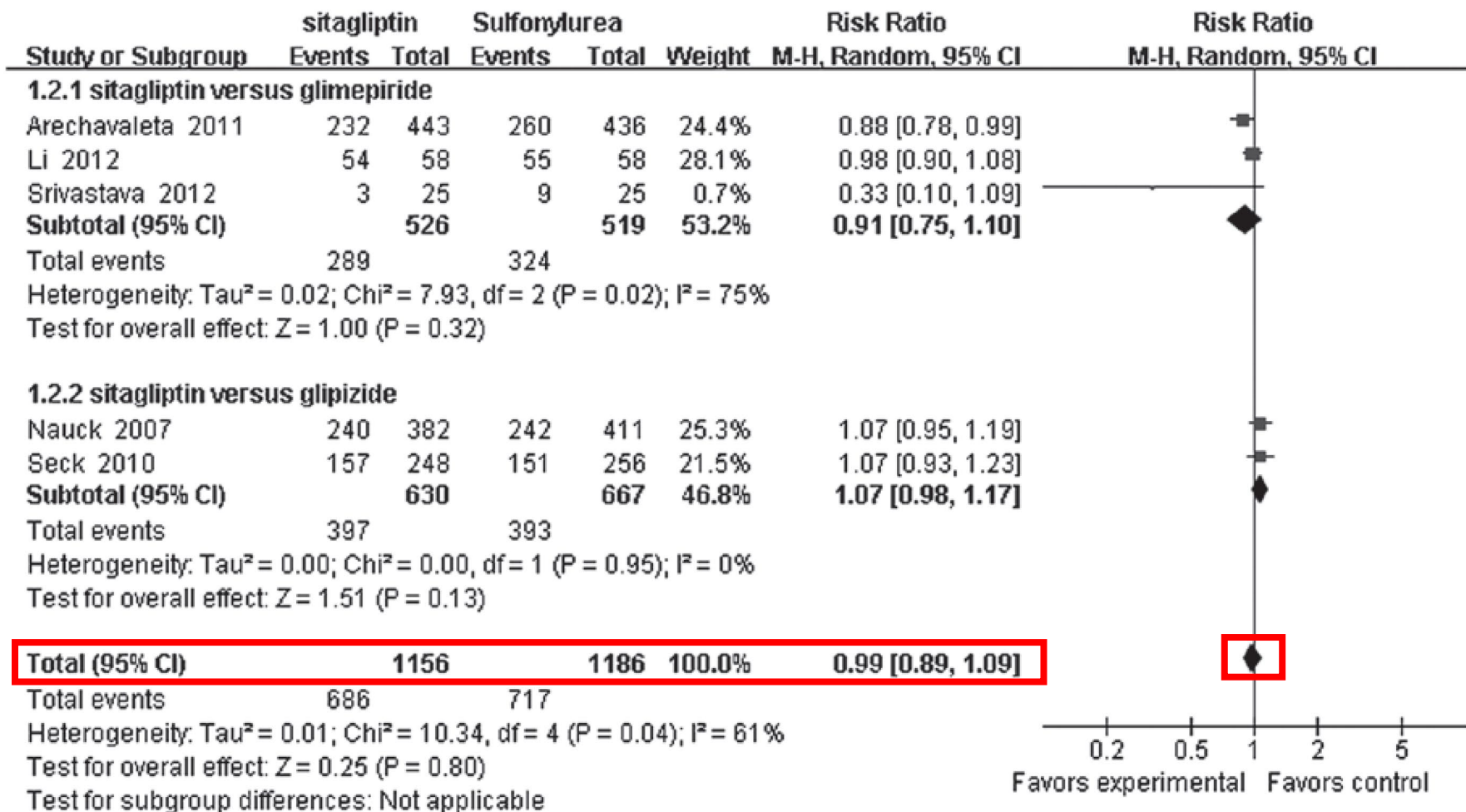
Received June 18, 2014; Accepted January 26, 2015

Hba1c Changes Were not Significant Between Sitagliptin and Sulfonylurea Groups¹



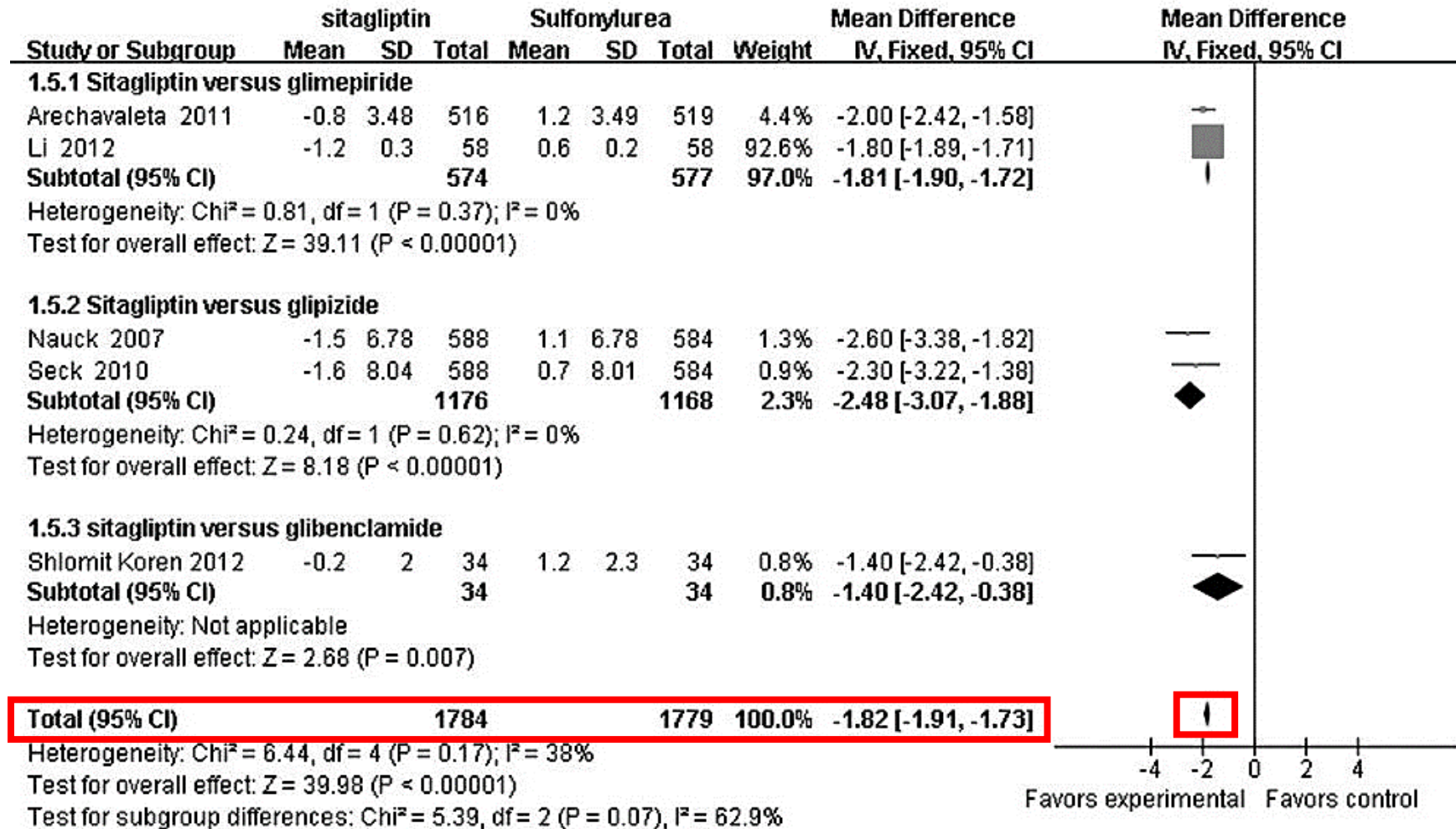
SD, standard deviation; CI, confidence interval; df, degrees of freedom.
1-Exp Ther Med. 2015; 9(4): 1528–1536.

Achievements of <7% HbA1c Target Were not Significant Between Sitagliptin and Sulfonylurea Groups¹



M-H, Mantel-Haenszel; CI, confidence interval
1-Exp Ther Med. 2015; 9(4): 1528–1536.

Sitagliptin Groups Did not Experience Weight Gain Compared to Sulfonylurea Groups¹



SD, standard deviation; CI, confidence interval
1-Exp Ther Med. 2015; 9(4): 1528–1536.

Lower Occurrence of Hypoglycemic Events in Sitagliptin Groups Compared to Sulfonylurea Groups¹

1.1.1 Sitagliptin versus glimepiride

Arechavaleta 2011	36	516	114	518	30.2%	0.32 [0.22, 0.45]
Li 2012	1	58	4	58	3.4%	0.25 [0.03, 2.17]
Srivastava 2012	1	25	2	25	2.9%	0.50 [0.05, 5.17]
Subtotal (95% CI)		599		601	36.5%	0.32 [0.23, 0.45]

Total events 38 120
 Heterogeneity: Tau² = 0.00; Chi² = 0.19, df = 2 (P = 0.91); I² = 0%
 Test for overall effect: Z = 6.49 (P < 0.00001)

1.1.2 Sitagliptin versus glipizide

Nauck 2007	29	588	187	584	29.5%	0.15 [0.11, 0.22]
Seck 2010	31	588	199	584	30.0%	0.15 [0.11, 0.22]
Subtotal (95% CI)		1176		1168	59.5%	0.15 [0.12, 0.20]

Total events 60 386
 Heterogeneity: Tau² = 0.00; Chi² = 0.00, df = 1 (P = 0.99); I² = 0%
 Test for overall effect: Z = 14.10 (P < 0.00001)

1.1.3 sitagliptin versus glibenclamide

Shlomit Koren 2012	1	34	14	34	4.0%	0.07 [0.01, 0.51]
Subtotal (95% CI)		34		34	4.0%	0.07 [0.01, 0.51]

Total events 1 14
 Heterogeneity: Not applicable
 Test for overall effect: Z = 2.62 (P = 0.009)

Total (95% CI)	1809	1803	100.0%	0.20 [0.13, 0.30]
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Total events 99 520
 Heterogeneity: Tau² = 0.12; Chi² = 12.15, df = 5 (P = 0.03); I² = 59%
 Test for overall effect: Z = 7.69 (P < 0.00001)



M-H, Mantel-Haenszel; CI, confidence interval
 1-Exp Ther Med. 2015; 9(4): 1528–1536.

ORIGINAL ARTICLE

Effect of Sitagliptin on Cardiovascular Outcomes in Type 2 Diabetes

Jennifer B. Green, M.D., M. Angelyn Bethel, M.D., Paul W. Armstrong, M.D.,
John B. Buse, M.D., Ph.D., Samuel S. Engel, M.D., Jyotsna Garg, M.S.,
Robert Josse, M.B., B.S., Keith D. Kaufman, M.D., Joerg Koglin, M.D.,
Scott Korn, M.D., John M. Lachin, Sc.D., Darren K. McGuire, M.D., M.H.Sc.,
Michael J. Pencina, Ph.D., Eberhard Standl, M.D., Ph.D., Peter P. Stein, M.D.,
Shailaja Suryawanshi, Ph.D., Frans Van de Werf, M.D., Ph.D.,
Eric D. Peterson, M.D., M.P.H., and Rury R. Holman, M.B., Ch.B.,
for the TECOS Study Group*

Aim¹: the long-term effect on cardiovascular events of adding sitagliptin, a dipeptidyl peptidase 4 inhibitor, to usual care in patients with type 2 diabetes and cardiovascular disease.

Sitagliptin Cardiovascular Outcomes Study (TECOS) Study Design¹

Main inclusion criteria

1. Patients aged ≥ 50 years with T2D
2. HbA_{1c} 6.5–8.0% receiving stable oral glucose-lowering therapy and/or insulin*
3. Pre-existing vascular disease

+ Usual care for T2D

Sitagliptin 100 mg daily*

vs

Placebo

N = 14,671; median follow-up 3.0 years

Primary endpoint: time to first occurrence of:

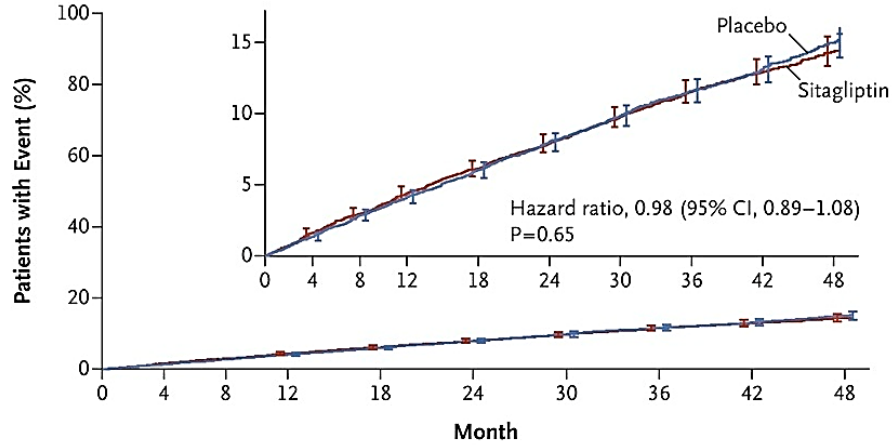
- CV-related death
- Unstable angina requiring hospitalisation
- Non-fatal stroke
- Non-fatal MI

*50 mg daily if the baseline eGFR was ≥ 30 and < 50 mL per minute per 1.73 m².

¹N Engl J Med. 2015.16;373(3):232-42

Results¹

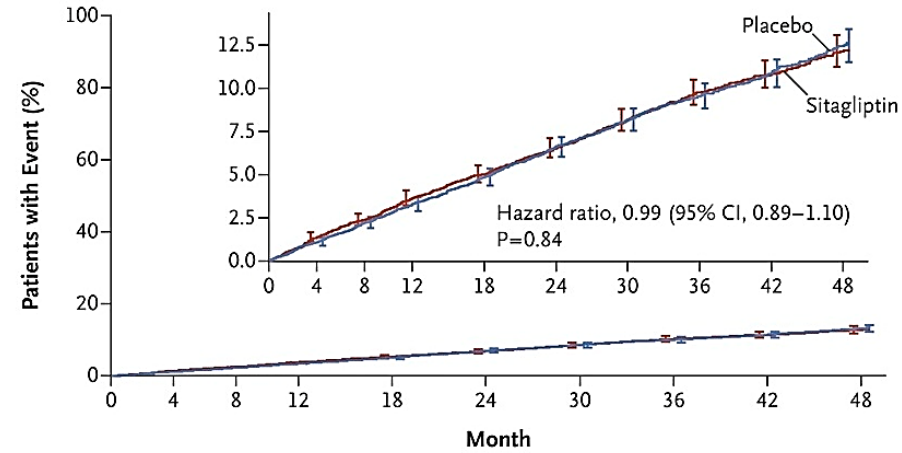
Primary Composite Cardiovascular Outcome[#]



No. at Risk

Sitagliptin	7332	7131	6937	6777	6579	6386	4525	3346	2058	1248
Placebo	7339	7146	6902	6751	6512	6292	4411	3272	2034	1234

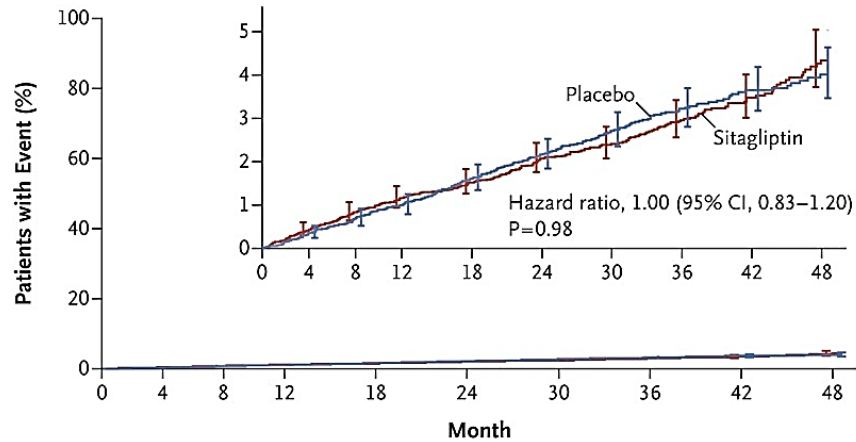
Secondary Composite Cardiovascular Outcome*



No. at Risk

Sitagliptin	7332	7145	6969	6817	6638	6457	4584	3396	2097	1270
Placebo	7339	7161	6939	6796	6573	6359	4472	3332	2070	1260

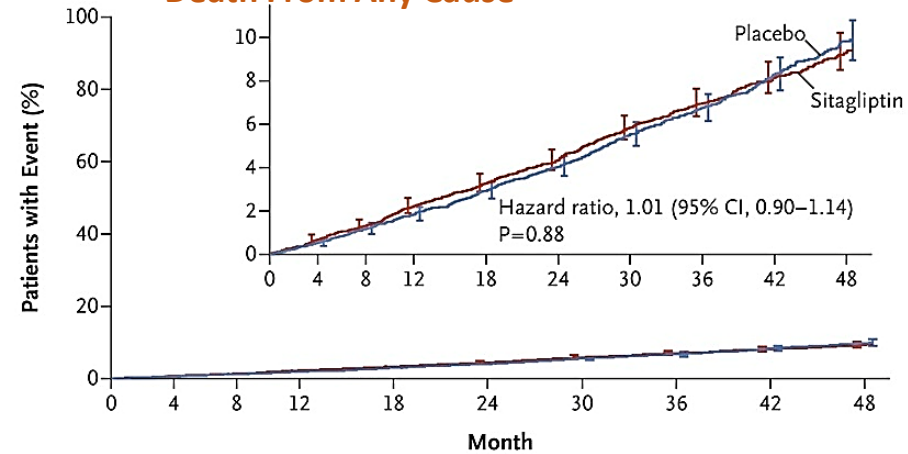
Hospitalization for Heart Failure



No. at Risk

Sitagliptin	7332	7189	7036	6917	6780	6619	4728	3515	2175	1324
Placebo	7339	7204	7025	6903	6712	6549	4599	3443	2131	1315

Death From Any Cause



No. at Risk

Sitagliptin	7332	7262	7180	7103	7010	6904	4964	3739	2321	1435
Placebo	7339	7271	7176	7098	6982	6864	4891	3673	2293	1412

[#]The primary composite cardiovascular outcome was defined as the first confirmed event of cardiovascular death, nonfatal myocardial infarction, nonfatal stroke, or hospitalization for unstable angina. ^{*}The secondary composite cardiovascular outcome was the first confirmed event of cardiovascular death, nonfatal myocardial infarction, or nonfatal stroke.

1-N Engl J Med. 2015. 16;373(3):232-42

Conclusion:

- Among patients with type 2 diabetes and established cardiovascular disease, adding **sitagliptin** to usual care **did not** appear to increase the risk of major adverse cardiovascular events, hospitalization for heart failure, or other adverse events.

Dosage and Administration

Sitagliptin: Once-Daily Dosing Administration¹

Usual Dosing for Sitagliptin*

The recommended dose of Sitagliptin is 100 mg once daily as monotherapy or as combination therapy with metformin or a PPAR γ agonist.

Patients With Renal Insufficiency*,†

A dosage adjustment is recommended in patients with moderate or severe renal insufficiency and in patients with end-stage renal disease requiring hemodialysis or peritoneal dialysis.

50 mg once daily	25 mg once daily
<u>Moderate</u> eGFR greater than or equal to 30 mL/min/1.73 m ² to less than 45 mL/min/1.73 m ²	<u>Severe and ESRD[‡]</u> eGFR less than 30 mL/min/1.73 m ² (including patients with end stage renal disease [ESRD] on dialysis)

Assessment of renal function is recommended prior to Sitagliptin initiation and periodically thereafter.

*Sitagliptin can be taken with or without food. †Patients with mild renal insufficiency—100 mg once daily.

‡ESRD=end-stage renal disease requiring hemodialysis or peritoneal dialysis.

¹-Sitagliptin FDA Label, 2018, Reference ID: 4219849.

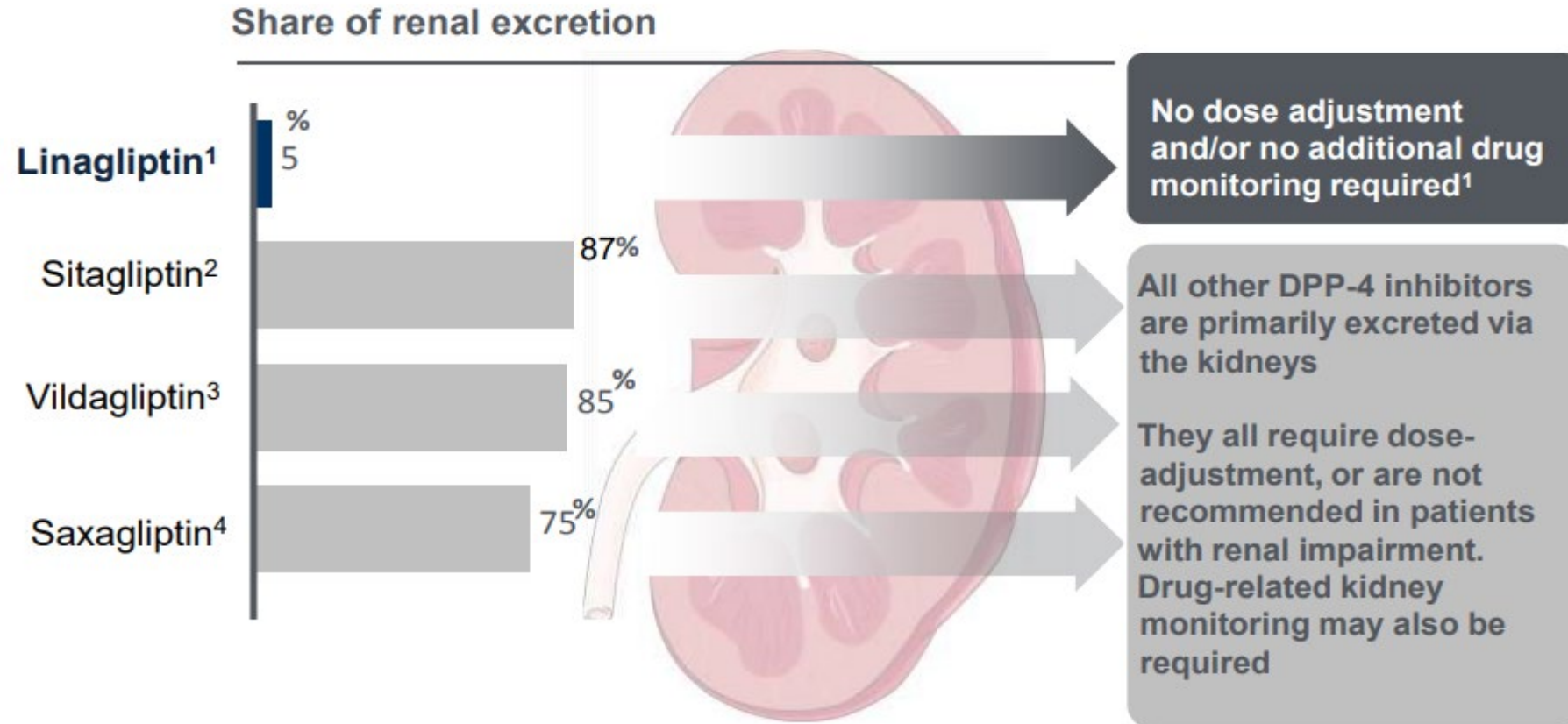
PPAR γ agonist= Thiazolidinedione class.

Sitagliptin + Metformin: Twice-Daily Dosing Administration¹

- Individualize the starting dose of Sitagliptin +Metformin based on the patient's current regimen.
- Adjust the dosing based on effectiveness and tolerability;
 - not exceeding the maximum recommended daily dose:
(100 mg sitagliptin and 2000 mg metformin).
- Twice daily with meals, with gradual dose escalation:
 - to reduce the gastrointestinal effects due to metformin.
 - Not use in eGFR <30 mL/min/1.73 m².
 - Not recommended in eGFR between 30 to <45 mL/min/1.73 m².

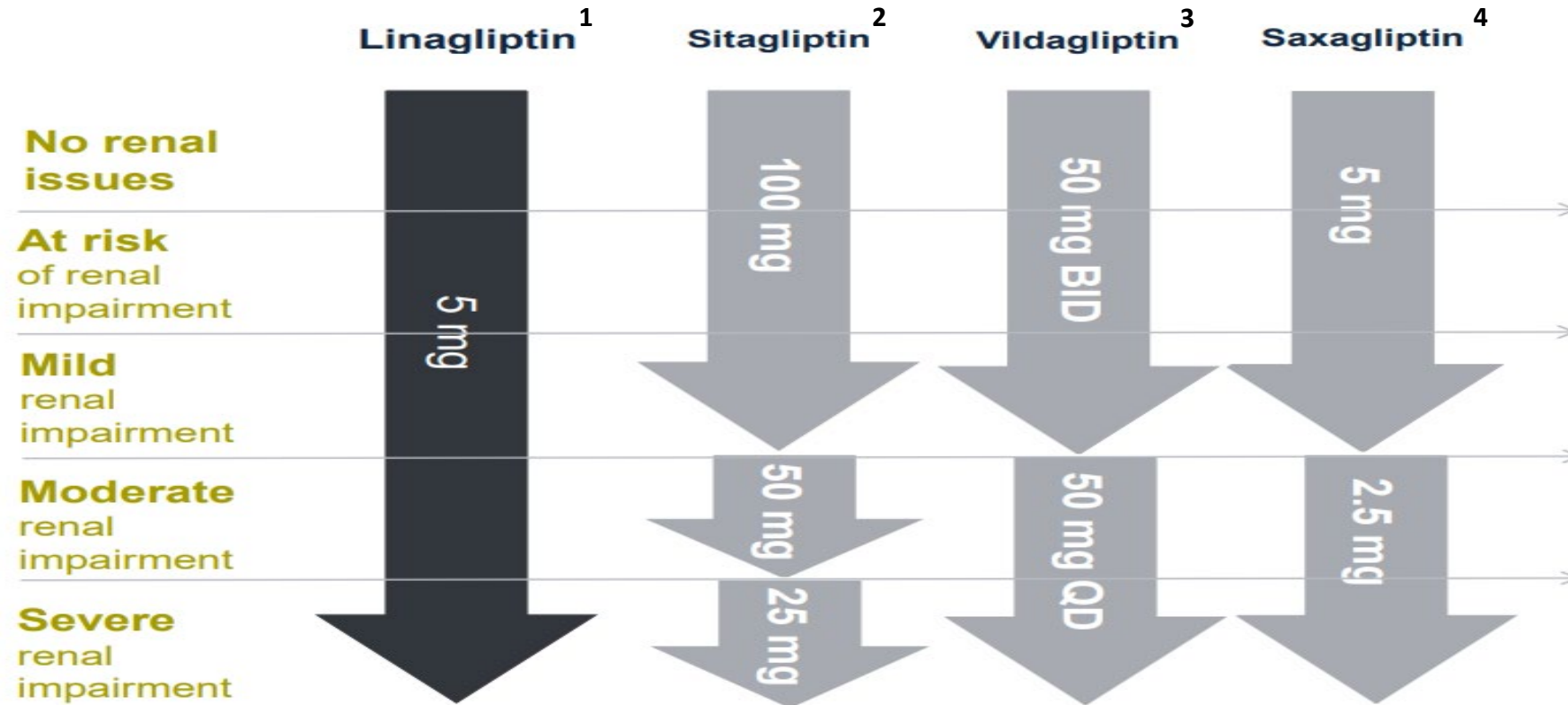
- **Linagliptin Efficacy**

Linagliptin is the only DPP-4 inhibitor which is primarily excreted by gut

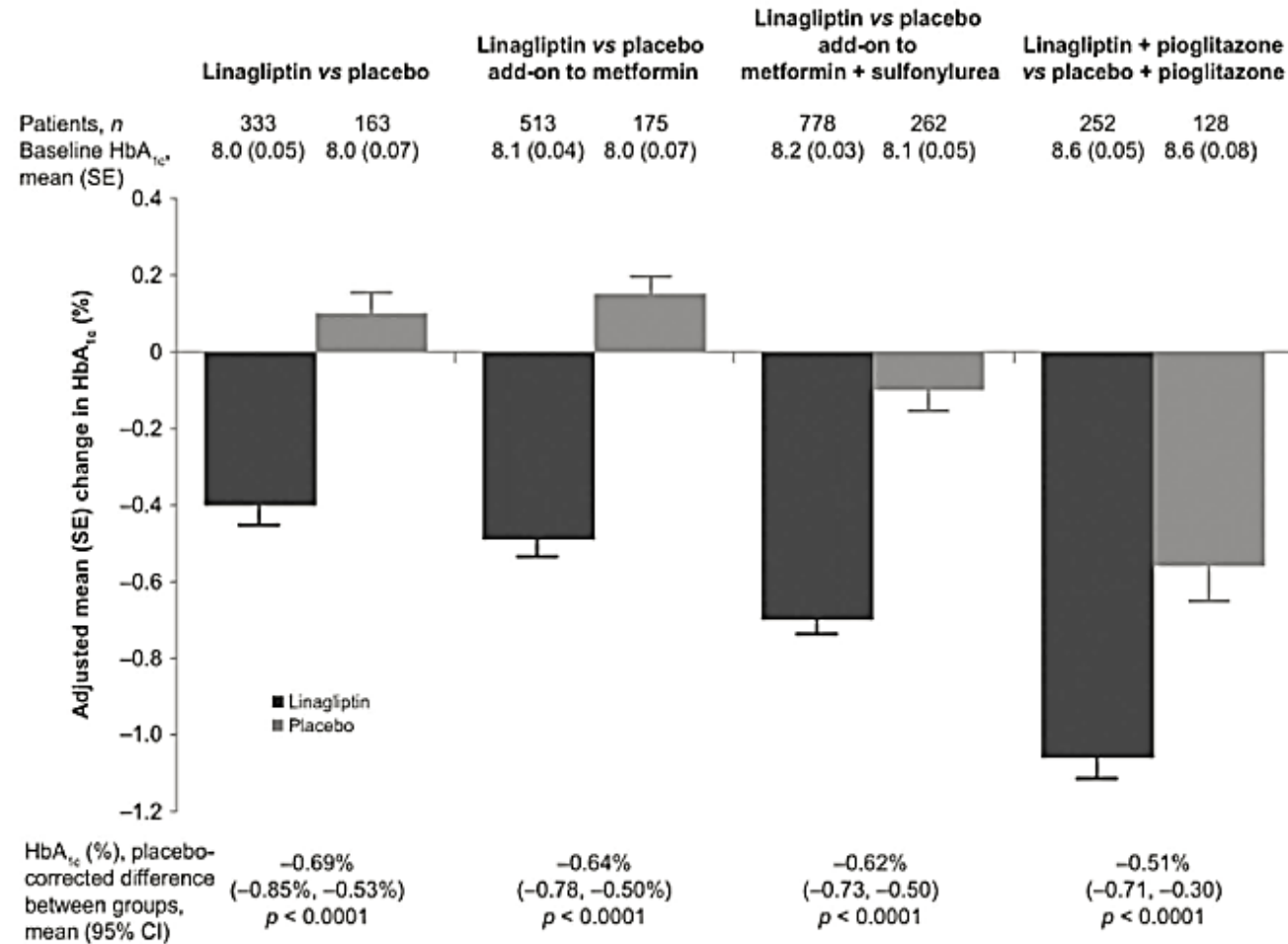


1. Linagliptin US prescribing information , 2. Vincent SH et al. Drug Metab Dispos. 2007;35(4): 533–538 , 3. He H, et al. Drug Metab. Dispos.2009 37(3):536–544 , 4. Saxagliptin US prescribing information

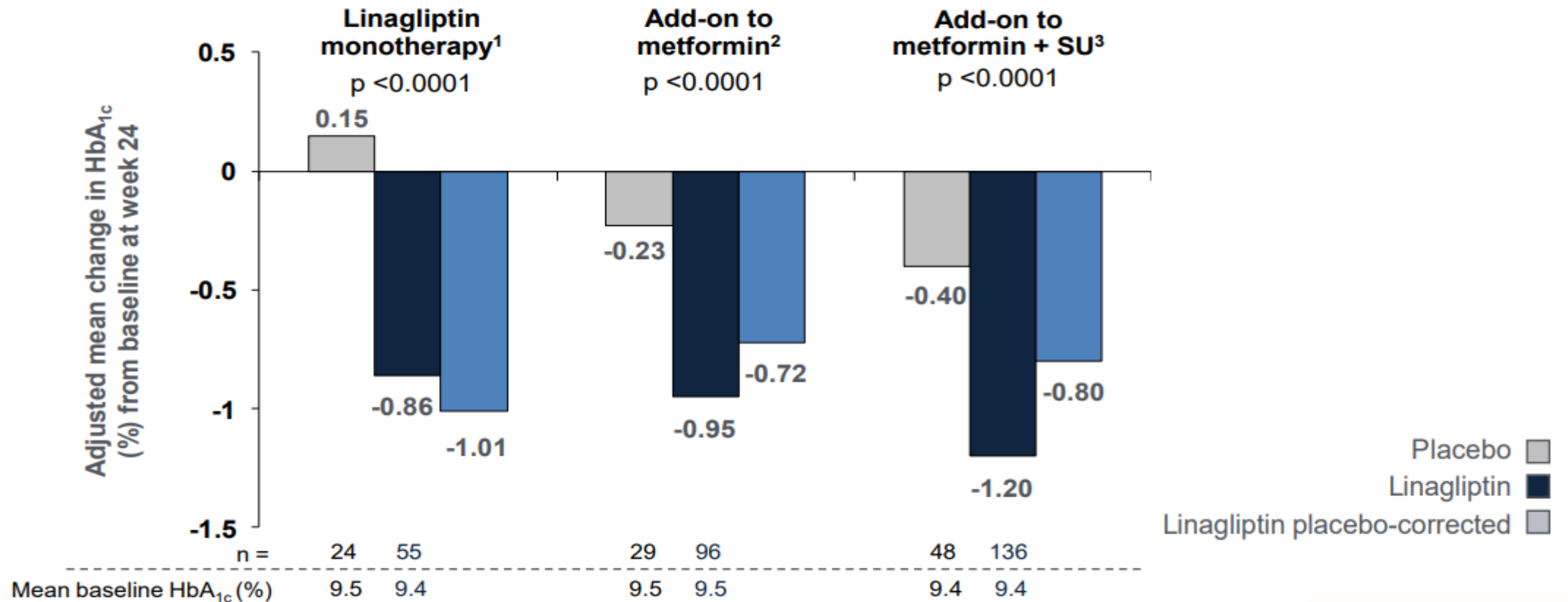
Linagliptin is the first only DPP-4 inhibitor that does not require dose adjustment: Easy use



Δ HbA_{1c} across different background therapy Linagliptin vs. placebo



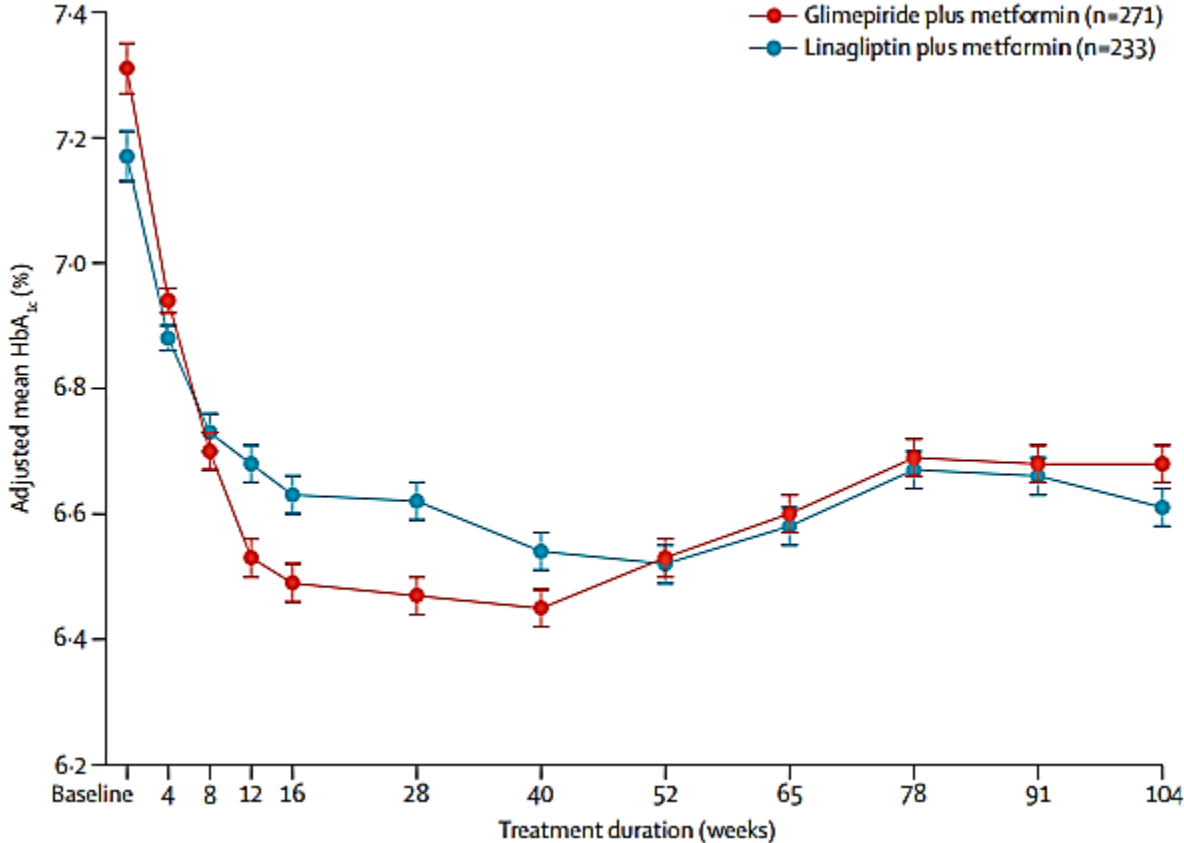
Linagliptin achieves HbA1c decrease of up to 1.2% in poorly controlled patients



Significant HbA1c reductions in type 2 diabetes patients with baseline HbA1c ≥ 9%

1. Diabetes Obesity and Metabolism 2011;13(3):258–267, 2. Diabetes Obesity and Metabolism 2011;13(1):65–74, 3. Diabetic Medicine 2011;28,1352-1361

Linagliptin sustained HbA1c reduction over 104 weeks similar efficacy as a SU over 104 weeks



Linagliptin, has similar efficacy as a SU over 104 weeks

1. Lancet, 2012; 380(9840), 475–483



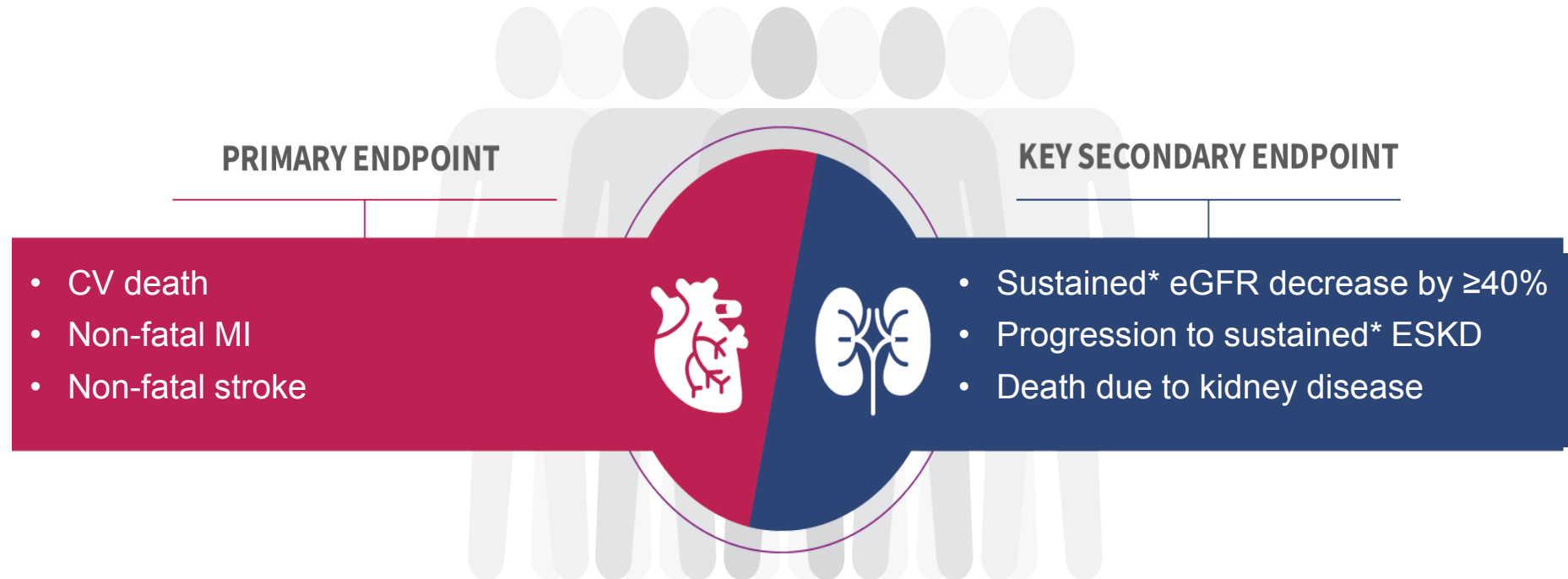
Research

JAMA | **Original Investigation**

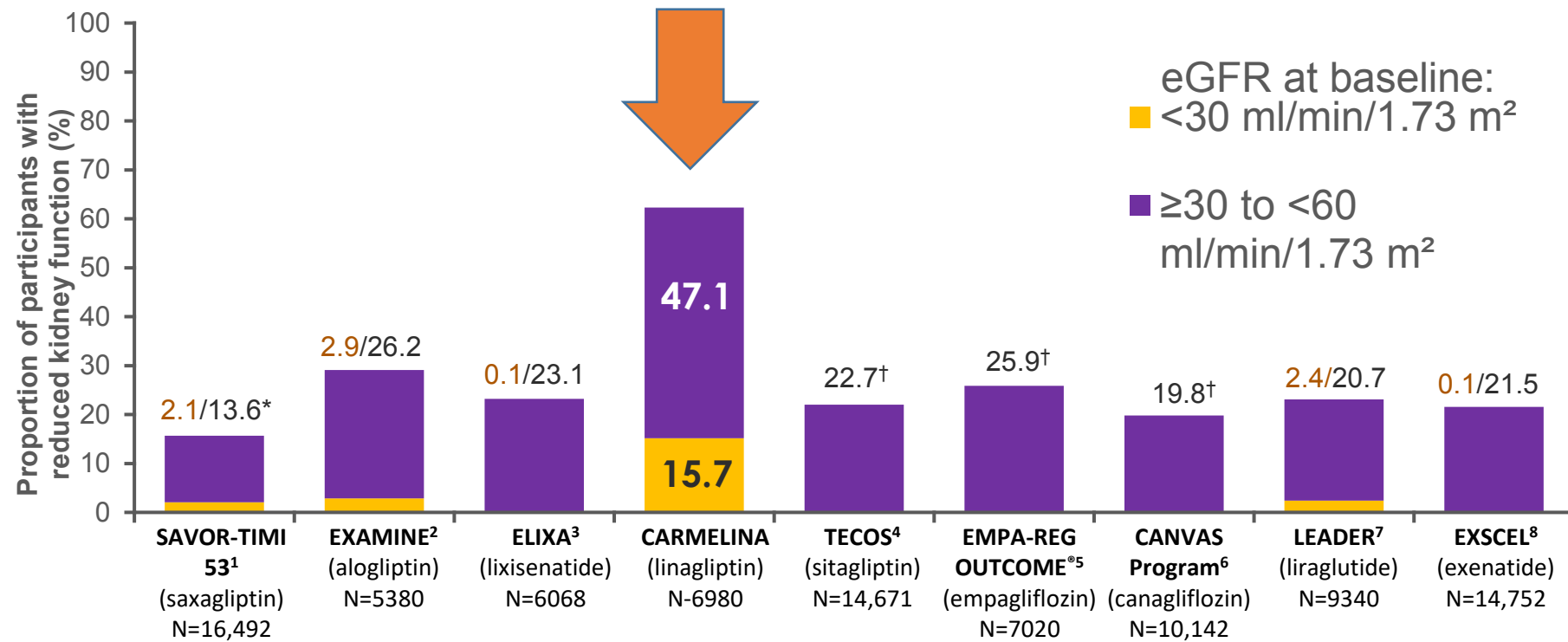
Effect of Linagliptin vs Placebo on Major Cardiovascular Events in Adults With Type 2 Diabetes and High Cardiovascular and Renal Risk The CARMELINA Randomized Clinical Trial

Aim: CARMELINA is a large, long-term cardiovascular (CV) outcomes trial testing the impact of linagliptin vs. placebo on top of standard care on CV and renal outcomes.

CARMELINA[®] was designed to evaluate the CV and kidney safety of linagliptin in patients with T2D¹



Higher prevalence of renal impairment CARMELINA than recent CVOTs

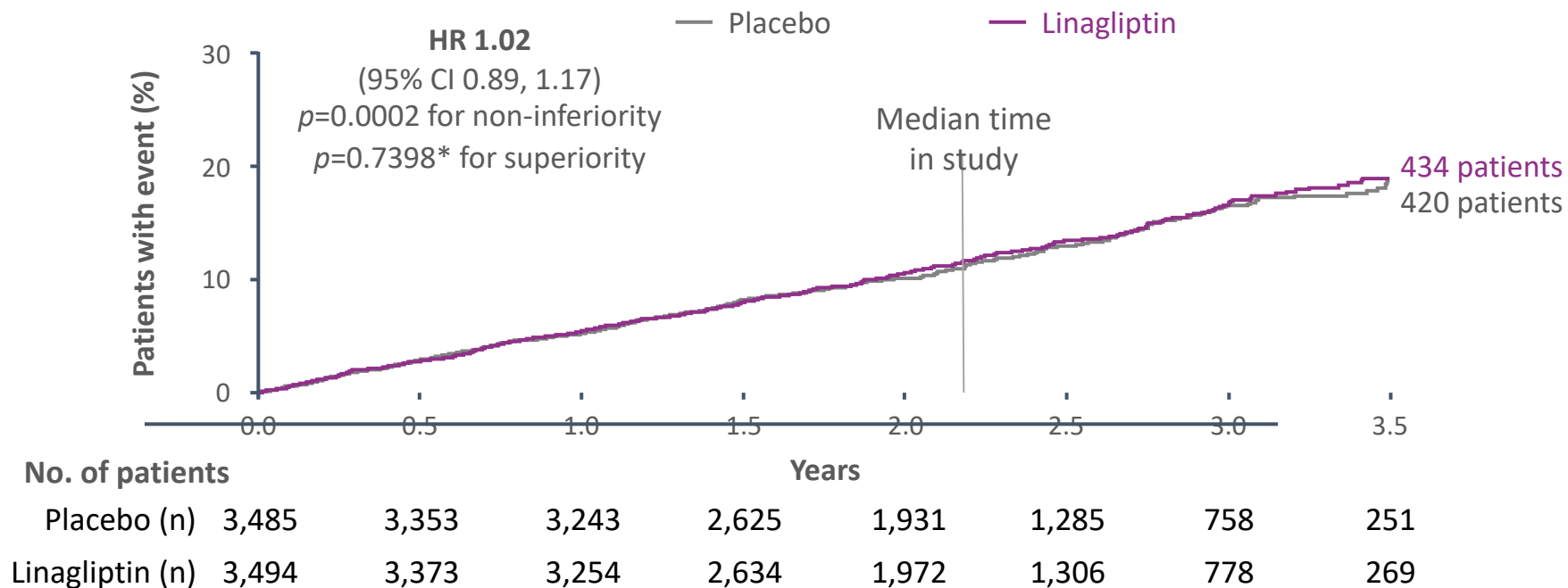


*eGFR ≥30 to <50 ml/min/1.73 m²; †Trial excluded patients with eGFR <30 ml/min/1.73 m² CVOT, cardiovascular outcomes trial; eGFR, estimated glomerular filtration rate

1. Scirica BM *et al. N Engl J Med* 2013;369:1317; 2. White WB *et al. N Engl J Med* 2013;369:1327 (supplementary appendix); 3. Pfeffer MA *et al. N Engl J Med* 2015;373:2247 (supplementary appendix); 4. Green JB *et al. N Engl J Med* 2015;373:232 (supplementary appendix); 5. Zinman B *et al. N Engl J Med* 2015;373:2117 6. Neal B *et al. Diabetes Obes Metabol* 2017;19:926; 7. Marso SP *et al. N Engl J Med* 2016;375:311; 8. Holman RR *et al. N Engl J Med* 2017;377:1228

The long-term CV safety profile of linagliptin was confirmed

Time to first occurrence of 3P-MACE



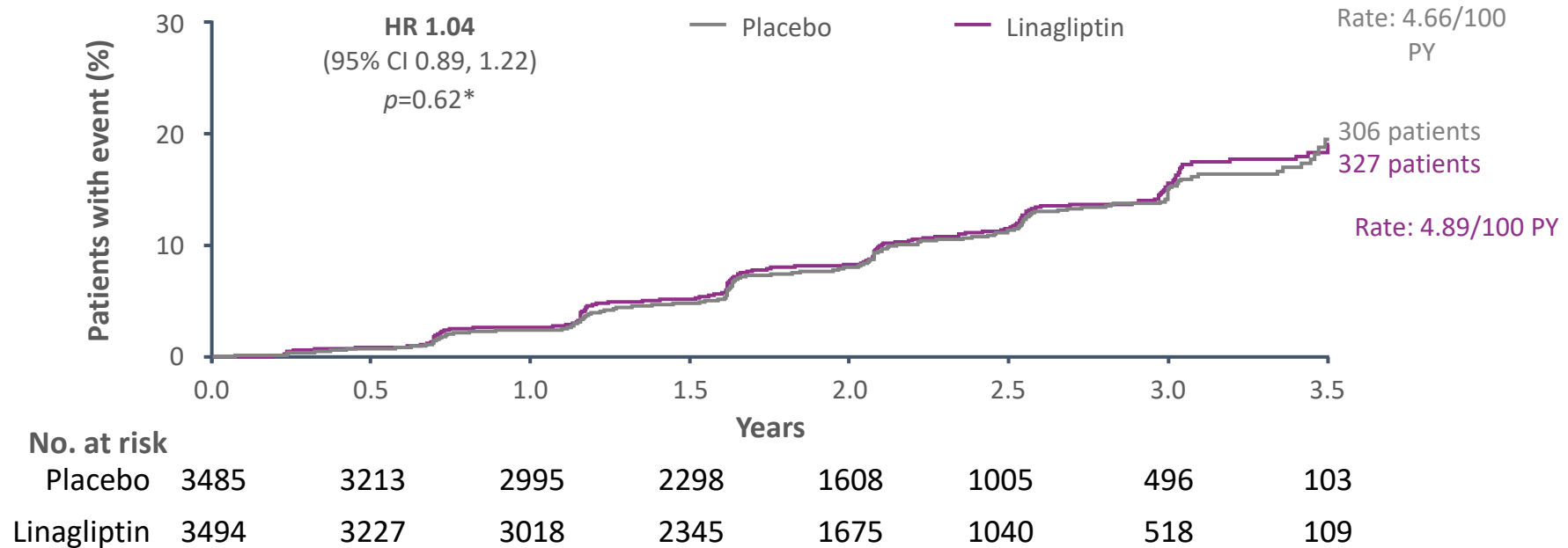
Linagliptin event rate 5.77/100 PY Placebo event rate 5.63/100 PY

Treated set, Kaplan-Meier estimate. Hazard ratio and 95% CI based on Cox regression model with terms for treatment group ($p=0.7398$) and region ($p=0.7878$); *Two-sided 3P-MACE, 3-point major adverse cardiovascular events (cardiovascular death, non-fatal myocardial infarction, non-fatal stroke)

Rosenstock J, et al. JAMA. 2018 Nov 9. doi: 10.1001/jama.2018.18269

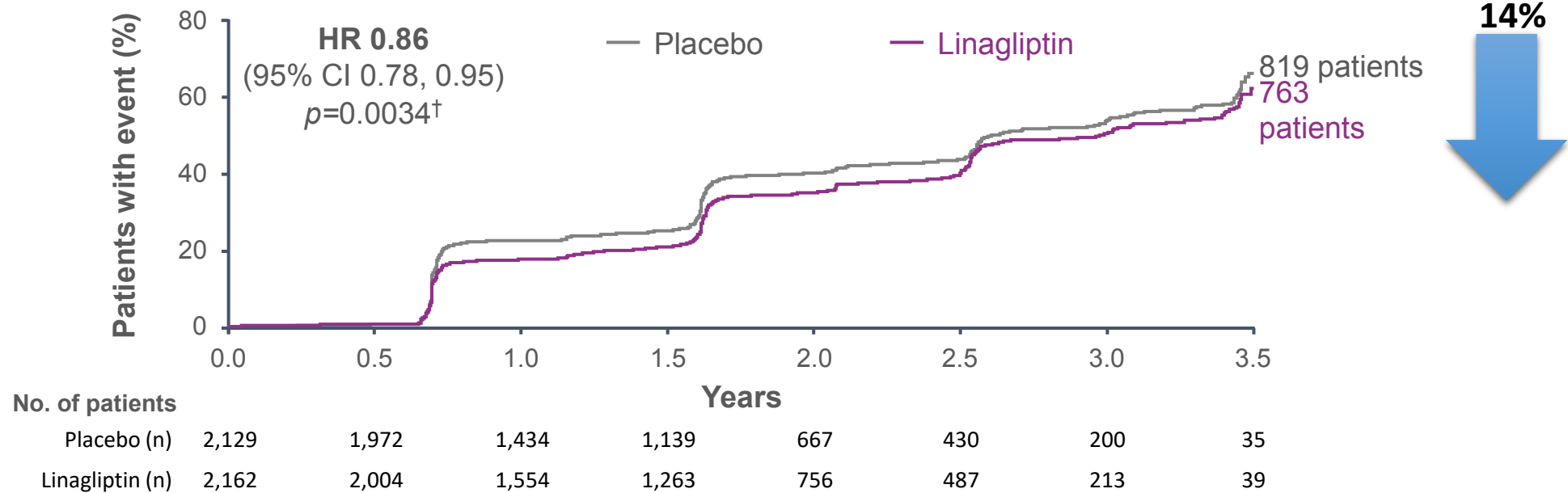
Time to first occurrence of key secondary outcome: sustained ESKD, sustained decrease of $\geq 40\%$ in eGFR from baseline, or death due to kidney disease

The kidney safety profile of linagliptin was confirmed



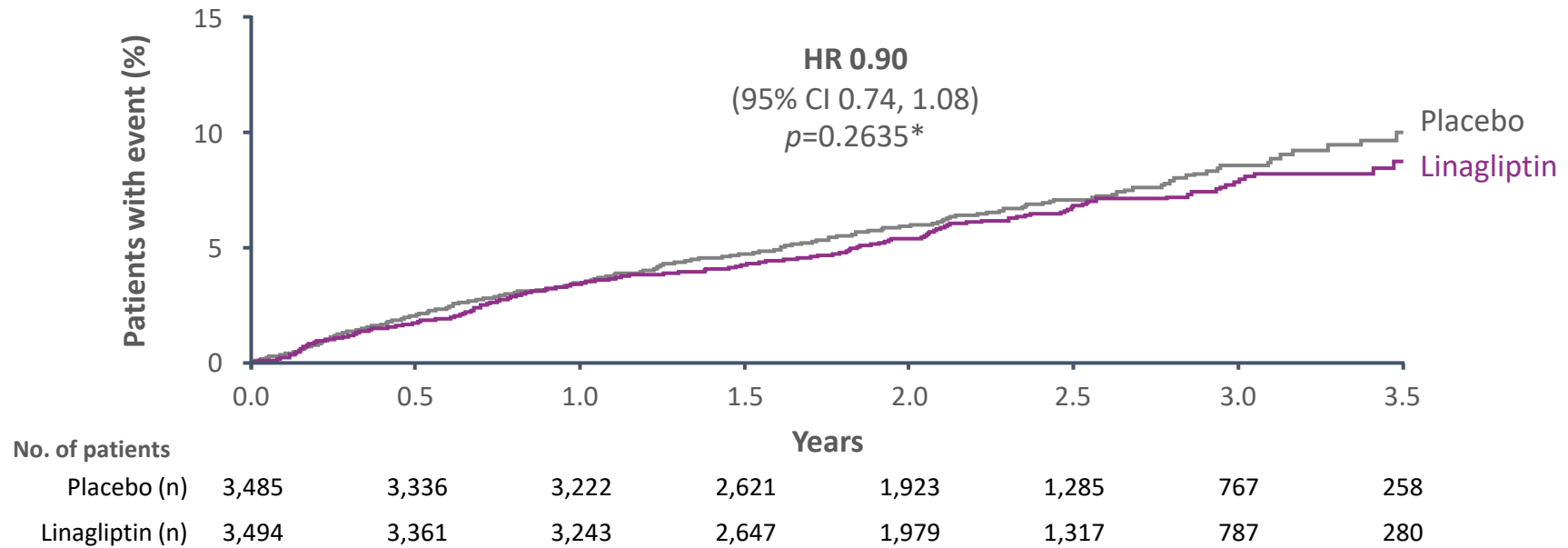
Linagliptin was associated with a significant reduction in albuminuria progression

Time to first occurrence of albuminuria progression*



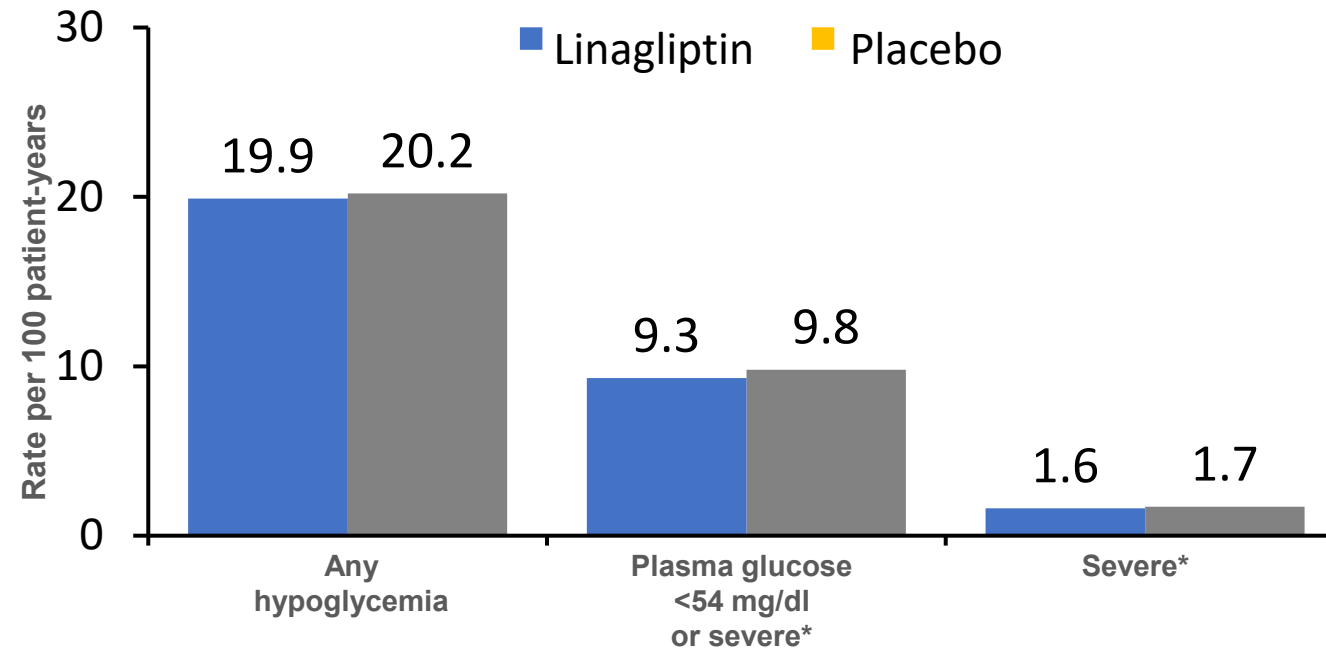
There was no increased risk of hospitalization for HF with Linagliptin

Time to first occurrence of adjudication-confirmed hospitalization for HF



Overall linagliptin did not increase the risk of hypoglycemia

Hypoglycemia: rates per 100 patient-years overall



Dosage And Administration ¹

Recommend dosing:

The recommended dose of Linagliptin is 5 mg once daily.

Linagliptin tablets can be taken with or without food.

- **Conclusion**

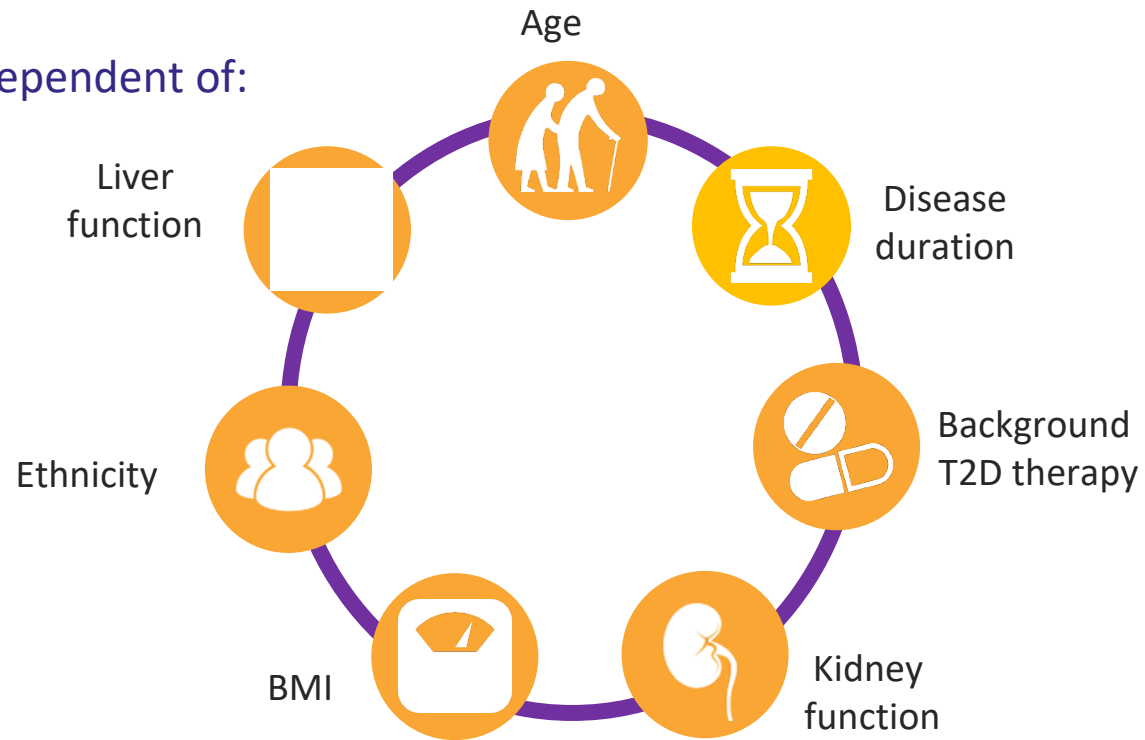


1-Diabetes Obes Metab. 2011;13:841–849. 2- Diabetes Obes Metab. 2007;9:194–205. 3- Int J Clin Pract. 2010;64:562–576. 4-Diabetes Res Clin Pract. 2011;93(1):e15-75-
Diabetes Care. 2019;42(Suppl 1):S90-S102. 6-N Engl J Med. 2015.16;373(3):232-42

Linagliptin Has Broad Therapeutic Indication

Linagliptin
5 mg
once daily

Independent of:





Dosage Forms and Strengths¹:

- 2.5 mg linagliptin/500 mg metformin HCl

- 2.5 mg linagliptin/1000 mg metformin HCl

1- Linagliptin and Metformin FDA Label.;2019, Reference ID: 4457960.

Dosage and Administration¹:



Individualize the starting dose of **LIROPRIM** based on the patient's current regimen.

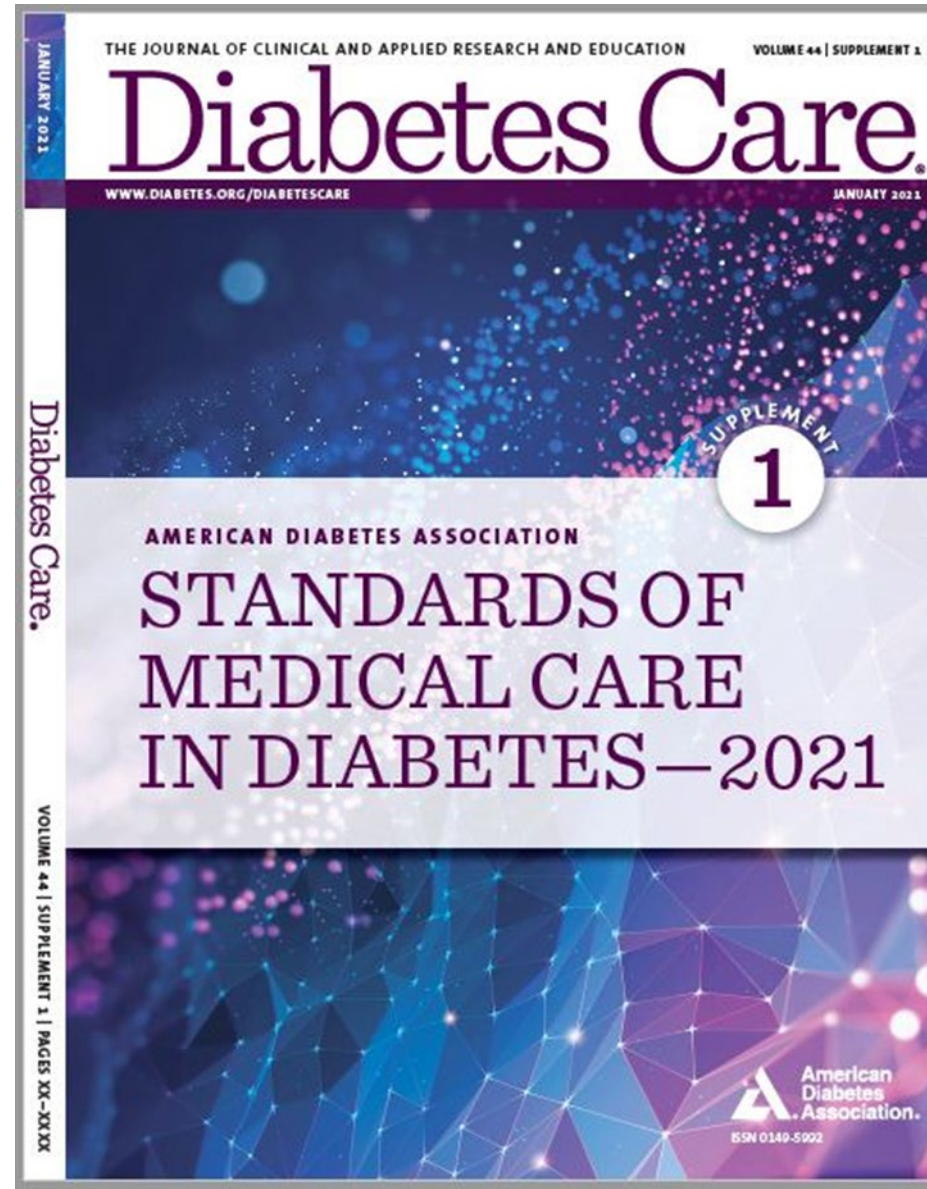


Give **twice daily with meals**, with gradual dose escalation to reduce the gastrointestinal effects due to metformin.



The maximum recommended dose is **2.5 mg linagliptin/1000 mg metformin HCl** twice daily.

Pharmacologic Approaches to Glycemic Treatment



Pharmacologic Approaches to Glycemic Management:
Diabetes Care 2021;44(Suppl.1):S100-S110.

CONSIDER INDEPENDENTLY OF BASELINE A1C, INDIVIDUALIZED A1C TARGET, OR METFORMIN USE*

...
ID
UTIC
INERTIA REASSESS
AND MODIFY
TREATMENT
REGULARLY
(3-6 MONTHS)

+ASCVD/Indicators of High Risk

- Established ASCVD
- Indicators of high ASCVD risk (age ≥ 55 years with coronary, carotid, or lower-extremity artery stenosis $>50\%$, or LVH)

EITHER/OR

- GLP-1 RA with proven CVD benefit[†]
- SGLT2i with proven CVD benefit[†]

If A1C above target

If further intensification is required or patient is unable to tolerate GLP-1 RA and/or SGLT2i, choose agents demonstrating CV benefit and/or safety:

- For patients on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit and vice versa[†]
- TZD[‡]
- DPP-4i if not on GLP-1 RA
- Basal insulin[‡]
- SU[‡]

+HF

Particularly HFrEF (LVEF $<45\%$)

SGLT2i with proven benefit in this population^{5,6,7}

† label indication of reducing CVD events and though less well studied for CVD effects, a demonstrated CVD safety and lower risk of hypoglycemia; **‡** safety to DPP-4i varies by region and individual agent eGFR for initiation and continued use (dapagliflozin have shown reduction in CVOTs. Canagliflozin and outcome data. Dapagliflozin and failure outcome data.

+CKD

DKD and Albuminuria⁸

NO

PREFERABLY

- SGLT2i with primary evidence of reducing CKD progression
- OR
- SGLT2i with evidence of reducing CKD progression in CVOTs^{5,6,8}
- OR
- GLP-1 RA with

EITHER/OR

- GLP-1 RA with proven CVD benefit[†]
- SGLT2i with proven CVD benefit^{1,7}

For patients with T2D and CKD⁸ (e.g., eGFR <60 mL/min/1.73 m²) and thus at increased risk of cardiovascular events

COMPELLING NEED TO MINIMIZE HYPOGLYCEMIA

- DPP-4i
- GLP-1 RA

If A1C above target

- SGLT2i
- OR
- TZD

Continue with

Consider the addition of SU[‡] OR basal insulin:
Choose later generation SU with lower risk of hypoglycemia.
Consider basal insulin with lower risk of hypoglycemia⁸

† proven benefit means it has label indication of reducing heart failure in this population

8. Refer to Section 11: Microvascular Complications and Foot Care

9. Degludec / glargine U-300 $<$ glargine U-100 / detemir $<$ NPH Insulin

10. Semaglutide $>$ liraglutide $>$ dulaglutide $>$ exenatide $>$ lixisenatide

11. If no specific comorbidities (i.e., no established CVD, low risk of hypoglycemia, and lower priority to avoid weight gain or no weight-related comorbidities)

12. Consider country- and region-specific cost of drugs. In some countries TZDs are relatively more expensive and DPP-4i are relatively cheaper.



Indicators of high ASCVD risk (age ≥ 55 years with coronary, carotid or lower extremity artery stenosis $>50\%$, or LVH)

COMPELLING NEED TO MINIMIZE WEIGHT GAIN

- GLP-1 RA
- SGLT2i

If A1C above target

If quadruple therapy required, or SGLT2i and/or GLP-1 RA not tolerated or contraindicated, use regimen with lowest risk of weight gain

PREFERABLY

DPP-4i (if not on GLP-1 RA) based on weight neutrality

If DPP-4i not tolerated or contraindicated or patient already on GLP-1 RA, cautious addition of:

- SU[‡]
- TZD[‡]
- Basal insulin

† Actioned whenever these become new clinical considerations regardless of background glucose-lowering medications.

‡ Most patients enrolled in the relevant trials were on metformin at baseline as glucose-lowering therapy.

COST IS A MAJOR ISSUE^{11,12}

- SU[‡]
- TZD[‡]

If A1C above target

- SU[‡]

If A1C above target

...therapy basal insulin with lowest acquisition cost

OR

Consider other therapies based on cost

COMPELLING NEED TO MINIMIZE HYPOGLYCEMIA

COMPELLING NEED TO MINIMIZE WEIGHT GAIN OR PROMOTE WEIGHT LOSS

COST IS A MAJOR ISSUE^{11,12}

INDICATORS OF HIGH-RISK OR ESTABLISHED A

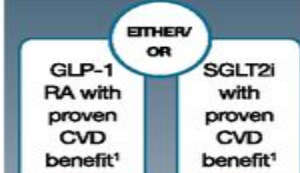
CONSIDER INDEPENDENTLY OF BASELINE A1C
INDIVIDUALIZED A1C TARGET, OR METFORMIN U

+ASCVD/Indicators of High Risk

- Established ASCVD
- Indicators of high ASCVD risk (age ≥55 years with coronary, carotid, or lower-extremity artery stenosis >50%, or LVH)

+HF

- Particularly HFREF (LVEF <45%)
- SGLT2i with proven benefit in this population^{5,6,7}



If A1C above target

If further intensification is required or patient is unable to tolerate GLP-1 RA and/or SGLT2i, choose agents demonstrating CV benefit and/or safety:

- For patients on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit and vice versa¹
- TZD²
- DPP-4i if not on GLP-1 RA
- Basal insulin³
- SU⁴

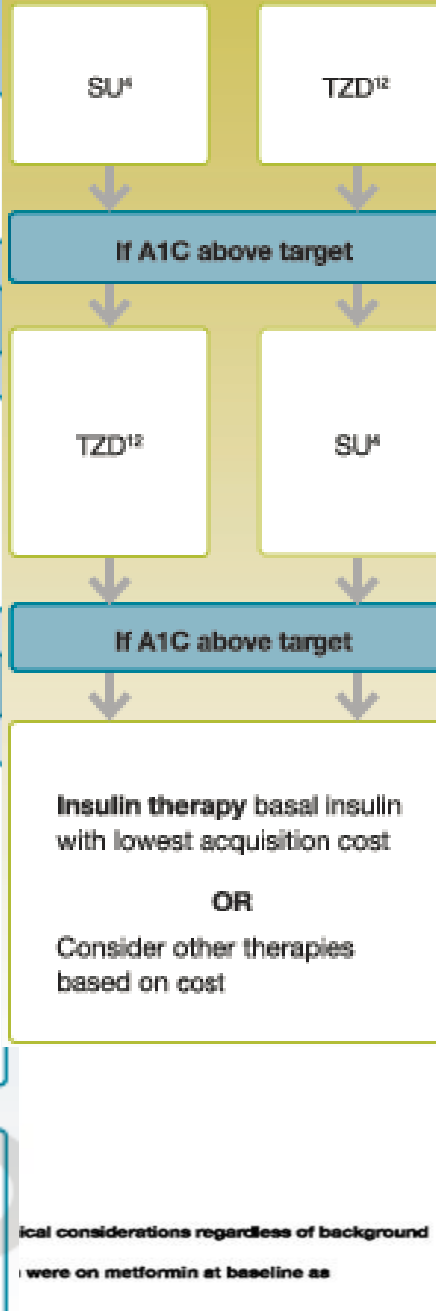
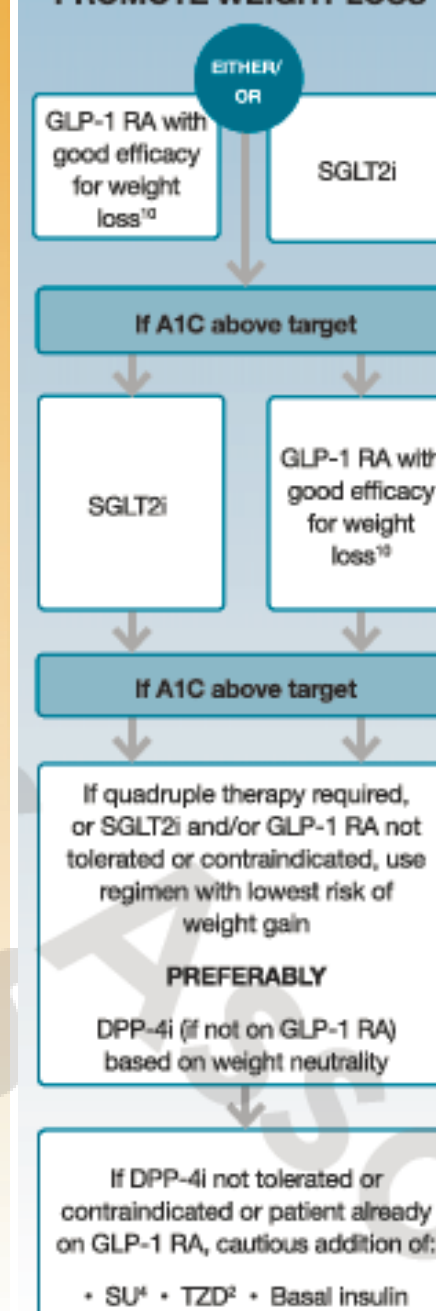
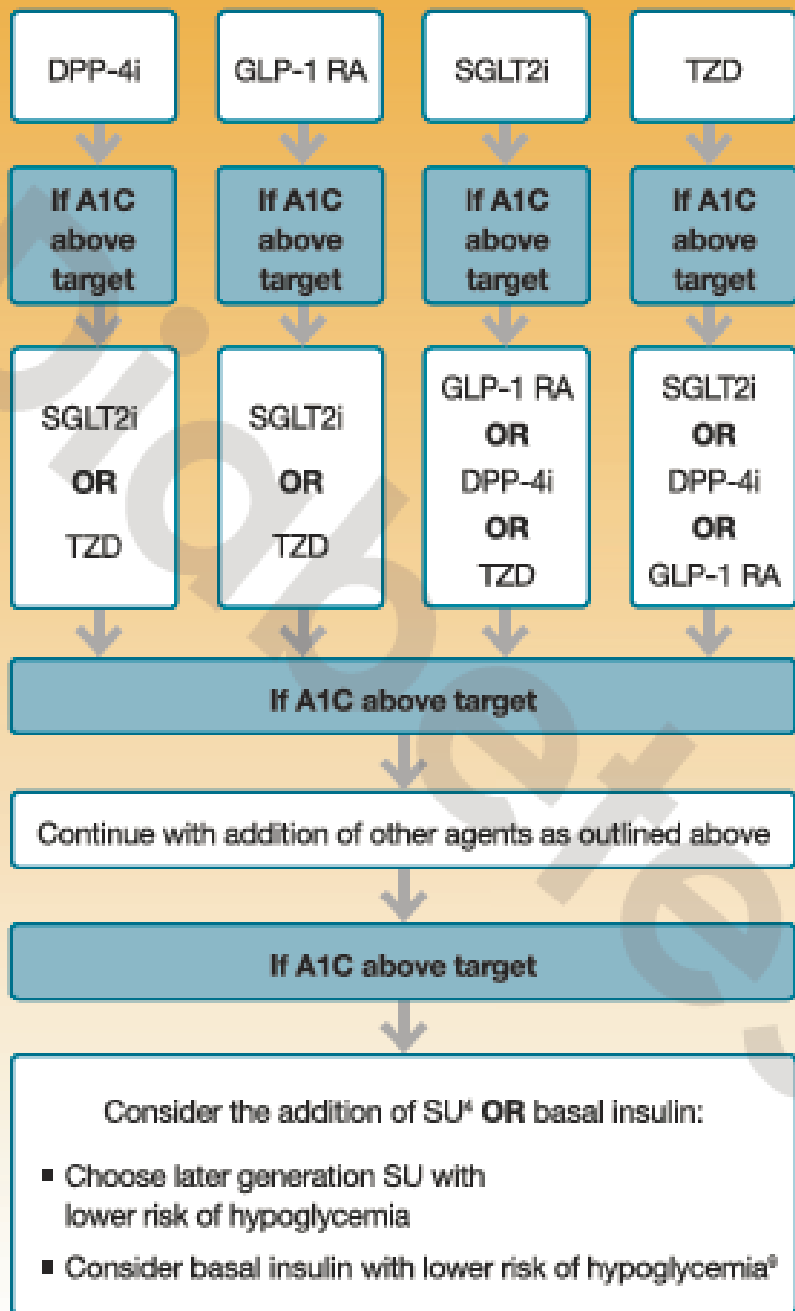
- Proven CVD benefit means it has label indication of reducing CVD events
- Low dose may be better tolerated though less well studied for CVD effects
- Degludec or U-100 glargine have demonstrated CVD safety
- Choose later generation SU to lower risk of hypoglycemia; glimepiride has shown similar CV safety to DPP-4i
- Be aware that SGLT2i labelling varies by region and individual agent with regard to indicated level of eGFR for initiation and continued use
- Empagliflozin, canagliflozin, and dapagliflozin have shown reduction in HF and to reduce CKD progression in CVOTs. Canagliflozin and dapagliflozin have primary renal outcome data. Dapagliflozin and empagliflozin have primary heart failure outcome data.

DKD & Albuminuria

PREFER
SGLT2 primary e of reduci progres
OR
SGLT2 eviden reducin progres CVO1
OR
GLP-1 F proven benefit¹ if not toler contrain

For pati and CKD <60 mL/m thus at in cardiova

GLP-1 RA with proven CVD benefit¹



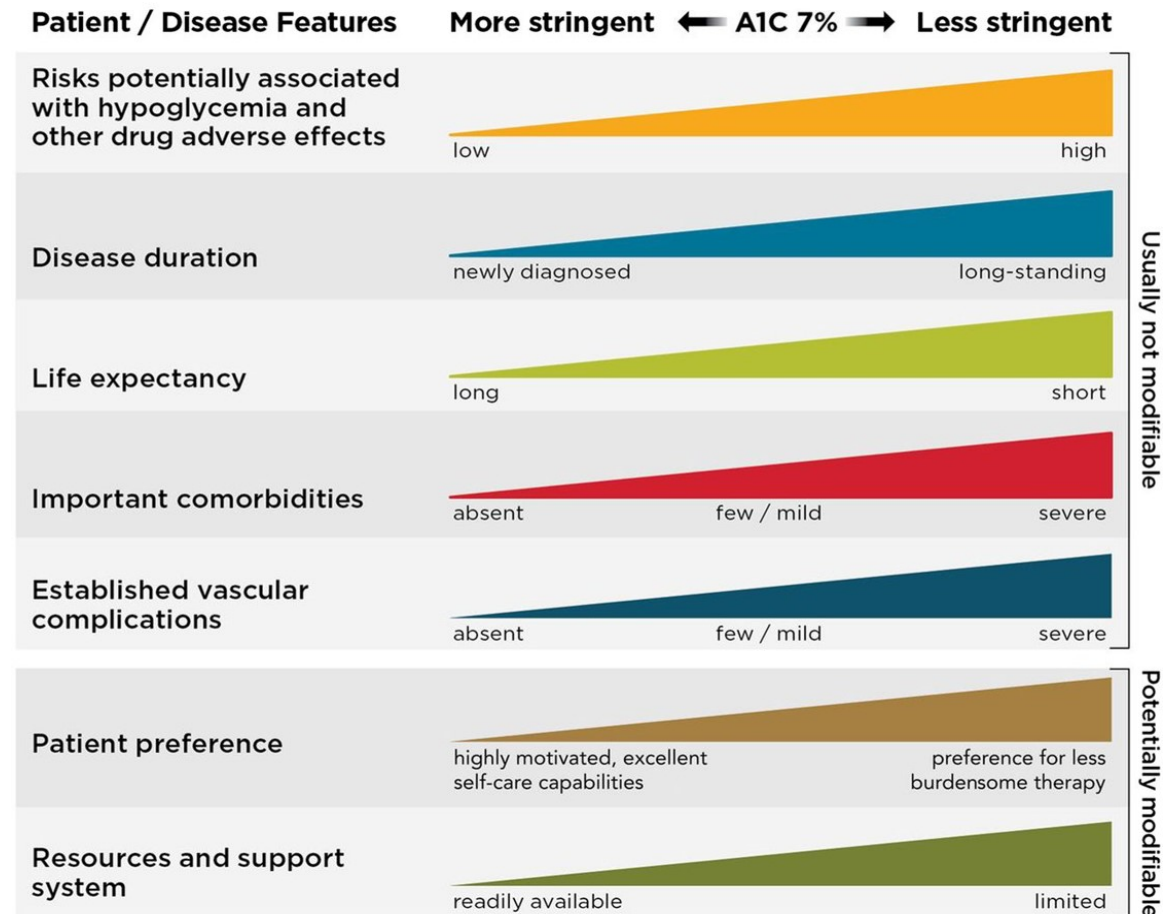
Estimated average glucose

A1C (%)	mg/dL*	mmol/L
5	97 (76–120)	5.4 (4.2–6.7)
6	126 (100–152)	7.0 (5.5–8.5)
7	154 (123–185)	8.6 (6.8–10.3)
8	183 (147–217)	10.2 (8.1–12.1)
9	212 (170–249)	11.8 (9.4–13.9)
10	240 (193–282)	13.4 (10.7–15.7)
11	269 (217–314)	14.9 (12.0–17.5)
12	298 (240–347)	16.5 (13.3–19.3)

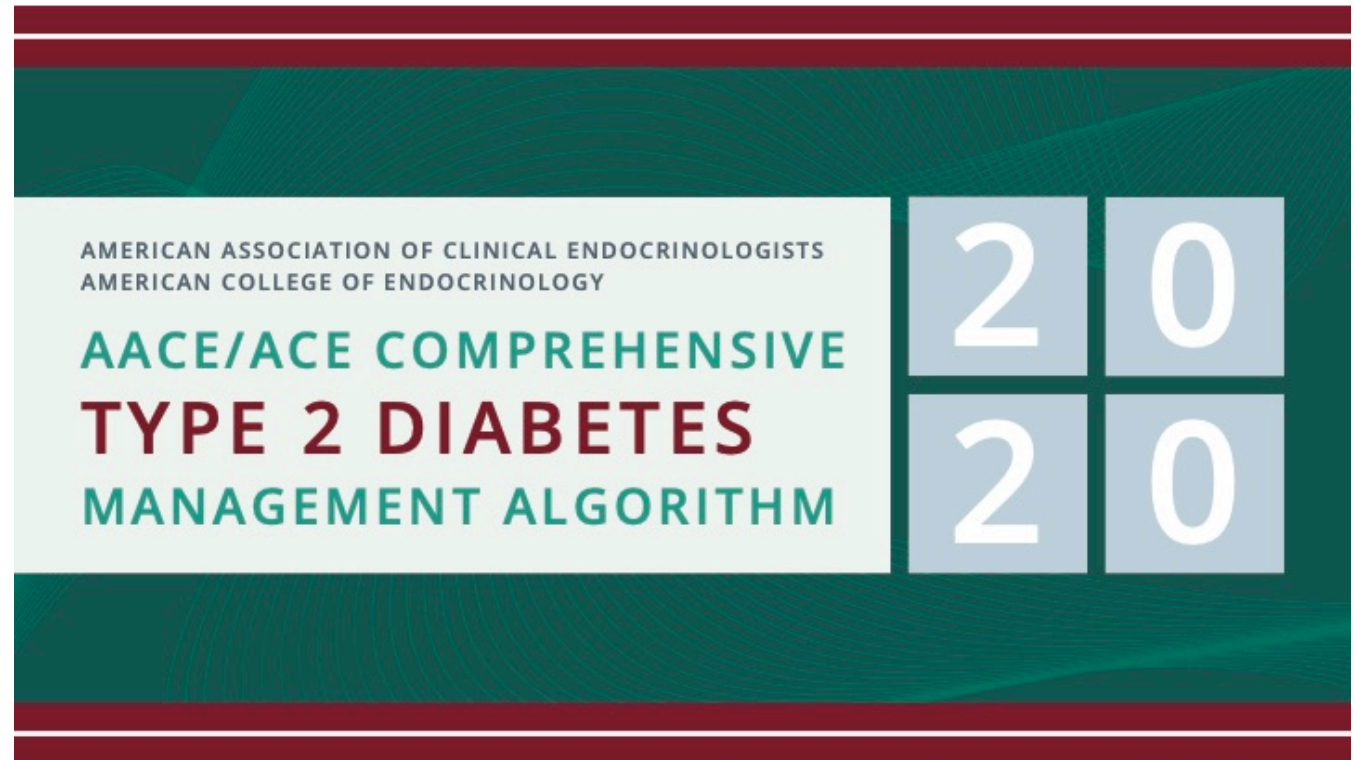
Data in parentheses are 95% CI. A calculator for converting A1C results into eAG, in either mg/dL or mmol/L, is available at professional.diabetes.org/eAG. *These estimates are based on ADAG data of ~2,700 glucose measurements over 3 months per A1C measurement in 507 adults with type 1, type 2, or no diabetes. The correlation between A1C and average glucose was 0.92 (6,7). Adapted from Nathan et al. (6).

Approach to individualization of glycemic target

Approach to Individualization of Glycemic Targets



Pharmacologic Approaches to Glycemic Treatment



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GLYCEMIC CONTROL ALGORITHM

INDIVIDUALIZE GOALS

A1C ≤6.5% For patients without concurrent serious illness and at low hypoglycemic risk

A1C >6.5% For patients with concurrent serious illness and at risk for hypoglycemia

LIFESTYLE THERAPY AND ONGOING GLUCOSE MONITORING (CGM preferred)

INDEPENDENT OF GLYCEMIC CONTROL, IF

Entry A1C ≥7.5% - 9.0%

Entry A1C >9.0%

AND/OR LA GLP1-RA

Entry A1C <7.5%

MONOTHERAPY^{1,2}

- ✓ Metformin
- ✓ GLP1-RA
- ✓ SGLT2i
- ✓ DPP4i
- ⚠ TZD
- ✓ AGi
- ⚠ SU/GLN

Independent of glycemic control, if established ASCVD or high risk, CKD 3, or HFrEF, start LA GLP1-RA or SGLT2i with proven efficacy*

DUAL THERAPY¹

- ✓ GLP1-RA
- ✓ SGLT2i
- ✓ DPP4i
- ⚠ TZD
- ⚠ SU/GLN
- ⚠ Basal Insulin
- ✓ Colesevelam
- ✓ Bromocriptine QR
- ✓ AGi

3 MONTHS²

TRIPLE THERAPY¹

- ✓ GLP1-RA
- ✓ SGLT2i
- ⚠ TZD
- ⚠ SU/GLN
- ⚠ Basal Insulin
- ✓ DPP4i
- ✓ Colesevelam
- ✓ Bromocriptine QR
- ✓ AGi

SYMPTOMS

NO

YES

DUAL Therapy

INSULIN ± Other Agents

OR

TRIPLE Therapy

ADD OR INTENSIFY INSULIN

Refer to Insulin Algorithm

1 Order of medications represents a suggest
2 If not at goal in 3 months, proceed to next

*CKD 3: canagliflozin; HFrEF: dapagliflozin
CKD 3 = stage 3 chronic kidney disease; HFrEF = heart failure with reduced ejection fraction; LA = long-acting (≥24 hour duration)

MET +
or other agent

✓ Few adverse events and/or possible benefits
⚠ Use with caution



Thank you