Management of CAD in Diabetes

Jens

Disclosures

Honoraria from:
NovoNordisk (semaglutide)
Boehringer-Ingelheim (empagliflozin)
AstraZeneca (dapagliflozin)

What AI thinks a clueless cardiologist looks like.

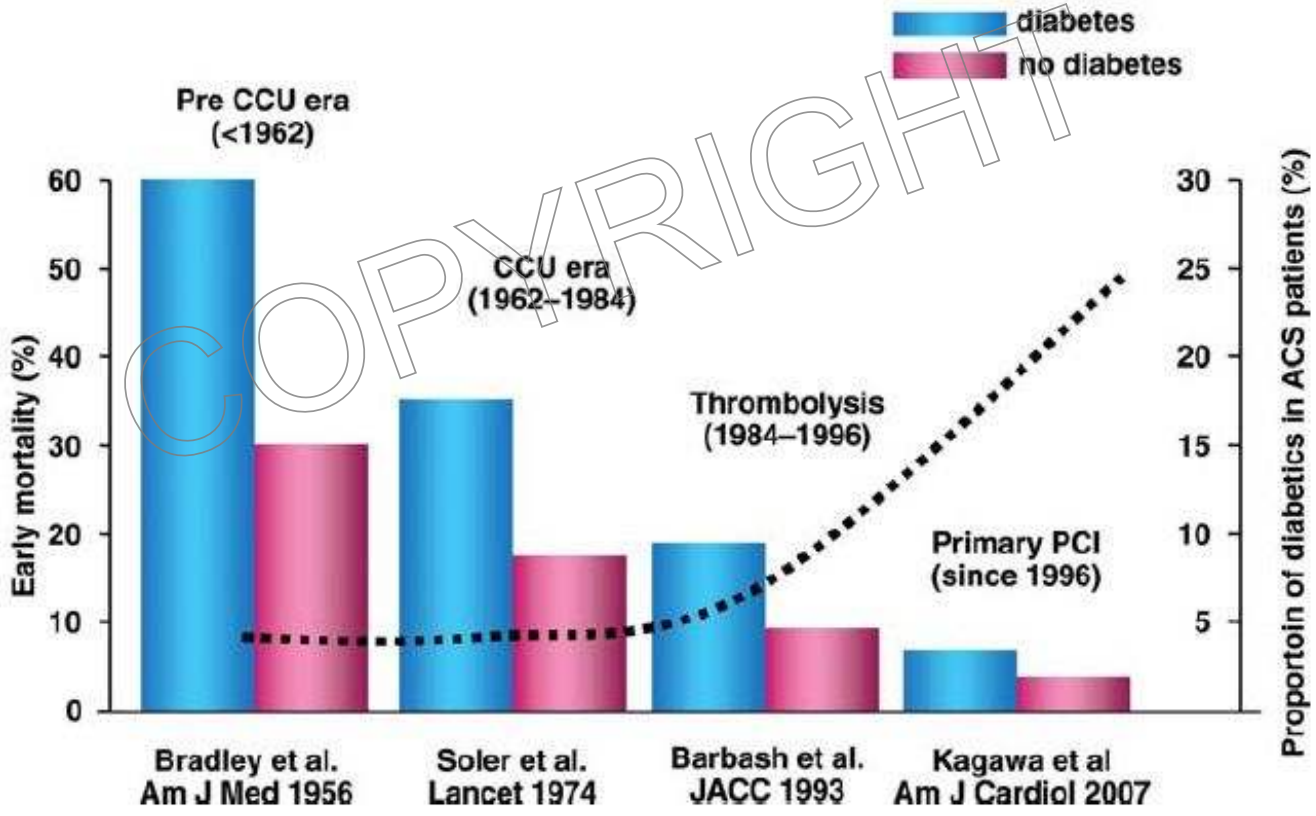
What did I learn while preparing this talk?

1. Diabetes is a big problem.
2. Diabetic patients are at increased cardiovascular risk.
3. Diabetics often have atypical presentations of angina.
4. Atherosclerosis is not necessarily the main problem anymore.
5. Comprehensive treatment of risk factors is important.
6. Lower the glucose.
7. Once the HbA1C is around 7% specific diabetic agents become important to further lower CV risk.
8. Err on the aggressive side of antithrombotic therapy.
9. CABG is the preferred revascularisation strategy for most patients.

Diabetes has poor outcomes.

- 90% of diabetics → type 2
- 73% of diabetes related mortality → patients <60 years
- Once patients develop TOD → 20% 5 year mortality
- CV disease the cause of death in diabetics → 2/3 of patients
- CMO occurs in up to 50% of patients
- HFpEF population → 40% are diabetic

Early mortality of diabetic and non- diabetic patients with acute myocardial infarction: Historical perspective



The New England
Journal of Medicine

Volume 231 DECEMBER 28, 1944 Number 26

THE CAUSE OF DEATH IN DIABETES*

A Report of 307 Autopsied Cases

STANLEY L. ROBBINS, M.D.,† AND ARTHUR W. TUCKER, JR., M.D.‡
BOSTON

TABLE 1.

CAUSE OF DEATH	DIABETIC GROUP NO. OF CASES	DIABETIC GROUP PERCENTAGE	DIABETIC GROUP CORRECTED PERCENTAGE*	NONDIABETIC GROUP PERCENTAGE
Coma	22	7.2	—	—
Vascular disease:				
Cardiac decompensation	35	11.4	12.3	12.6
Coronary occlusion	31	10.0	10.8†	4.2†
Cerebral hemorrhage and thrombosis	15	4.9	5.2	7.5
Peripheral vascular disease	13	4.2	4.5†	0.0†
Central (pulmonary embolism)	7	2.3	2.4	2.8
Renal disease:				
Glomerulonephritis	2	0.7	0.7	0.4
Acute pyelonephritis	21	6.8	7.3†	1.6†
Miscellaneous	2	0.7	0.7	2.0
Infection:				
Pulmonary	73	23.8	25.6	24.2
Peritoneal	13	4.2	4.5	4.8
Extremities	7	2.3	2.4†	0.5†
Other infections	22	7.2	7.7	5.9
Cancer	24	7.8	8.4†	14.7†
Other causes (including unknown)	20	6.5	7.0	17.0

*From a statistical viewpoint, in order to compare the diabetic and control groups, it is necessary to eliminate coma cases from the comparison, since they are a hazard peculiar only to the diabetic patient and are not found in a series of control cases. This column, therefore, represents the diabetic series from which coma cases have been excluded, the mortality percentage being recomputed in order that they may be strictly comparable with those of the control group.

†Denotes statistically significant differences.

New Eng J Med 1944; 231: 865-68

Diabetes doubles the risk of vascular events.

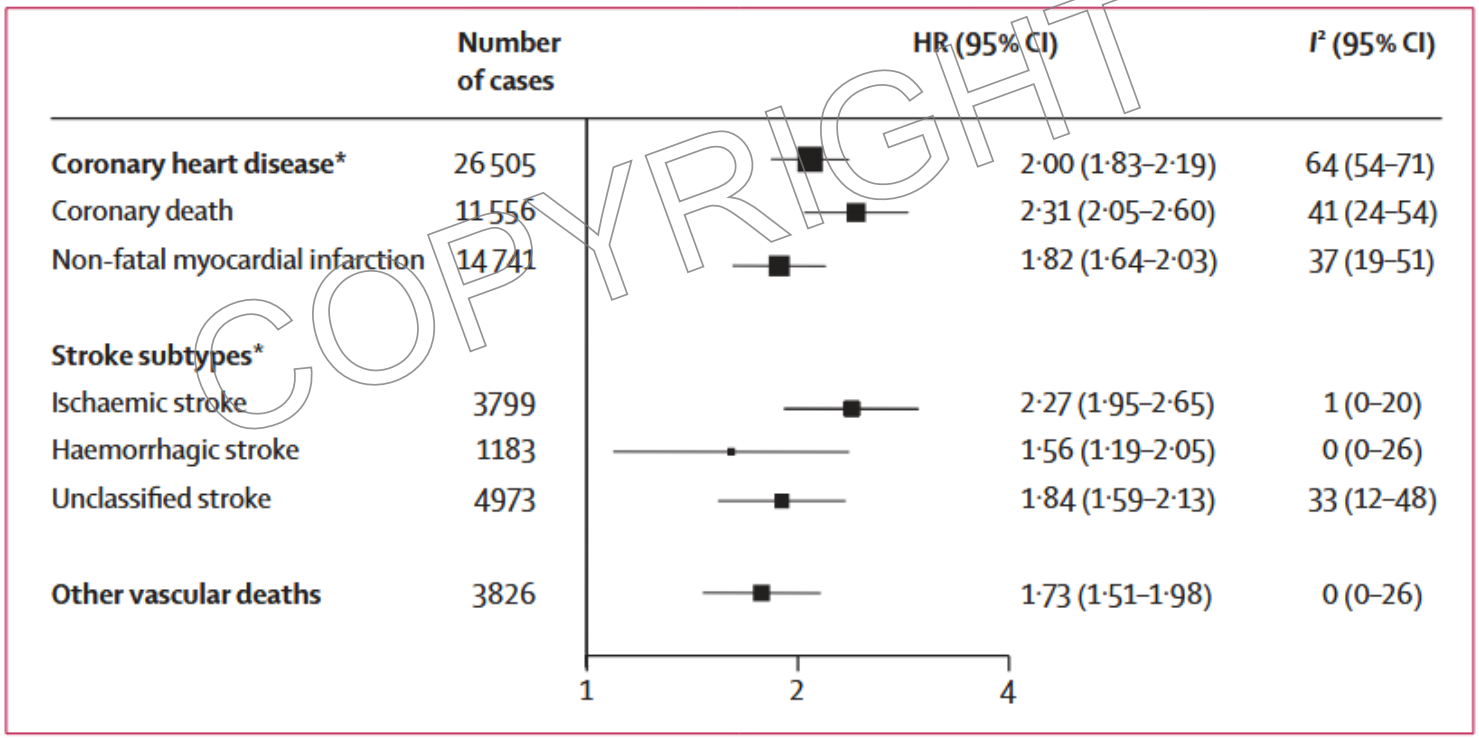


***Figure 1*: Hazard ratios (HRs) for vascular outcomes in people with versus those without diabetes at baseline**

Lancet 2010; 375: 2215–22

Causes of death in a multinational study of vascular disease in diabetes 2001

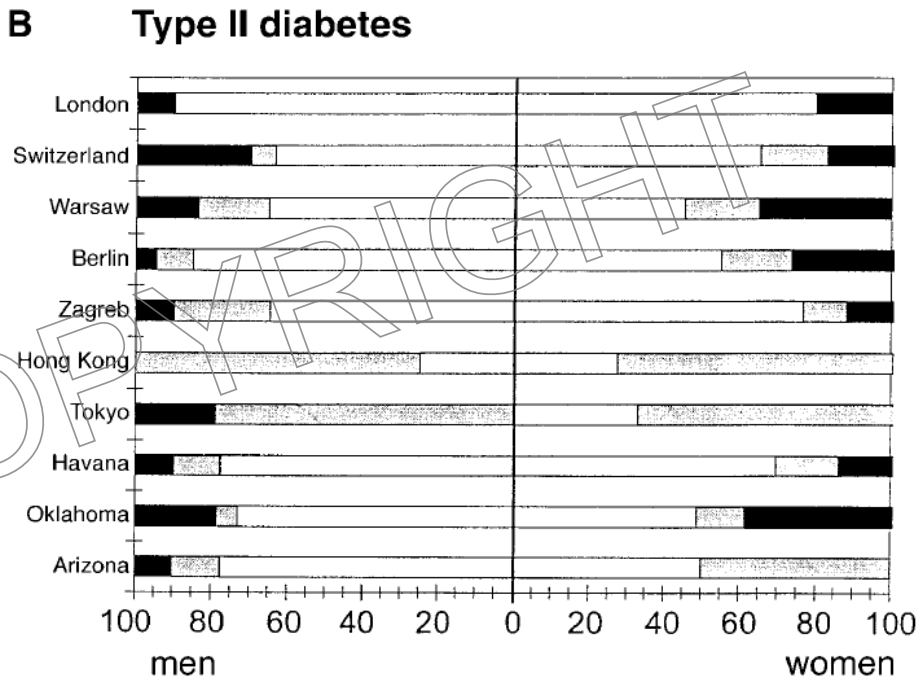


Fig. 3A, B. Percentage of cardiovascular deaths assigned to Ischaemic Heart Disease (IHD), Cerebrovascular Accident (CVA) and other causes by centre, diabetes type and sex. □, IHD; ▒, CVA; ■, other (See text for relevant ICD-Codes)

Diabetologia 2001; 44 (Suppl 2): S14 – S21

Causes of death in diabetics in India

Causes of death in 269 diabetics[a]

	Total no. (%)	IDDM no. (%)	NIDDM no. (%)	*P* value
Infections	91(33.83)	16(34.78)	75(33.63)	>0.09
Chronic renal failure	83(30.85)	13(28.26)	70(31.39)	>0.09
Coronary artery disease	44(16.36)	1(2.17)	43(19.28)	<0.01
Cerebrovascular disease	37(13.75)	2(4.35)	35(15.69)	<0.05
Hypoglycaemia	21(7.81)	8(17.39)	13(5.83)	<0.01
Diabetic ketoacidosis	18(6.69)	12(26.09)	6(2.69)	<0.001
Acute renal failure	15(5.58)	0	15(6.73)	—
Malignancy	12(4.46)	1(2.17)	11(4.93)	>0.25
Hyperosmolar coma	6(2.23)	0	6(2.69)	—
Chronic liver disease	6(2.23)	0	6(2.69)	—
Gastrointestinal bleeding	5(1.86)	1(2.17)	4(1.79)	>0.9
Adult respiratory distress syndrome	4(1.49)	1(2.17)	3(1.34)	—
Pulmonary thromboembolism	3(1.11)	0	3(1.34)	—
Rheumatic heart disease	1(0.37)	0	1(0.45)	—
Paroxysmal atrial tachycardia	1(0.37)	0	1(0.45)	—
Disseminated intravascular coagulation	1(0.37)	0	1(0.45)	—
Hepatic coma	1(0.37)	0	1(0.45)	
Undetermined cause	20(7.43)	5(10.87)	15(6.73)	>0.25
All causes	269(100)	46(100)	223(100)	

[a] Includes patients with more than one cause of death.

Diabetes Research and Clinical Practice 1999; 43: 67–74

Causes of death of diabetes in Japan

Table 9 | Causes of death in Japanese general population and diabetic patients - comparisons between 1971–1980, 1981–1990, 1991–2000 and 2001–2010

Causes of death	1971~1980		1981~1990		1991~2000		2001~2010	
	General population[9] (*n* = 695,821)	Diabetic patients[4] (*n* = 9,737)	General population[10] (*n* = 793,014)	Diabetic patients[5] (*n* = 11,648)	General population[11] (*n* = 970,331)	Diabetic patients[6] (*n* = 18,385)	General population[8] (*n* = 1,197,066)	Diabetic patients[17] (*n* = 45,708)
Vascular diseases	31.7	41.5	24.6	39.3	22.7	26.8	18.8	14.9
Chronic renal failure	1.0	12.8	2.0	11.2	1.8	6.8	2.0	3.5
Ischemic heart diseases	6.6	12.3	6.4	14.6	7.3	10.2	6.5	4.8
Cerebrovascular diseases	24.1	16.4	16.2	13.5	13.6	9.8	10.3	6.6
Malignant neoplasia	21.6	25.3	25.9	29.2	31.0	34.1	29.5	38.3
Lung					5.6	5.3	5.8	7.0
Liver					3.5	8.6	2.7	6.0
Pancreas					2.0	4.8	2.3	5.7
Infectious diseases	6.2	9.2	8.4	10.2	9.2	14.3	12.1	17.0
Others	40.5	24.1	41.3	21.3	37.1	24.8	39.6	29.8

J Diabetes Investig 2017; 8: 397–410

Prevention

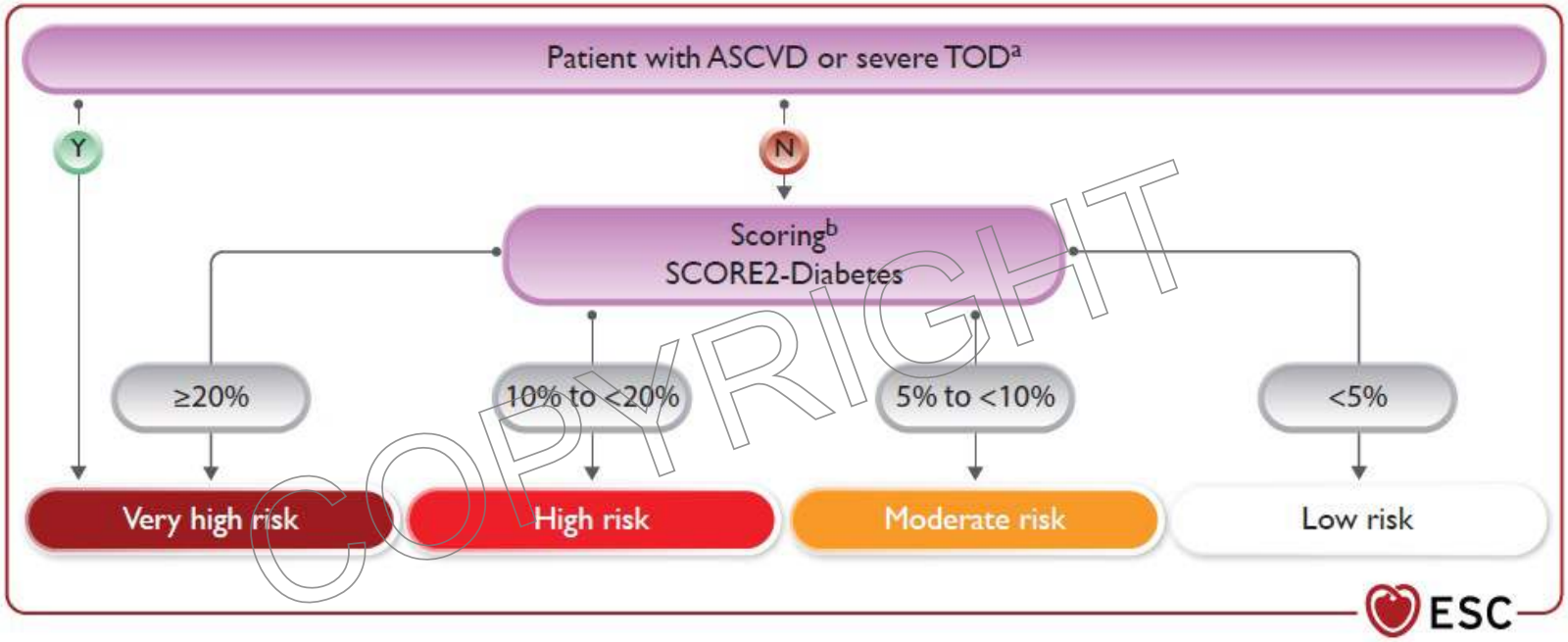


Figure 3 Cardiovascular risk categories in patients with type 2 diabetes. ASCVD, atherosclerotic cardiovascular disease; CVD, cardiovascular disease risk; eGFR, estimated glomerular filtration rate; TOD, target-organ damage; UACR, urinary albumin-to-creatinine ratio. [a]Severe TOD defined as eGFR <45 mL/min/1.73 m^2 irrespective of albuminuria; or eGFR 45–59 mL/min/1.73 m^2 and microalbuminuria (UACR 30–300 mg/g; stage A2); or proteinuria (UACR >300 mg/g; stage A3), or presence of microvascular disease in at least three different sites [e.g. microalbuminuria (stage A2) plus retinopathy plus neuropathy].[43–45] [b]The thresholds (10-year CVD risk) suggested are not definitive but rather designed to prompt joint decision-making conversations with patients about intensity of treatment, as well as additional interventions. SCORE2-Diabetes refers to patients aged ≥40 years.

European Heart Journal 2023; 44: 4043–4140

Systematic Coronary Risk Evaluation 2-Diabetes (SCORE2-Diabetes)

Predicts 10-year CVD risk in patients with type 2 diabetes.

INSTRUCTIONS

Use this score to predict 10-year risk of cardiovascular disease in European patients under 70 years of age and who have a history of diabetes.

When to Use | Pearls/Pitfalls | Why Use

Sex	Male / Female	
Age	48	years
Smoking	Other / Current	
SBP	145	mm Hg
Diabetes	No / Yes	
Total cholesterol	5	mmol/L
HDL cholesterol	1.6	mmol/L
Age at diabetes diagnosis	41	years
HbA1c	9	mmol/mol
eGFR	90	mL/min/1.73 m²

Risk region

See Evidence for definition of risk regions.

Low / Moderate / **High** / Very high

7.4 %

10-year risk of CVD

Copy Results | Next Steps

Risk factor management.

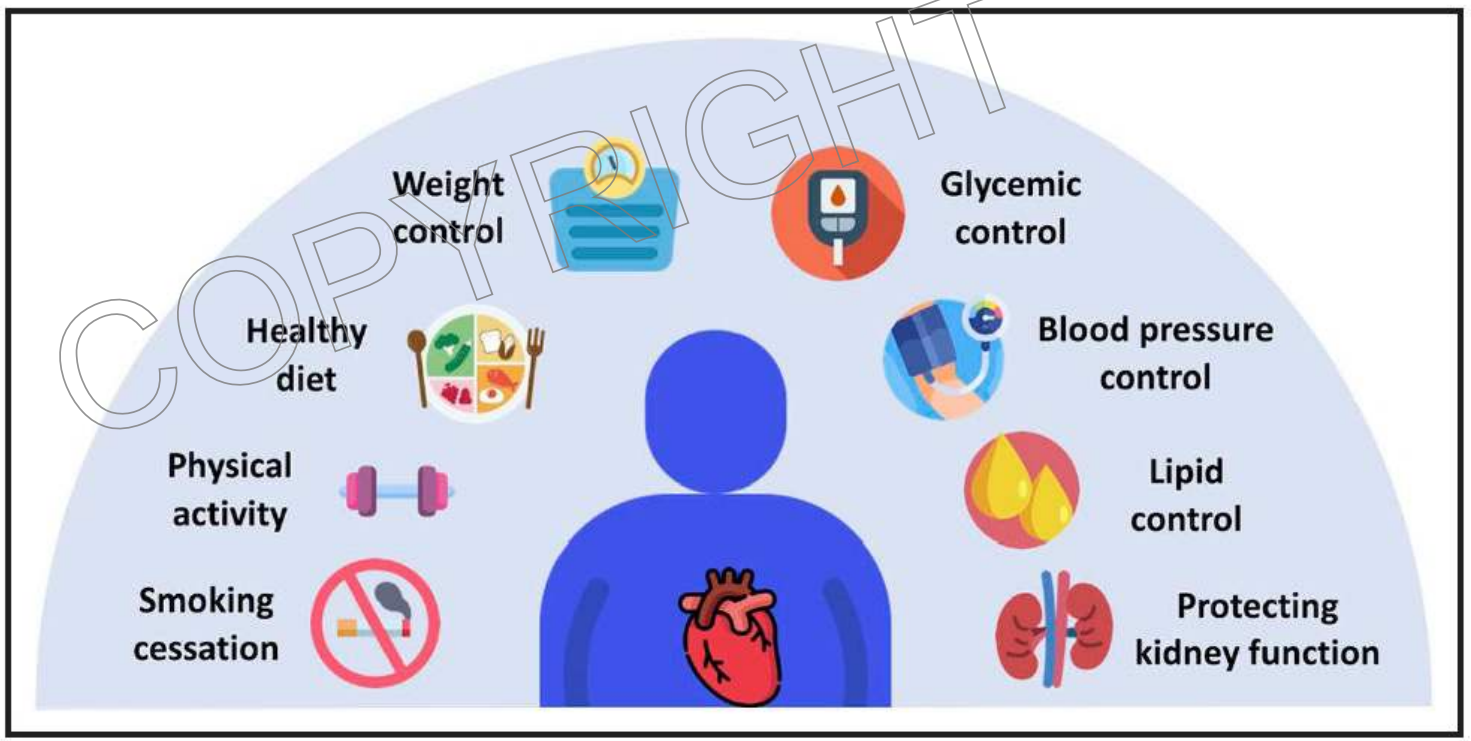
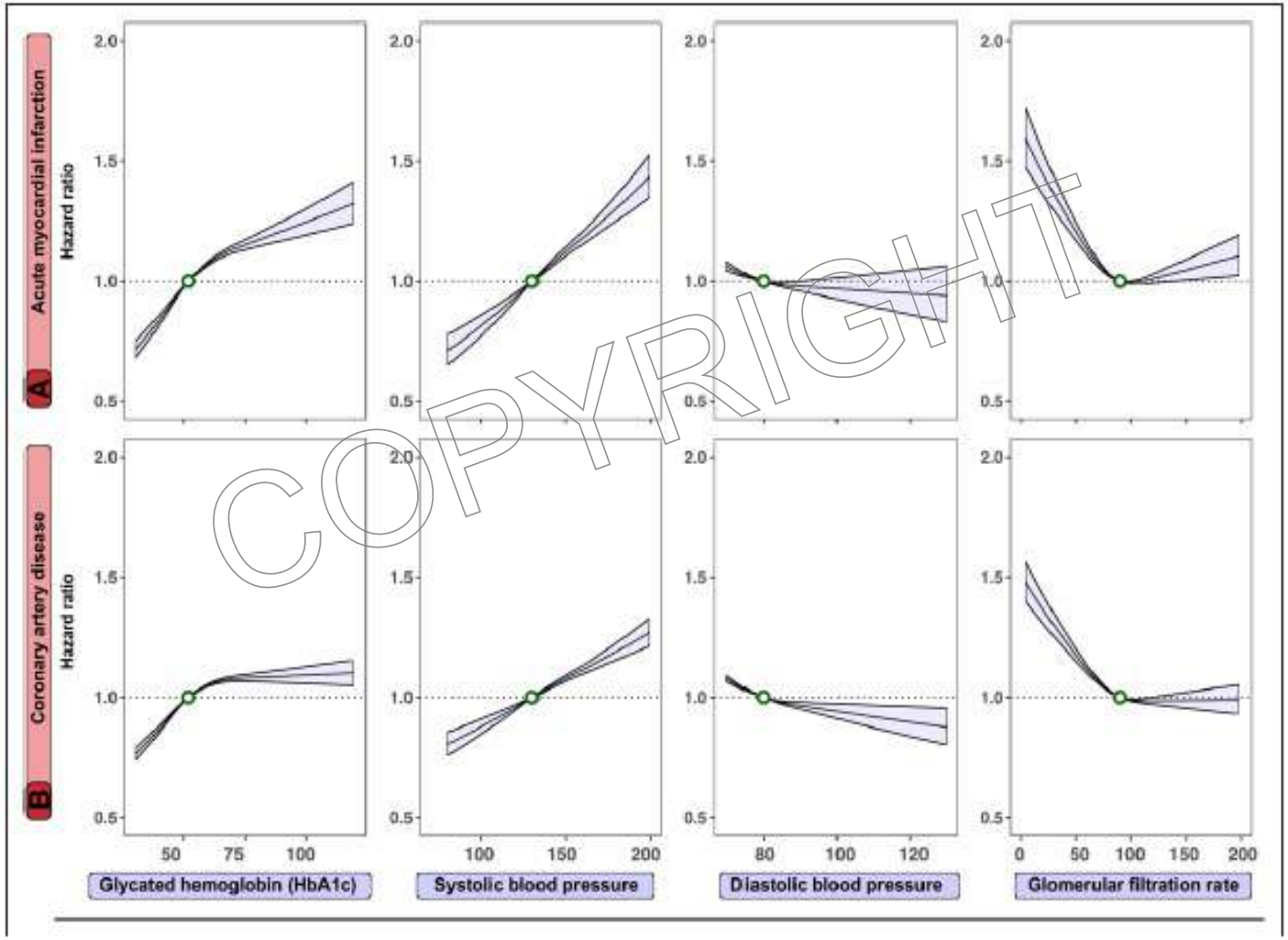
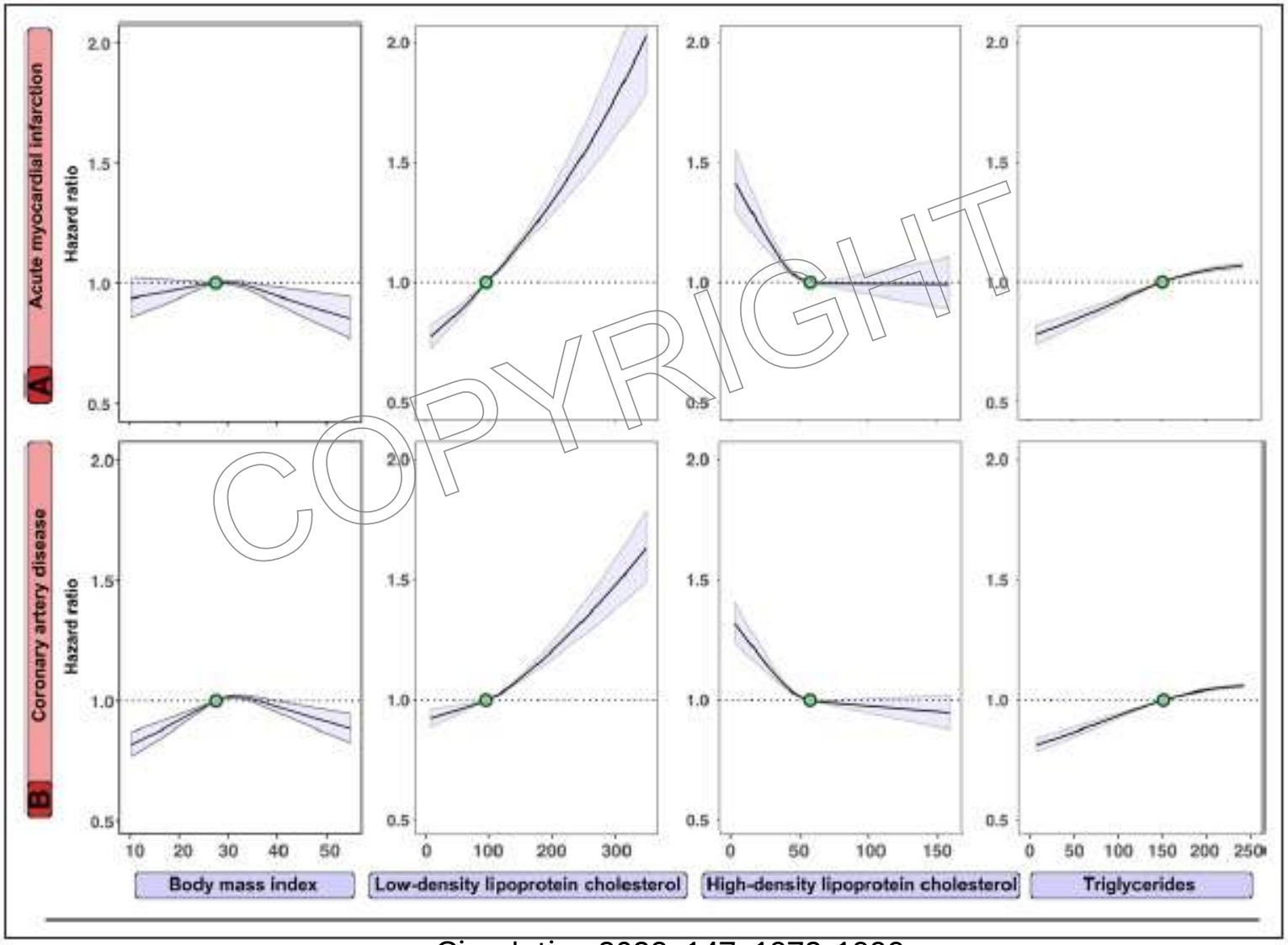


Figure. The importance of multifactorial risk reduction in the management of diabetes.

Circulation 2023;147:1887–1890



Circulation 2023; 147: 1872–1886



Circulation 2023; 147: 1872–1886

BP control has the biggest impact on CV risk reduction in diabetes

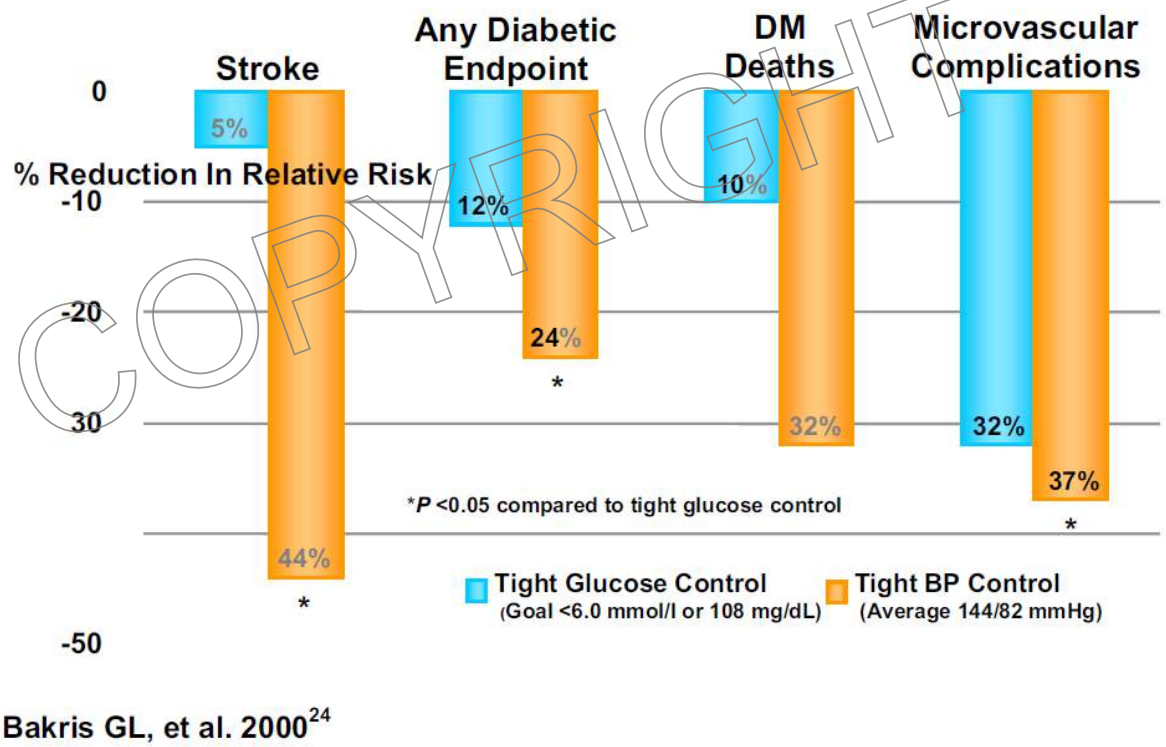


Figure 2. Diabetes: tight glucose and blood pressure (BP) control and cardiovascular outcomes in the United Kingdom Prospective Diabetes Study (UKPDS) (*p <0.05 vs tight glucose control). (Reprinted with permission from *Am J Kidney Dis.*[24])

Am J Cardiol 2011; 108[suppl]: 25B–32B

BP lowering in diabetes.

Table 2. Primary Outcome and Main Secondary Outcomes.*

Outcome	Intensive Treatment (N=6414)		Standard Treatment (N=6407)		Hazard Ratio (95% CI)†	P Value†
	No. of Events	Incidence Rate	No. of Events	Incidence Rate		
		no. of events/100 person-yr		*no. of events/100 person-yr*		
Primary outcome: nonfatal stroke, nonfatal MI, treatment or hospitalization for heart failure, or death from cardiovascular causes	393	1.65 (1.50–1.82)	492	2.09 (1.91–2.28)	0.79 (0.69–0.90)	<0.001
Secondary outcomes						
Fatal or nonfatal MI	68	0.28 (0.22–0.35)	81	0.33 (0.27–0.41)	0.84 (0.60–1.16)	—
Fatal or nonfatal stroke	284	1.19 (1.06–1.33)	356	1.50 (1.35–1.66)	0.79 (0.67–0.92)	—
Treatment or hospitalization for heart failure	31	0.13 (0.09–0.18)	46	0.19 (0.14–0.25)	0.66 (0.41–1.04)	—
Death from cardiovascular causes	60	0.24 (0.19–0.31)	79	0.32 (0.26–0.40)	0.76 (0.55–1.06)	—
Death from any cause	169	0.69 (0.59–0.80)	179	0.73 (0.63–0.84)	0.95 (0.77–1.17)	—
Primary-outcome event or death from any cause	493	2.07 (1.90–2.26)	584	2.48 (2.28–2.69)	0.83 (0.74–0.94)	—
CKD outcomes						
CKD progression	24	1.61 (1.08–2.41)	16	1.11 (0.68–1.80)	1.36 (0.71–2.59)	—
CKD development	232	1.14 (1.00–1.29)	214	1.05 (0.92–1.20)	1.11 (0.92–1.34)	—
Incident albuminuria	554	11.29 (10.39–12.27)	648	13.84 (12.81–14.95)	0.87 (0.77–0.97)	—

* Patients were counted only once for each outcome. Confidence intervals for outcomes other than the primary outcome have not been adjusted for multiplicity and may not be used for hypothesis testing. CKD denotes chronic kidney disease, and MI myocardial infarction.
† Multiple imputation for missing outcomes, under an assumption that data were missing at random, was used for the analyses of clinical outcomes.

N Engl J Med 2025; 392: 1155-67

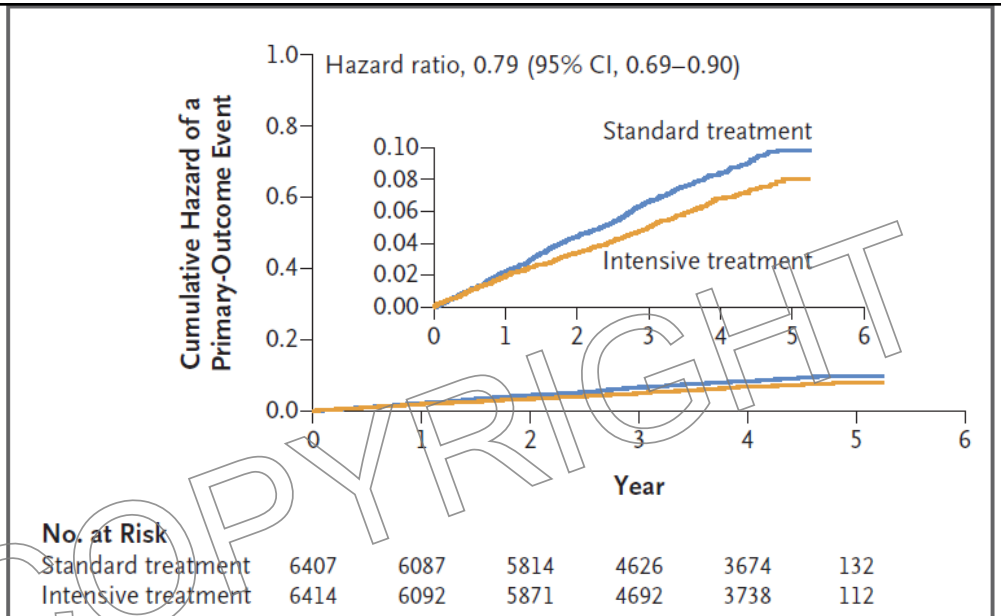


Figure 2. Kaplan–Meier Curves for the Primary Outcome.

The primary outcome was a composite of nonfatal stroke, nonfatal myocardial infarction, treatment or hospitalization for heart failure, or death from cardiovascular causes. Shown is the cumulative hazard of a primary-outcome event among patients who received intensive treatment and among patients who received standard treatment. The hazard ratio and 95% confidence interval for the intensive treatment were calculated by Cox proportional-hazards regression with adjustment for the regions where the clinical sites were located. The numbers listed below the graph are the numbers of patients who were undergoing follow-up and were still at risk. The inset shows the same data on an expanded y axis.

N Engl J Med 2025; 392: 1155-67

Statin use is of benefit.

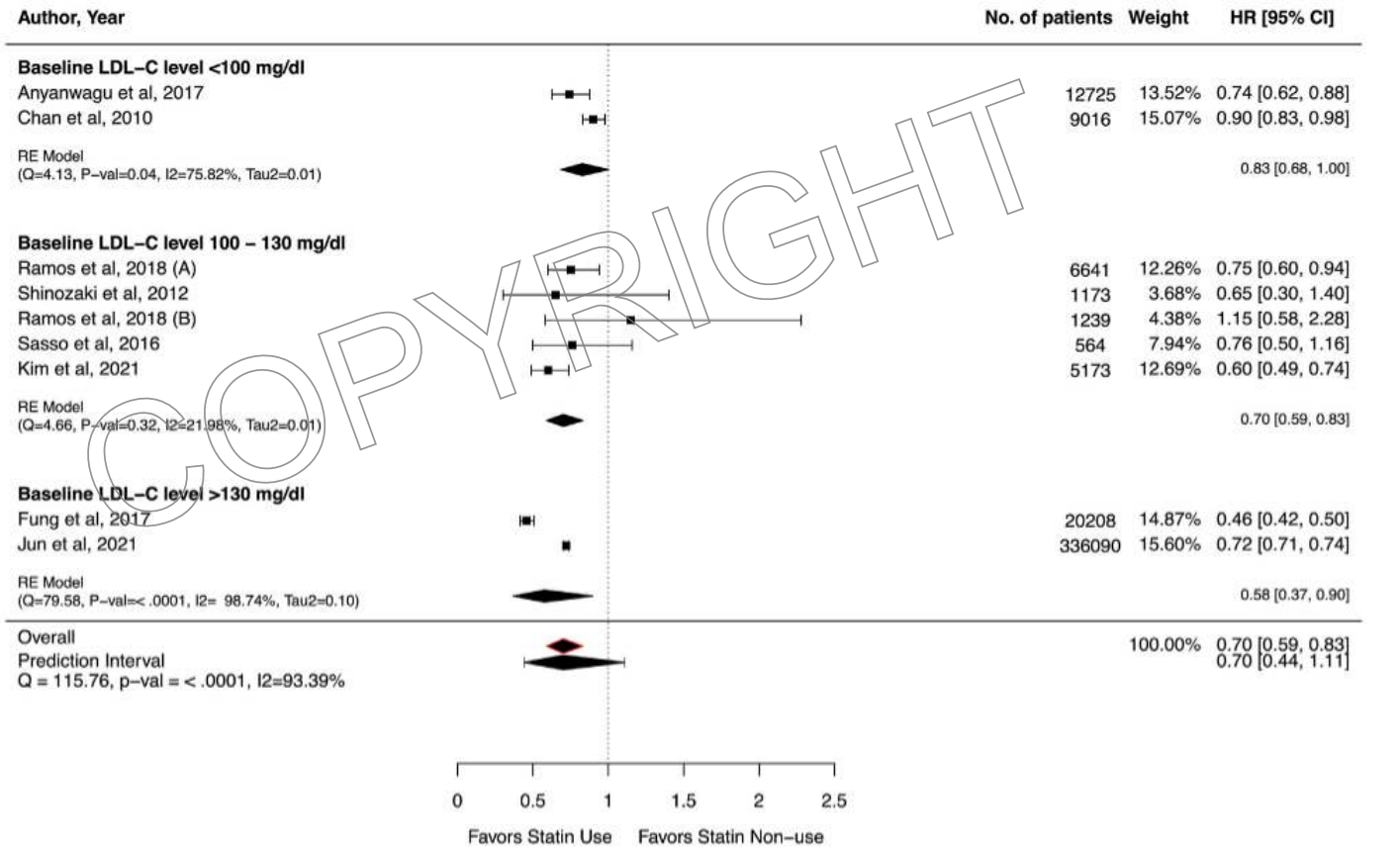
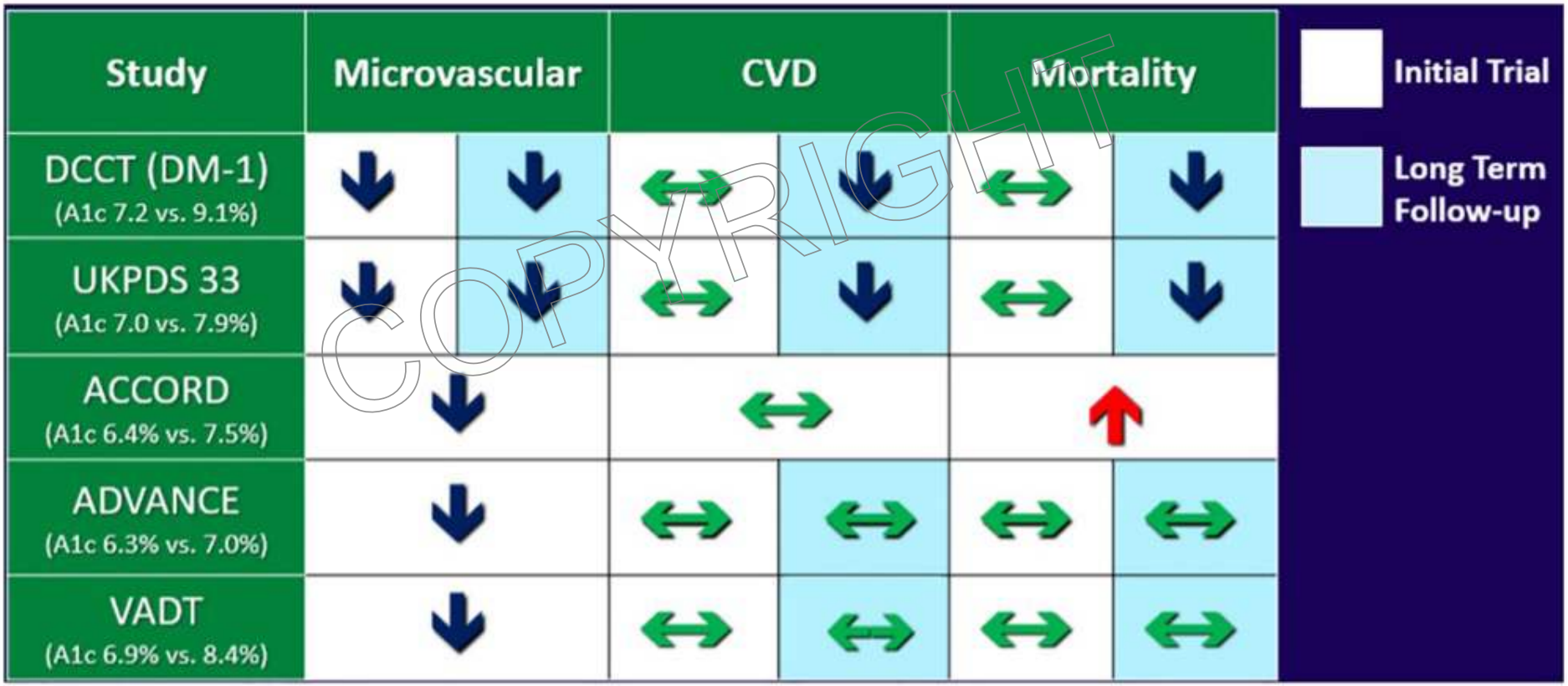


Figure 2 Meta-analysis of Major adverse cardiovascular events (MACE) stratified by baseline LDL-C Level. Hazard ratios (HRs), 95% confidence intervals and 95% prediction interval of statin use vs non-use in T2D patients. Multiply LDL-C values by 0.0259 to convert the units to mmol/L.

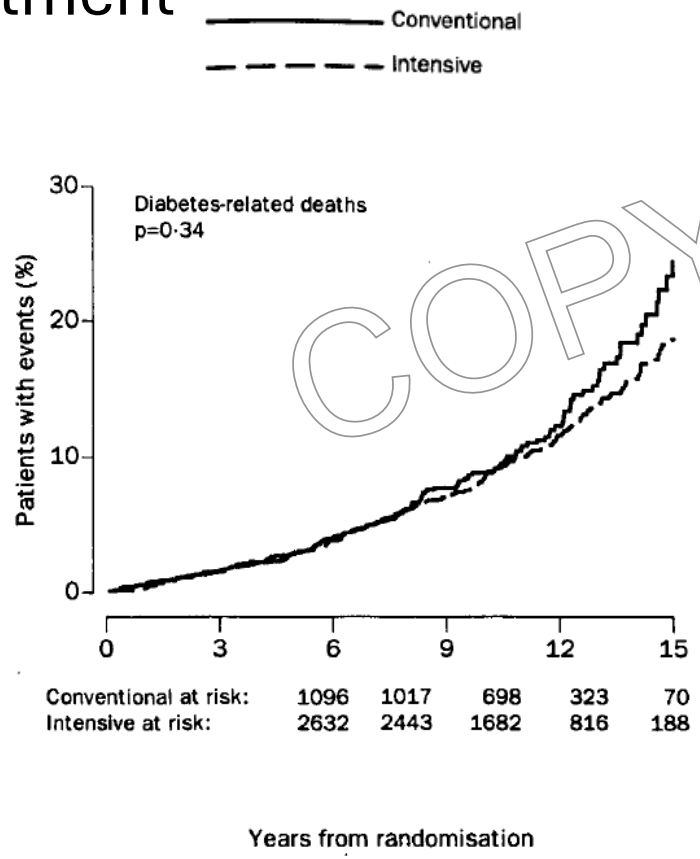
Nutrition, Metabolism & Cardiovascular Diseases 2024; 34: 2021 - 2033

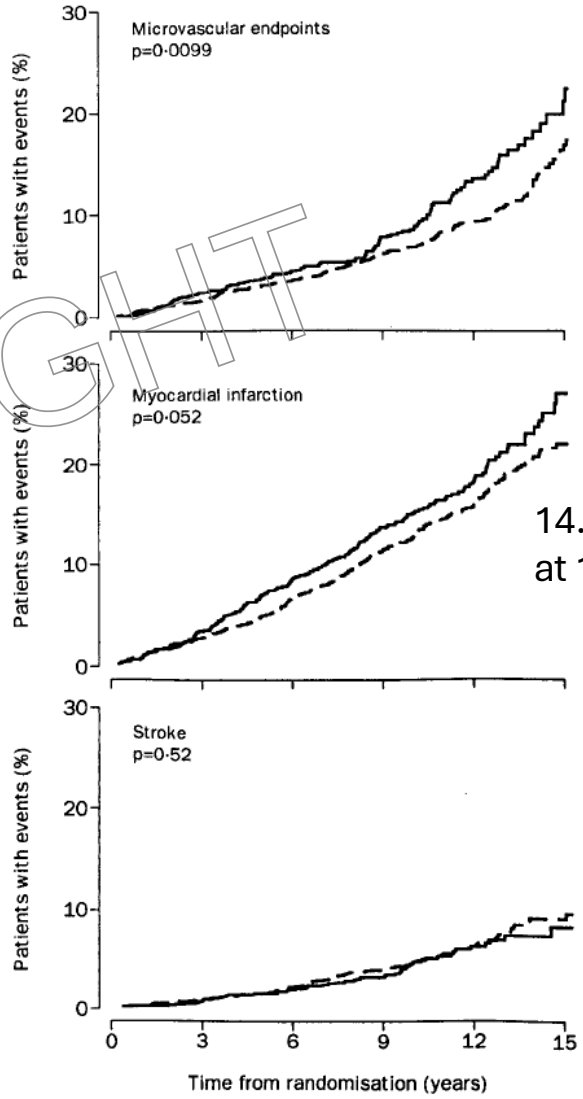
Is intensive glucose control needed?



J Osteopath Med 2024; 124: 127–135

UKPDS 33: Intensive vs Conventional diabetic treatment





14.8% vs 16.7% at 10 years

Lancet 1998; 352: 837-53

Metformin containing regimen vs conventional therapy in UKPDS – long term follow-up

Table 2. Aggregate Outcomes for Patients during Follow-up.*

Aggregate Outcome	Patients with Clinical Outcome		Absolute Risk†		P Value‡	Risk Ratio for Intensive-Therapy Regimen (95% CI)
	Intensive Therapy	Conventional Therapy	Intensive Therapy	Conventional Therapy		
	no. of patients					
Sulfonyurea–insulin group	2729	1138				
Any diabetes-related end point	1571	686	48.1	52.2	0.04	0.91 (0.83–0.99)
Diabetes-related death	618	297	14.5	17.0	0.01	0.83 (0.73–0.96)
Death from any cause	1162	537	26.8	30.3	0.007	0.87 (0.79–0.96)
Myocardial infarction	678	319	16.8	19.6	0.01	0.85 (0.74–0.97)
Stroke	260	116	6.3	6.9	0.39	0.91 (0.73–1.13)
Peripheral vascular disease	83	40	2.0	2.4	0.29	0.82 (0.56–1.19)
Microvascular disease	429	222	11.0	14.2	0.001	0.76 (0.64–0.89)
Metformin group	342	411				
Any diabetes-related end point	209	262	45.7	53.9	0.01	0.79 (0.66–0.95)
Diabetes-related death	81	120	14.0	18.7	0.01	0.70 (0.53–0.92)
Death from any cause	152	217	25.9	33.1	0.002	0.73 (0.59–0.89)
Myocardial infarction	81	126	14.8	21.1	0.005	0.67 (0.51–0.89)
Stroke	34	42	6.0	6.8	0.35	0.80 (0.50–1.27)
Peripheral vascular disease	13	21	2.3	3.4	0.19	0.63 (0.32–1.27)
Microvascular disease	66	78	12.4	13.4	0.31	0.84 (0.60–1.17)

* Shown are the numbers of patients who were followed for up to 30 years, including up to 10 years of post-trial monitoring, with aggregate clinical outcomes after assignment in the interventional phase of the United Kingdom Prospective Diabetes Study to the sulfonylurea–insulin group or the metformin group or to the corresponding conventional-therapy group.
† The absolute risk is the number of events per 1000 patient-years.
‡ P values were calculated with the use of the log-rank test.

N Engl J Med 2008; 359: 1577-89

Metformin is associated with much less hypoglycaemia.

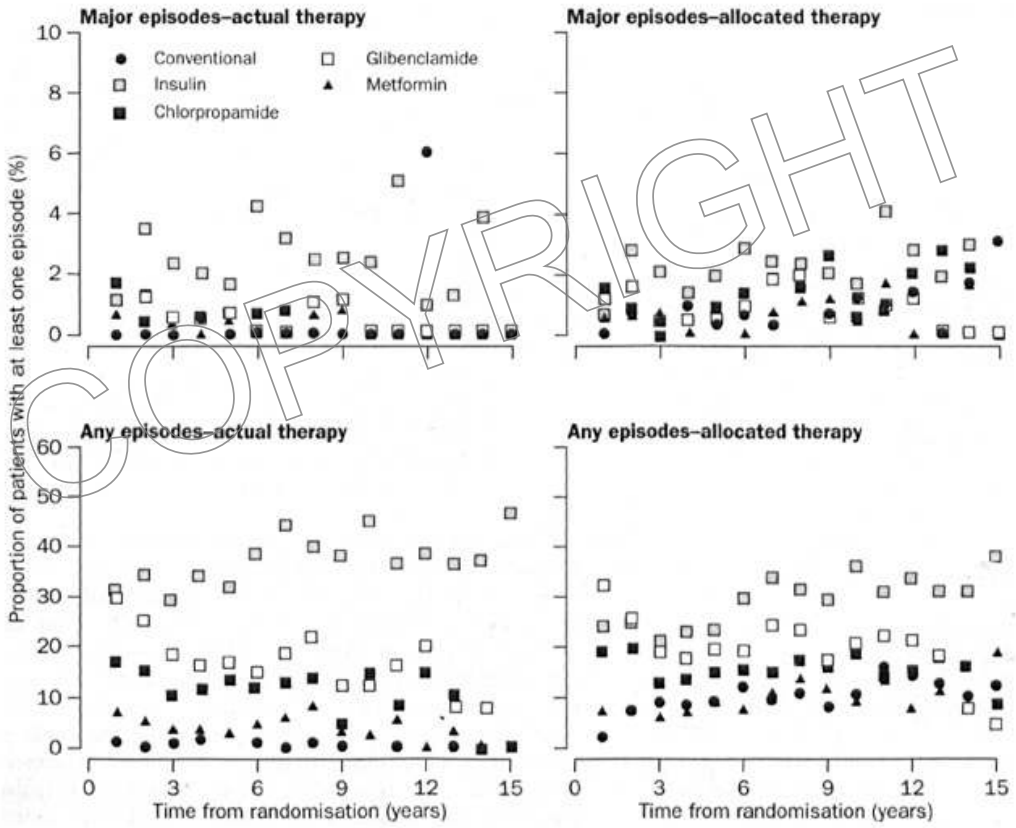


Figure 4: **Proportion of patients who reported one or more episodes of major hypoglycaemia or any hypoglycaemia per year, assessed by actual therapy and by allocation (intention to treat)**

Lancet 1998; 352: 854-65

Semaglutide and CV outcomes in diabetes

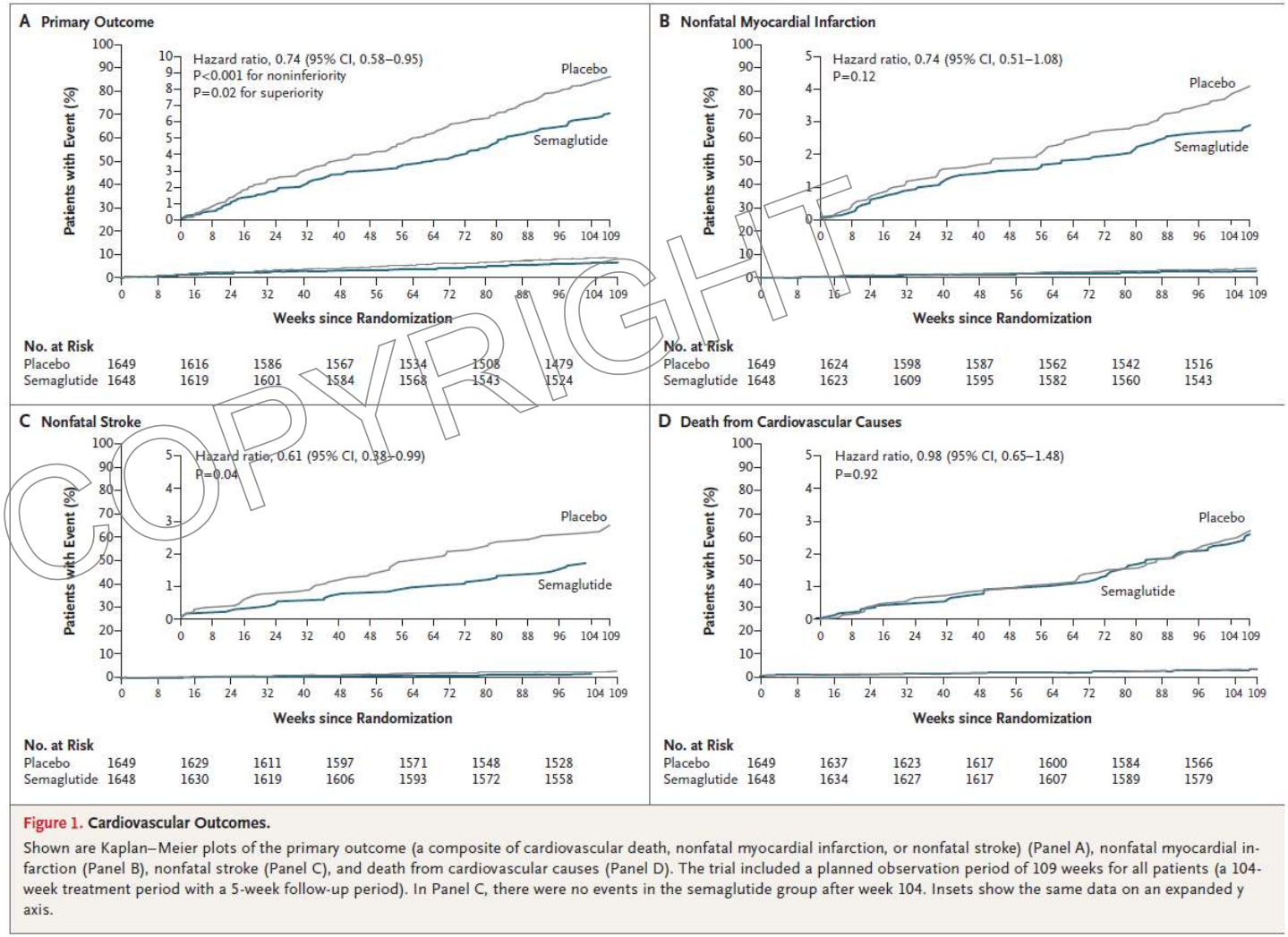
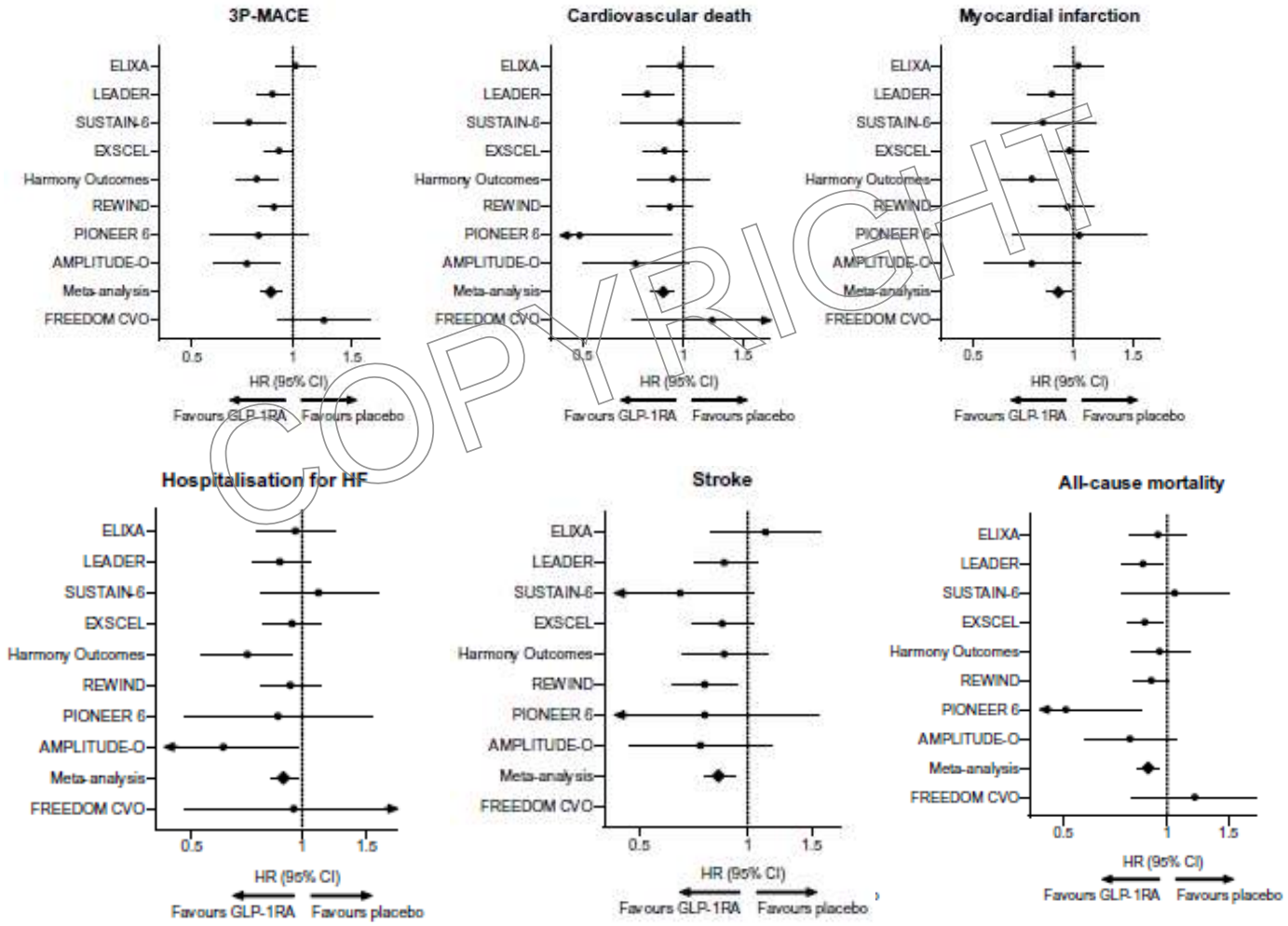


Figure 1. Cardiovascular Outcomes.

Shown are Kaplan–Meier plots of the primary outcome (a composite of cardiovascular death, nonfatal myocardial infarction, or nonfatal stroke) (Panel A), nonfatal myocardial infarction (Panel B), nonfatal stroke (Panel C), and death from cardiovascular causes (Panel D). The trial included a planned observation period of 109 weeks for all patients (a 104-week treatment period with a 5-week follow-up period). In Panel C, there were no events in the semaglutide group after week 104. Insets show the same data on an expanded y axis.

N Engl J Med 2016; 375: 1834-44



Diabetologia 2023; 66:1820–1831

Empagliflozin and CV outcomes

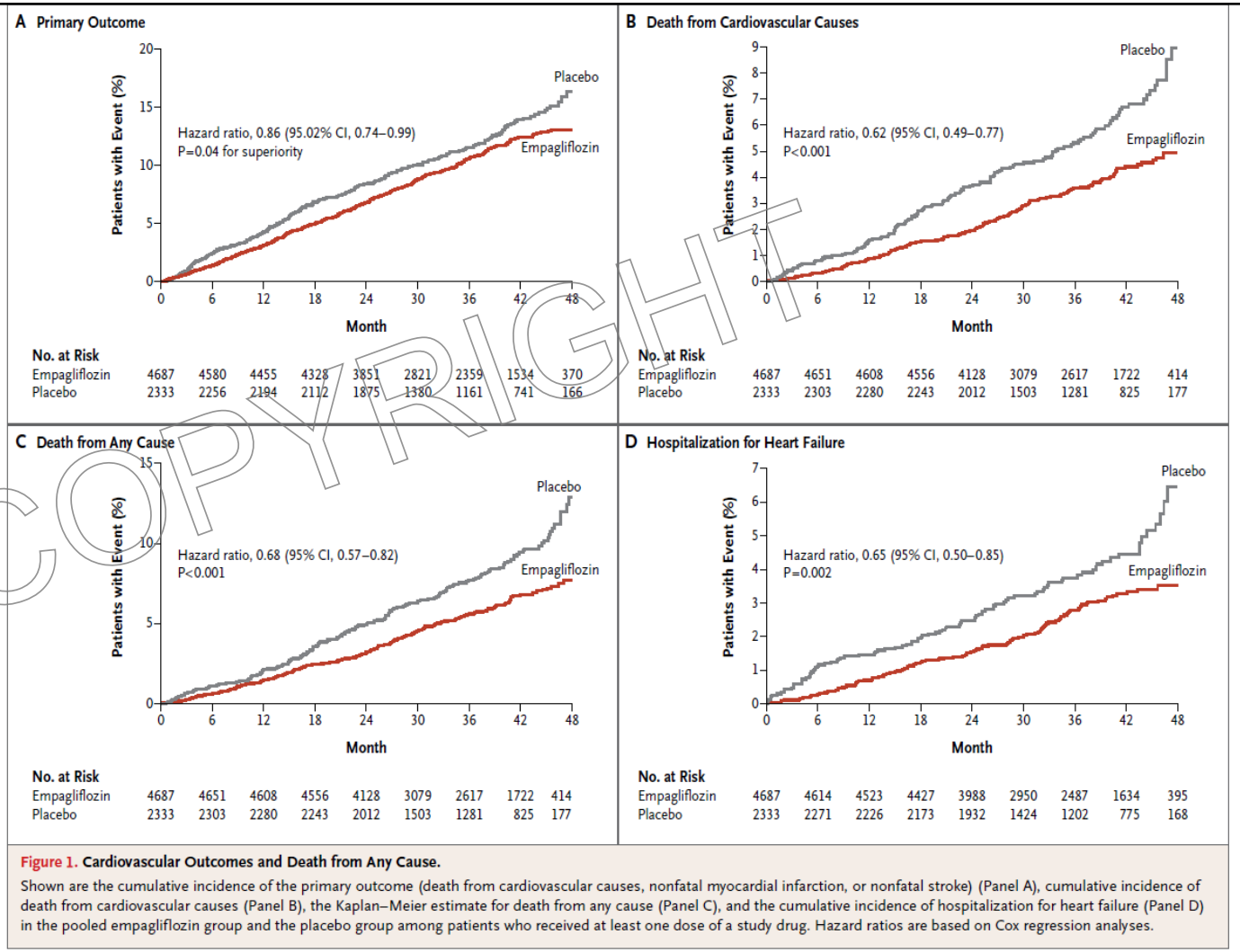


Figure 1. Cardiovascular Outcomes and Death from Any Cause.

Shown are the cumulative incidence of the primary outcome (death from cardiovascular causes, nonfatal myocardial infarction, or nonfatal stroke) (Panel A), cumulative incidence of death from cardiovascular causes (Panel B), the Kaplan–Meier estimate for death from any cause (Panel C), and the cumulative incidence of hospitalization for heart failure (Panel D) in the pooled empagliflozin group and the placebo group among patients who received at least one dose of a study drug. Hazard ratios are based on Cox regression analyses.

N Engl J Med 2015; 373: 2117-28

Table 1. Primary and Secondary Cardiovascular Outcomes.

Outcome	Placebo (N=2333)		Empagliflozin (N=4687)		Hazard Ratio (95% CI)	P Value
	no. (%)	*rate/1000 patient-yr*	*no. (%)*	*rate/1000 patient-yr*		
Death from cardiovascular causes, nonfatal myocardial infarction, or nonfatal stroke: primary outcome*	282 (12.1)	43.9	490 (10.5)	37.4	0.86 (0.74–0.99)	
Noninferiority						<0.001†
Superiority						0.04†
Death from cardiovascular causes, nonfatal myocardial infarction, nonfatal stroke, or hospitalization for unstable angina: key secondary outcome*	333 (14.3)	52.5	599 (12.8)	46.4	0.89 (0.78–1.01)	
Noninferiority						<0.001†
Superiority						0.08†
Death						
From any cause	194 (8.3)	28.6	269 (5.7)	19.4	0.68 (0.57–0.82)	<0.001
From cardiovascular causes	137 (5.9)	20.2	172 (3.7)	12.4	0.62 (0.49–0.77)	<0.001
Fatal or nonfatal myocardial infarction excluding silent myocardial infarction	126 (5.4)	19.3	223 (4.8)	16.8	0.87 (0.70–1.09)	0.23
Nonfatal myocardial infarction excluding silent myocardial infarction	121 (5.2)	18.5	213 (4.5)	16.0	0.87 (0.70–1.09)	0.22
Silent myocardial infarction‡	15 (1.2)	5.4	38 (1.6)	7.0	1.28 (0.70–2.33)	0.42
Hospitalization for unstable angina	66 (2.8)	10.0	133 (2.8)	10.0	0.99 (0.74–1.34)	0.97
Coronary revascularization procedure	186 (8.0)	29.1	329 (7.0)	25.1	0.86 (0.72–1.04)	0.11
Fatal or nonfatal stroke	69 (3.0)	10.5	164 (3.5)	12.3	1.18 (0.89–1.56)	0.26
Nonfatal stroke	60 (2.6)	9.1	150 (3.2)	11.2	1.24 (0.92–1.67)	0.16
Transient ischemic attack	23 (1.0)	3.5	39 (0.8)	2.9	0.85 (0.51–1.42)	0.54
Hospitalization for heart failure	95 (4.1)	14.5	126 (2.7)	9.4	0.65 (0.50–0.85)	0.002
Hospitalization for heart failure or death from cardiovascular causes excluding fatal stroke	198 (8.5)	30.1	265 (5.7)	19.7	0.66 (0.55–0.79)	<0.001

* Data were analyzed with the use of a four-step hierarchical-testing strategy for the pooled empagliflozin group versus the placebo group in the following order: noninferiority for the primary outcome, noninferiority for the key secondary outcome, superiority for the primary outcome, and superiority for the key secondary outcome. Each successive hypothesis could be tested, provided that those preceding it met the designated level of significance. Data are based on Cox regression analyses in patients who received at least one dose of a study drug.
† One-sided P values are shown for tests of noninferiority, and two-sided P values are shown for tests of superiority.
‡ Silent myocardial infarction was analyzed in 2378 patients in the empagliflozin group and 1211 patients in the placebo group.

N Engl J Med 2015; 373: 2117-28

Dapagliflozin and CV outcomes in diabetes

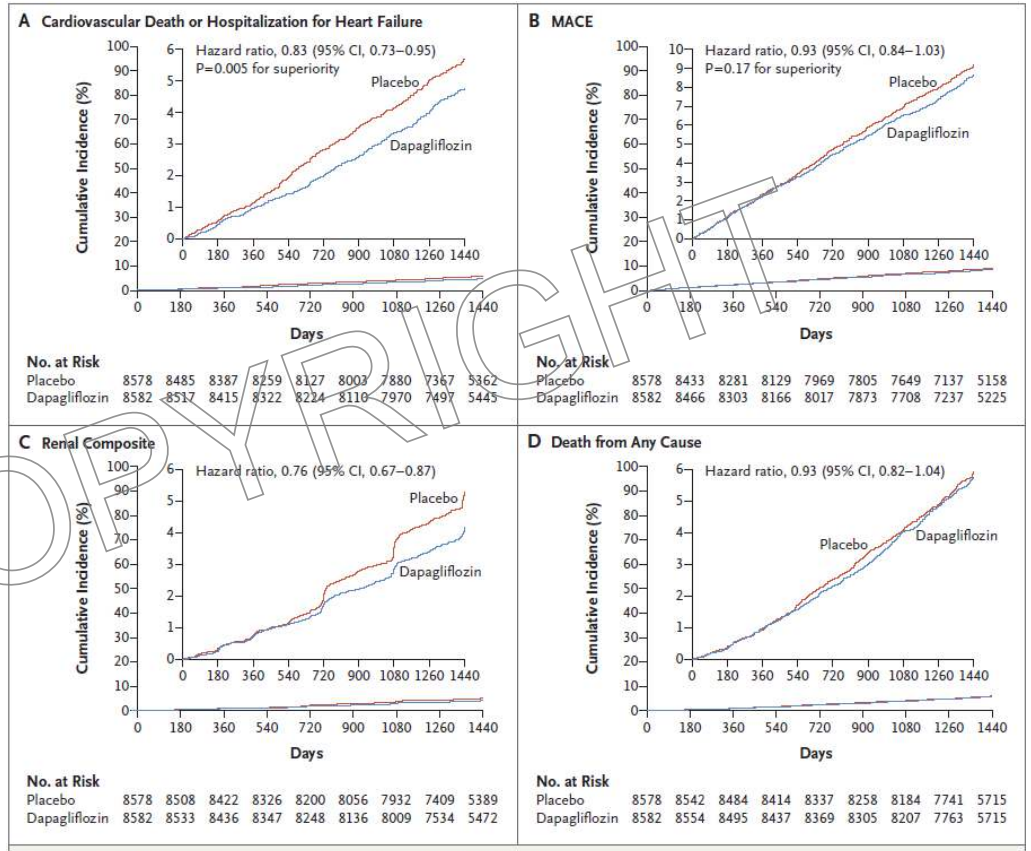


Figure 1. Major Cardiovascular and Renal Outcomes and Death from Any Cause.

Shown is the cumulative incidence of the two primary efficacy outcomes of cardiovascular death or hospitalization for heart failure (Panel A) and major adverse cardiovascular events (MACE), defined as cardiovascular death, myocardial infarction, or ischemic stroke (Panel B). Dapagliflozin was noninferior to placebo with respect to the primary safety outcome of MACE (upper boundary of the 95% CI, <1.3; P<0.001 for noninferiority). Also shown is the cumulative incidence of the secondary efficacy outcomes of a renal composite (≥40% decrease in estimated glomerular filtration rate to <60 ml per minute per 1.73 m^2 of body-surface area, new end-stage renal disease, or death from renal or cardiovascular causes) (Panel C) and death from any cause (Panel D). The inset in each panel shows the same data on an enlarged y axis.

N Engl J Med 2019; 380: 347-57

Outcome	Dapagliflozin (N=8582)		Placebo (N=8578)		Hazard Ratio (95% CI)	P Value
	no. (%)	*rate/1000 patient-yr*	*no. (%)*	*rate/1000 patient-yr*		
Cardiovascular death or hospitalization for heart failure	417 (4.9)	12.2	496 (5.8)	14.7	0.83 (0.73–0.95)	0.005
MACE	756 (8.8)	22.6	803 (9.4)	24.2	0.93 (0.84–1.03)	0.17
≥40% decrease in eGFR to <60 ml/min/1.73 m^2, ESRD, or death from renal or cardiovascular cause	370 (4.3)	10.8	480 (5.6)	14.1	0.76 (0.67–0.87)	
Death from any cause	529 (6.2)	15.1	570 (6.6)	16.4	0.93 (0.82–1.04)	
Hospitalization for heart failure	212 (2.5)	6.2	286 (3.3)	8.5	0.73 (0.61–0.88)	
Myocardial infarction	393 (4.6)	11.7	441 (5.1)	13.2	0.89 (0.77–1.01)	
Ischemic stroke	235 (2.7)	6.9	231 (2.7)	6.8	1.01 (0.84–1.21)	
Death from cardiovascular cause	245 (2.9)	7.0	249 (2.9)	7.1	0.98 (0.82–1.17)	
Death from noncardiovascular cause	211 (2.5)	6.0	238 (2.8)	6.8	0.88 (0.73–1.06)	
≥40% decrease in eGFR to <60 ml/min/1.73 m^2, ESRD, or death from renal cause	127 (1.5)	3.7	238 (2.8)	7.0	0.53 (0.43–0.66)	

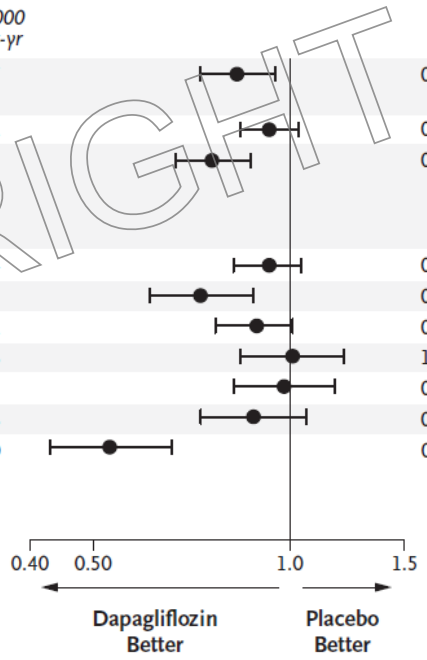
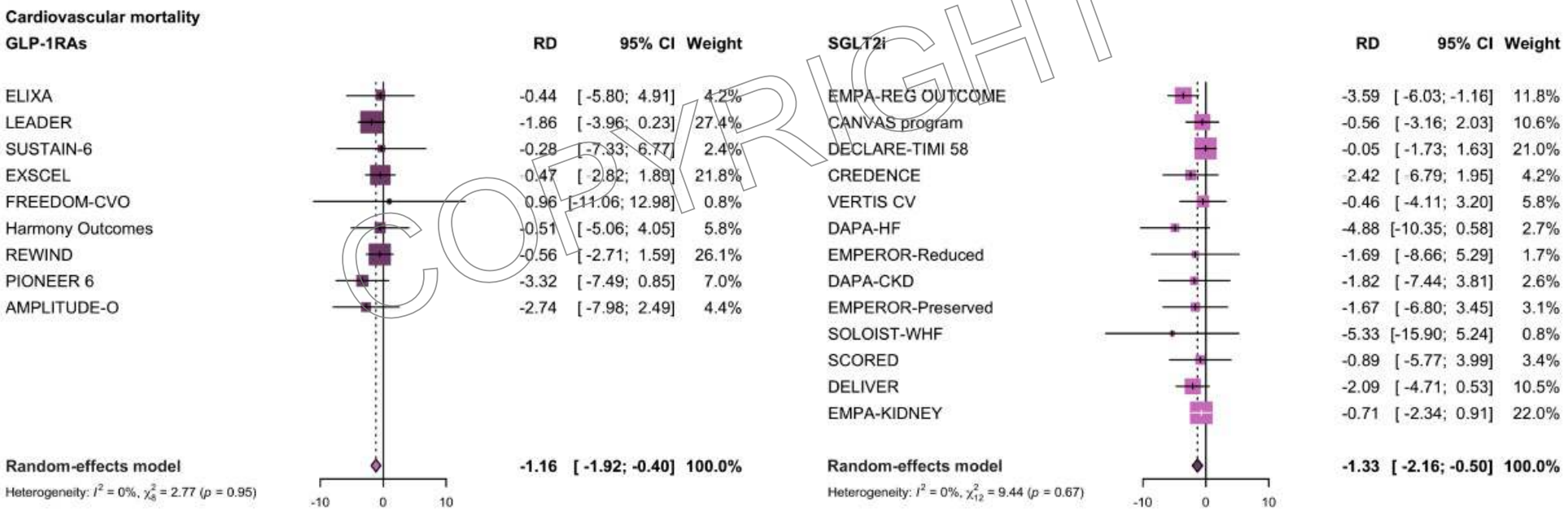


Figure 2. Key Efficacy Outcomes and Their Components.

Two-sided P values are shown for the two primary efficacy outcomes of cardiovascular death or hospitalization for heart failure and MACE. The abbreviation eGFR denotes estimated glomerular filtration rate, and ESRD end-stage renal disease.

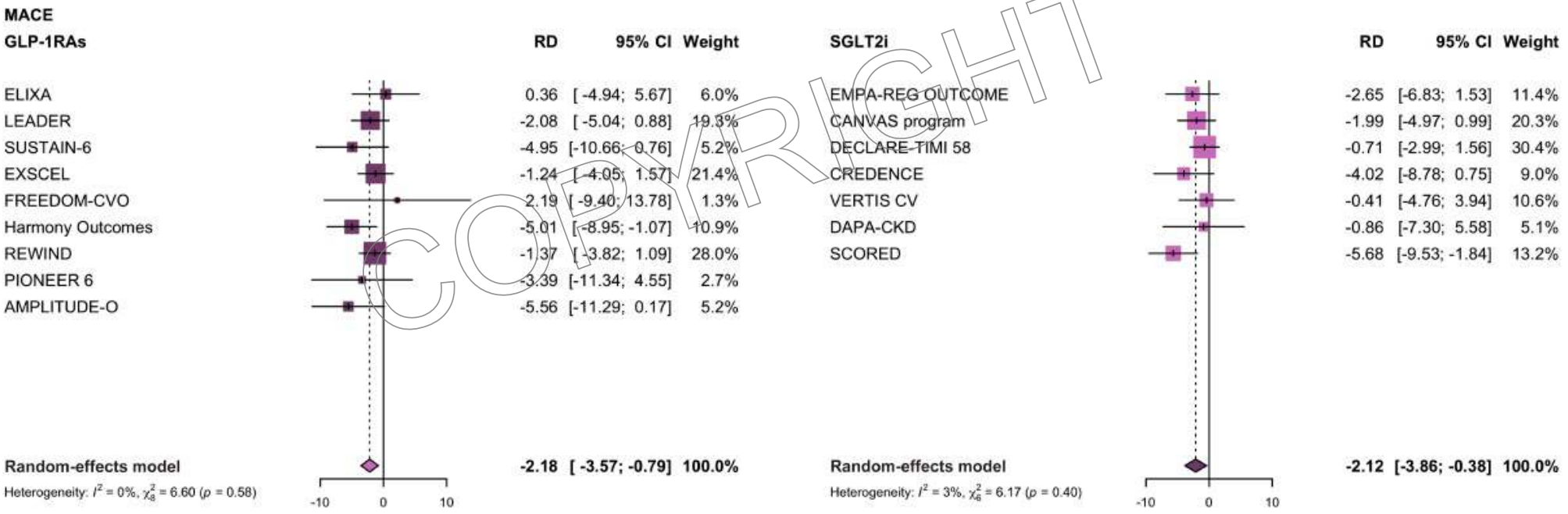
N Engl J Med 2019; 380: 347-57

5 year ARD for GLP-1RA and SGLT2i



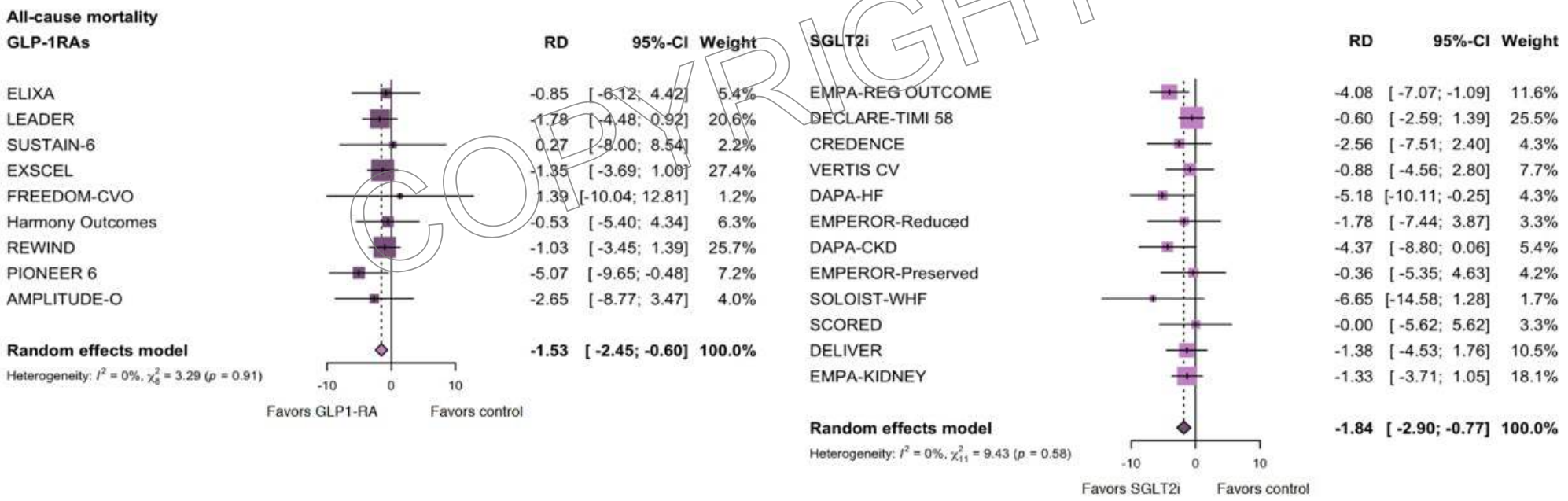
Diabetes Care 2023; 46: 1300–1310

5 year ARD for GLP-1RA and SGLT2i



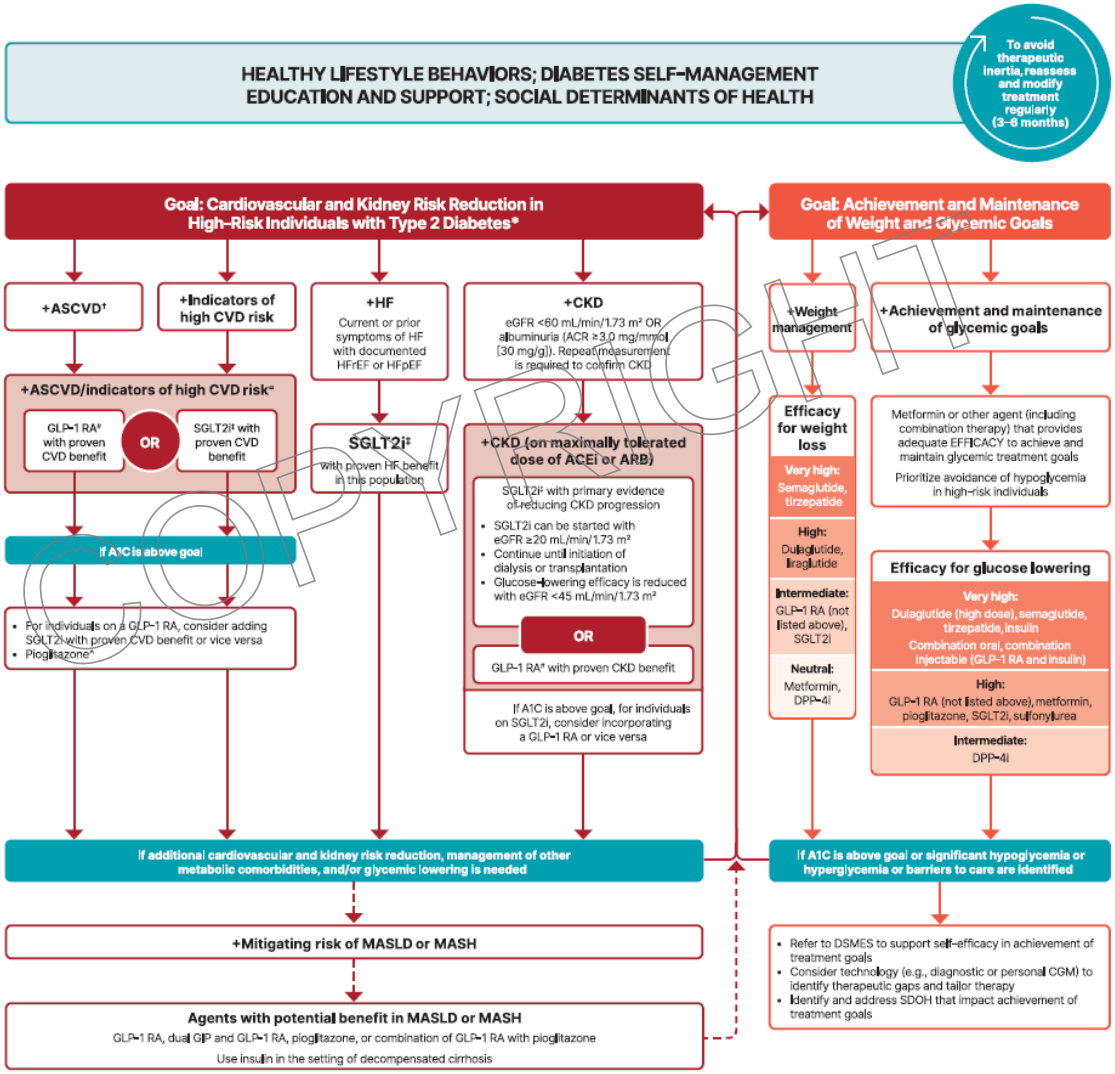
Diabetes Care 2023; 46: 1300–1310

All-cause mortality ARD of GLP-1RA and SGLT2i

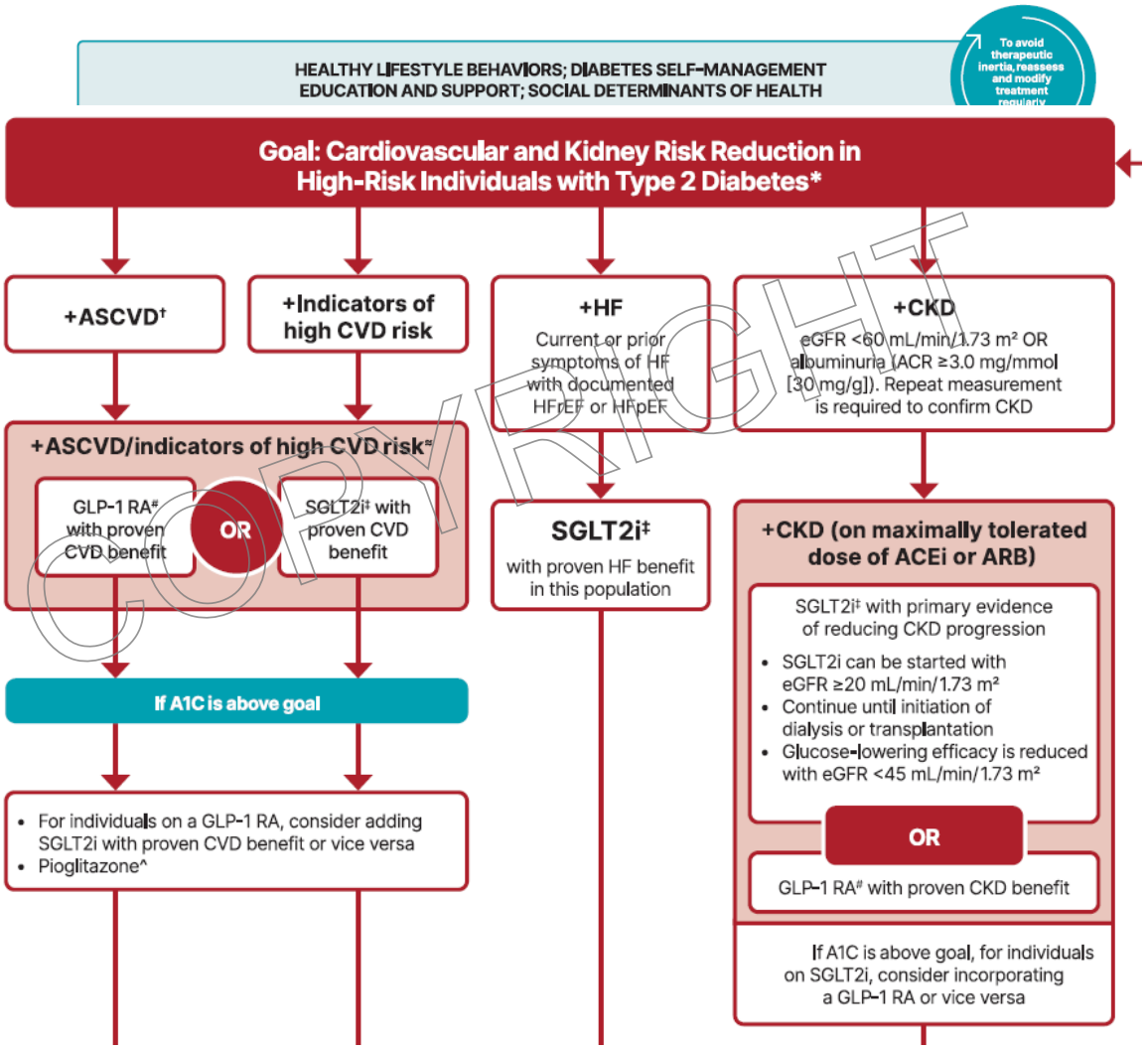


Diabetes Care 2023; 46: 1300–1310

Latest ADA recommendation



Diabetes Care 2025;48(Suppl. 1):S181–S206



Diabetes Care 2025;48(Suppl. 1):S181–S206

Effect of diabetes therapy on MACE (atherosclerotic)

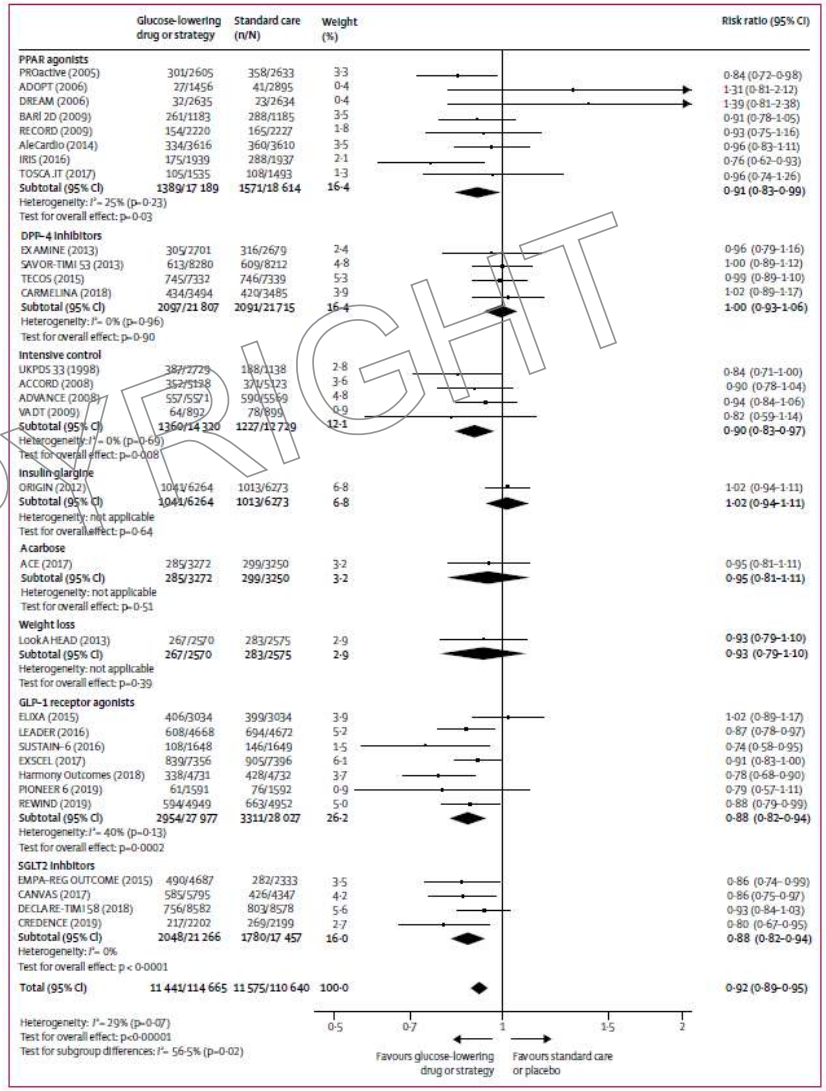


Figure 2: **Risk of atherosclerotic major adverse cardiovascular events comparing glucose-lowering drugs or strategies with standard care or placebo, stratified by strategy or drug class**

Risk ratios were calculated from an inverse-variance random-effects model. Heterogeneity among diabetes drug class or strategy subgroups was assessed with an interaction term representing treatment effect by therapy category. PPAR=peroxisome proliferator-activated receptor.

Lancet Diabetes Endocrinol 2020; 8: 418–35

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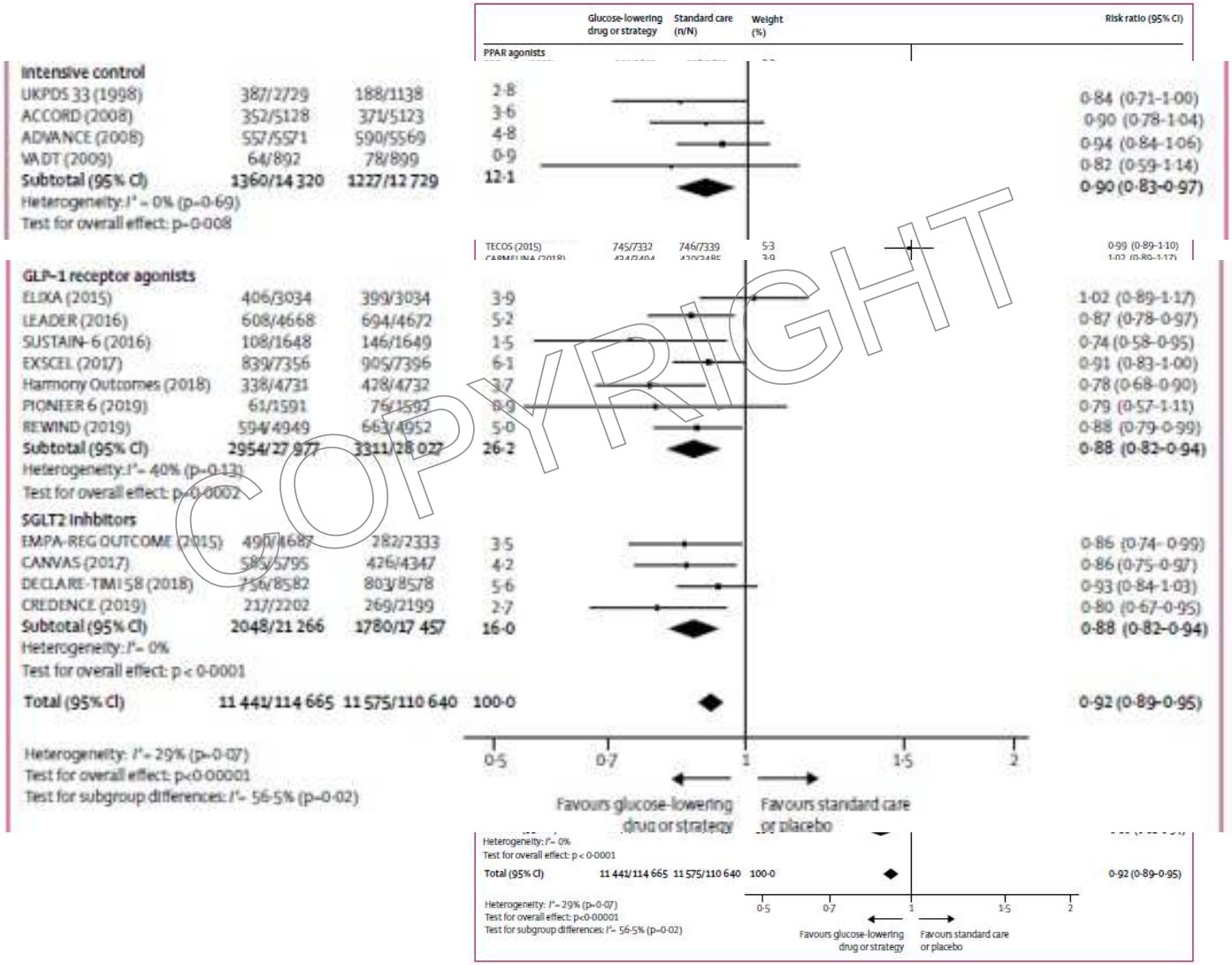

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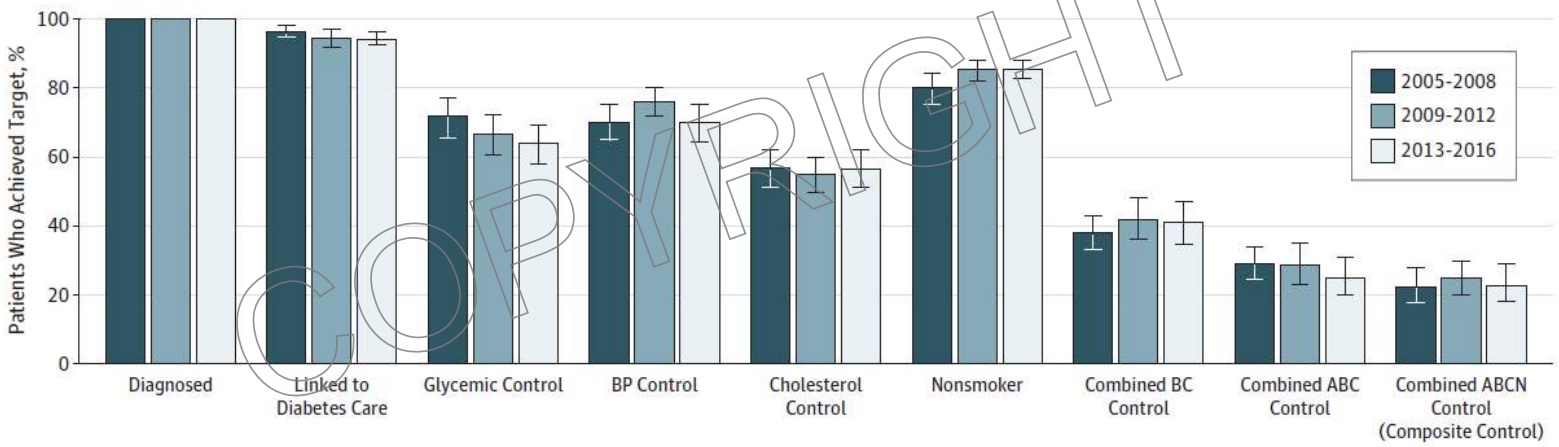
Lancet Diabetes Endocrinol 2020; 8: 418–35

Management of CV risk factor in diabetes is very important.

Figure 1. Cascade of Diabetes Care in the United States for 2005-2016

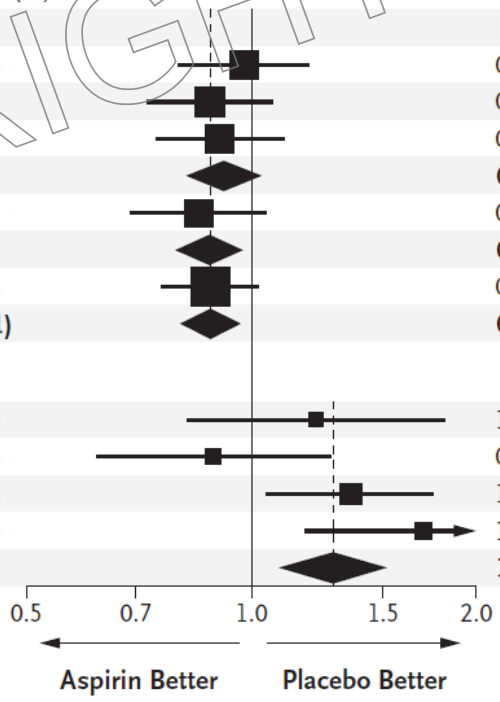


The cascade of diabetes care (also known as the diabetes care continuum) for US nonpregnant adults with diagnosed diabetes in 2005-2008, 2009-2012, and 2013-2016. The cascade of care illustrates the population-level steps of linkage to care, meeting individual treatment targets, and attaining the combined targets of care, and helps reveal the gaps in diabetes care. Glycemic control was defined as hemoglobin A_{1c} (HbA_{1c}) level less than or equal to an individualized target. Blood pressure (BP) control was defined as systolic/diastolic BP less than 140/90 mm Hg. Cholesterol control was defined as low-density lipoprotein cholesterol level less than 100 mg/dL (to convert to millimoles per liter, multiply by 0.0259). BC control refers to BP and cholesterol level control; ABC control refers to HbA_{1c}, BP, and cholesterol level control; and ABCN control was defined as HbA_{1c}, BP, and cholesterol level control and not smoking tobacco. Error bars indicate 95% CI.

JAMA Intern Med 2019; 179(10): 1376-1385

Aspirin for primary prevention.

Type of Event	Aspirin (N=7740)	Placebo (N=7740)	Rate Ratio (95% CI)	P Value
	no. of participants with event (%)			
Vascular Outcomes				
Nonfatal myocardial infarction	191 (2.5)	195 (2.5)	0.98 (0.80–1.19)	
Nonfatal presumed ischemic stroke	202 (2.6)	229 (3.0)	0.88 (0.73–1.06)	
Vascular death excluding intracranial hemorrhage	197 (2.5)	217 (2.8)	0.91 (0.75–1.10)	
Any serious vascular event excluding TIA	**542 (7.0)**	**587 (7.6)**	**0.92 (0.82–1.03)**	
TIA	168 (2.2)	197 (2.5)	0.85 (0.69–1.04)	
Any serious vascular event including TIA	**658 (8.5)**	**743 (9.6)**	**0.88 (0.79–0.97)**	**0.01**
Any arterial revascularization	340 (4.4)	384 (5.0)	0.88 (0.76–1.02)	
Any serious vascular event or revascularization	**833 (10.8)**	**936 (12.1)**	**0.88 (0.80–0.97)**	
Major Bleeding				
Intracranial hemorrhage	55 (0.7)	45 (0.6)	1.22 (0.82–1.81)	
Sight-threatening bleeding in eye	57 (0.7)	64 (0.8)	0.89 (0.62–1.27)	
Serious gastrointestinal bleeding	137 (1.8)	101 (1.3)	1.36 (1.05–1.75)	
Other major bleeding	74 (1.0)	43 (0.6)	1.70 (1.18–2.44)	
Any major bleeding	**314 (4.1)**	**245 (3.2)**	**1.29 (1.09–1.52)**	**0.003**



N Engl J Med 2018; 379: 1529-39

Adding rivaroxaban 2.5 mg 2x/day to aspirin for ASCVD

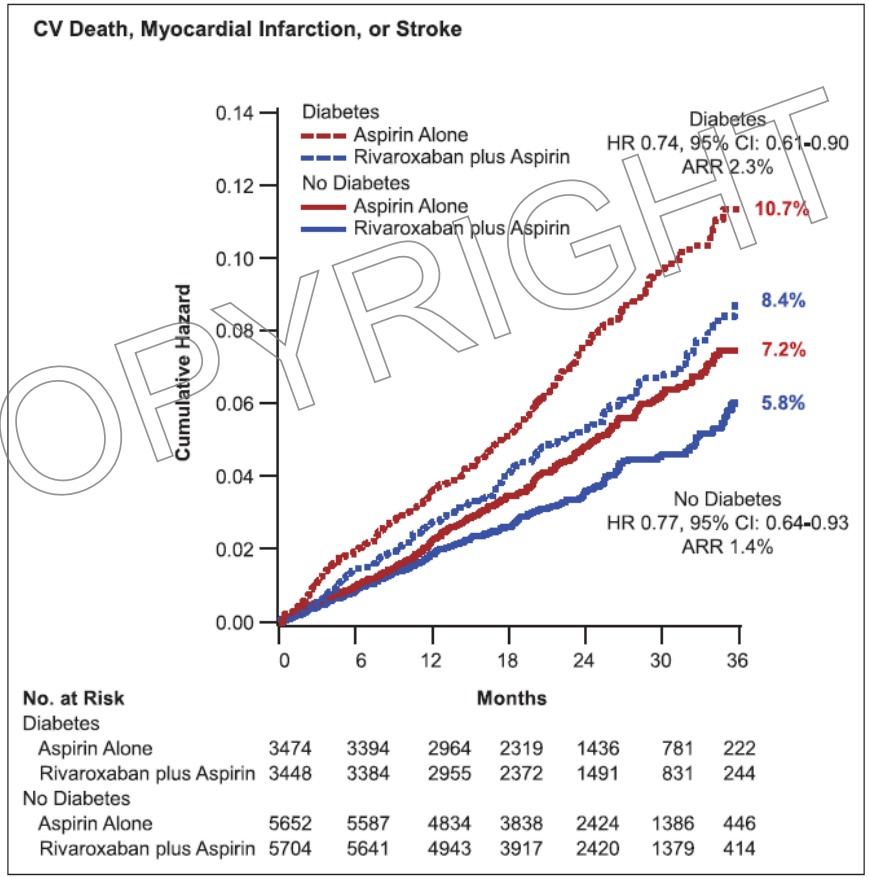
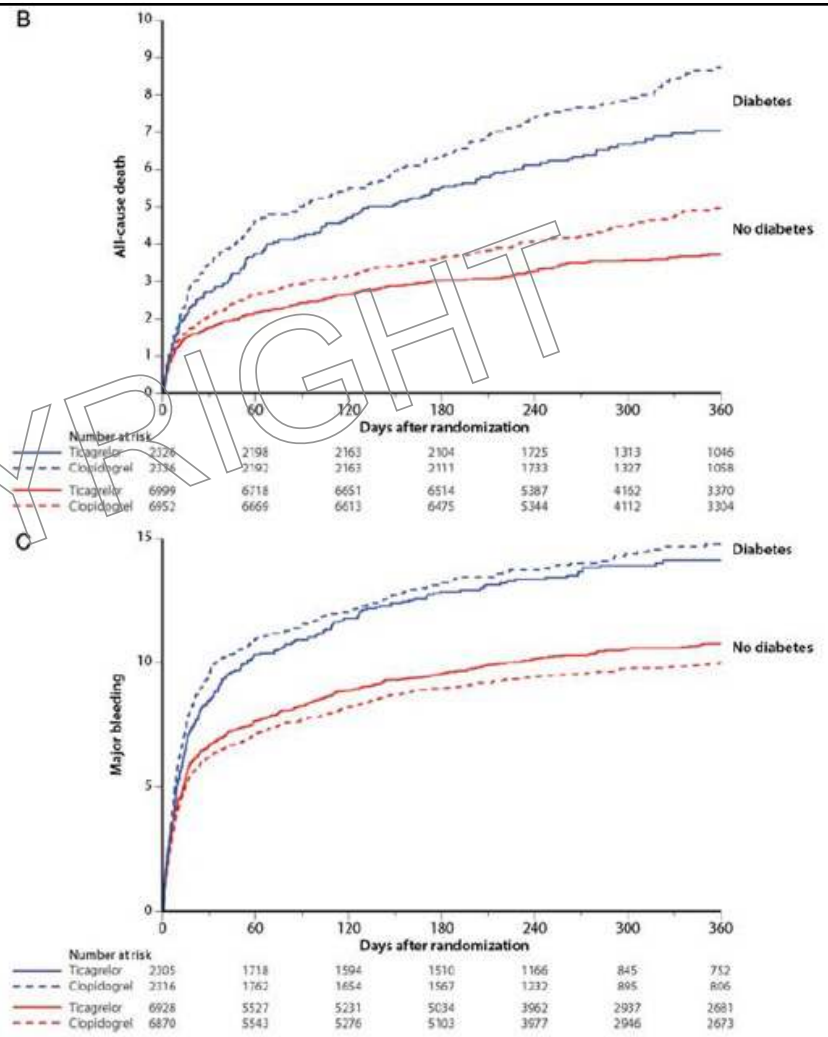


Figure 1. Cardiovascular death, myocardial infarction, or stroke.
Kaplan-Meier event curves for patients with and without diabetes mellitus randomized to aspirin plus placebo or aspirin plus low-dose rivaroxaban. The primary end point of cardiovascular death, myocardial infarction, or stroke is shown. Percentages are Kaplan-Meier risks at 3 years. ARR indicates absolute risk reduction; and HR, hazard ratio.

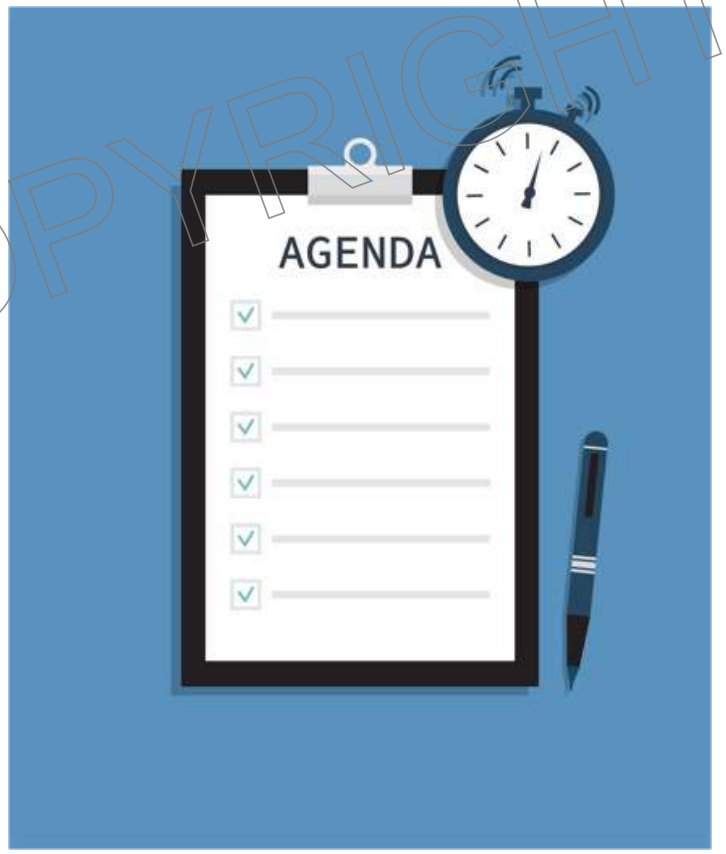
Circulation. 2020;141:1841–1854

Ticagrelor vs clopidogrel as part of DAPT after ACS



European Heart Journal 2010; 31, 3006–3016

A last few issues particular to CAD management in diabetes.



Hyperglycaemia and AMI

Diabetology & Metabolic Syndrome 2024; 16: 224

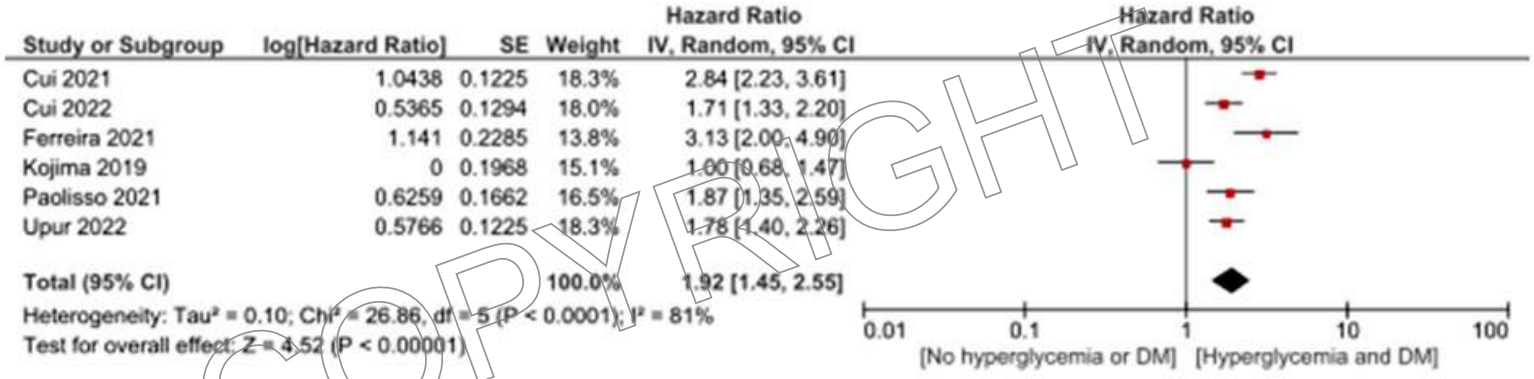


Fig. 4 Association of hyperglycemia with mortality in diabetic patients admitted with acute myocardial infarction using hazard ratio

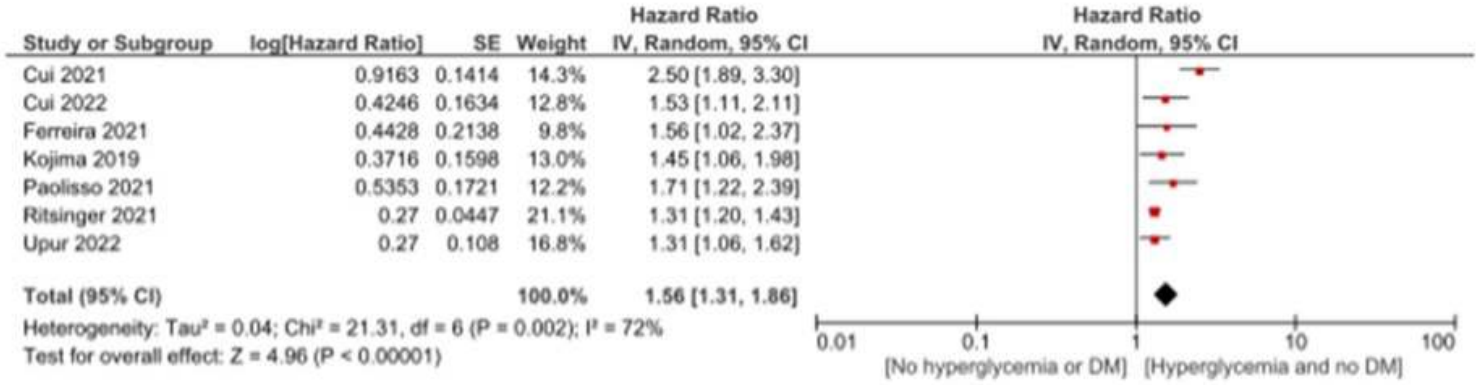
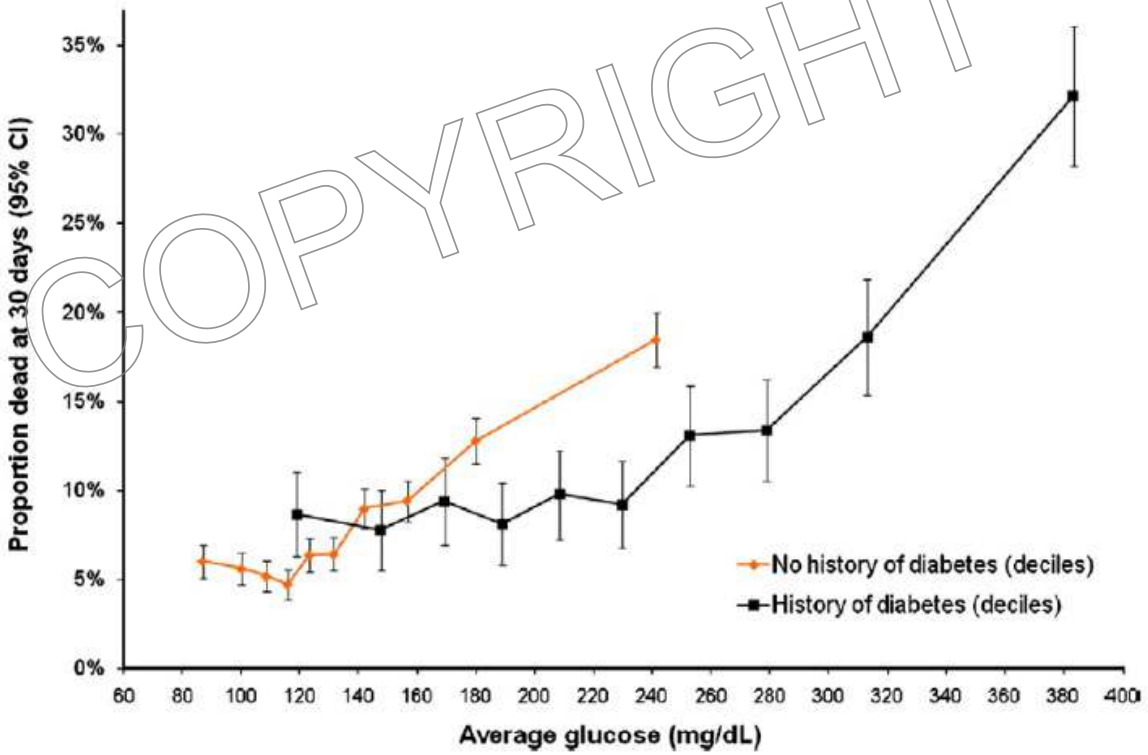
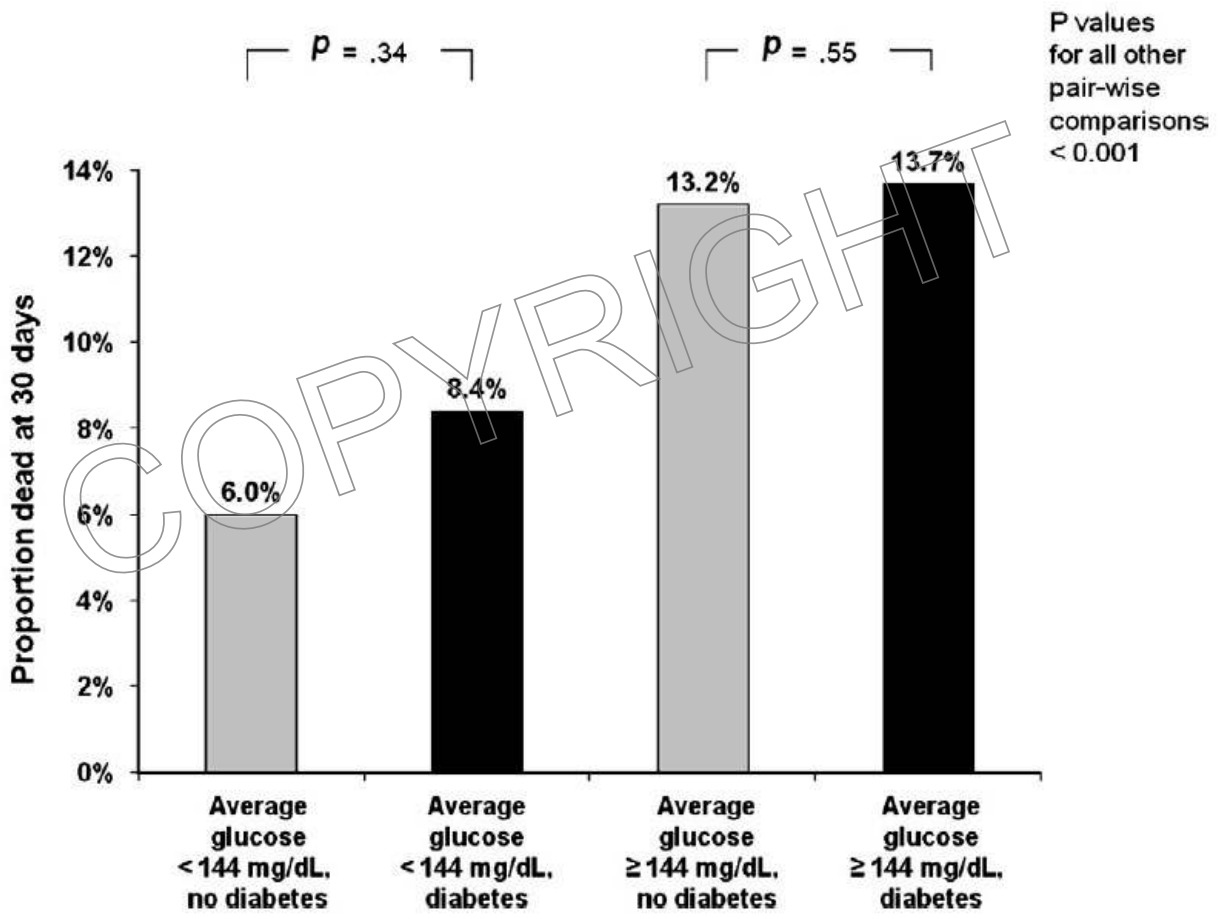


Fig. 6 Association of hyperglycemia with mortality in non-diabetic patients admitted with acute myocardial infarction using hazard ratio

Glucose in patients is an important prognostic indicator more so than diabetic status.



Am Heart J 2009; 157: 763-70



Am Heart J 2009; 157: 763-70

Revascularisation (PCI or CABG)

PCI has a higher risk of immediate complications such as coronary dissection.

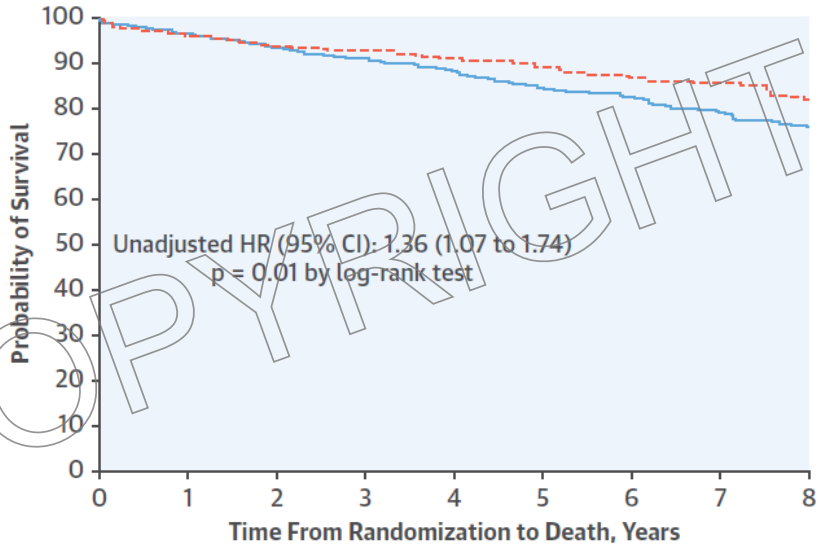
Acute stent thrombosis is more common in DM.

DM is a risk factor for in-stent restenosis.

Surgery has higher postoperative complications such as infection and delayed wound healing.

CABG better than PCI for multivessel disease.

CENTRAL ILLUSTRATION Survival Curves According to the Revascularization Strategy in the FREEDOM Follow-On Study



Number of patients at risk

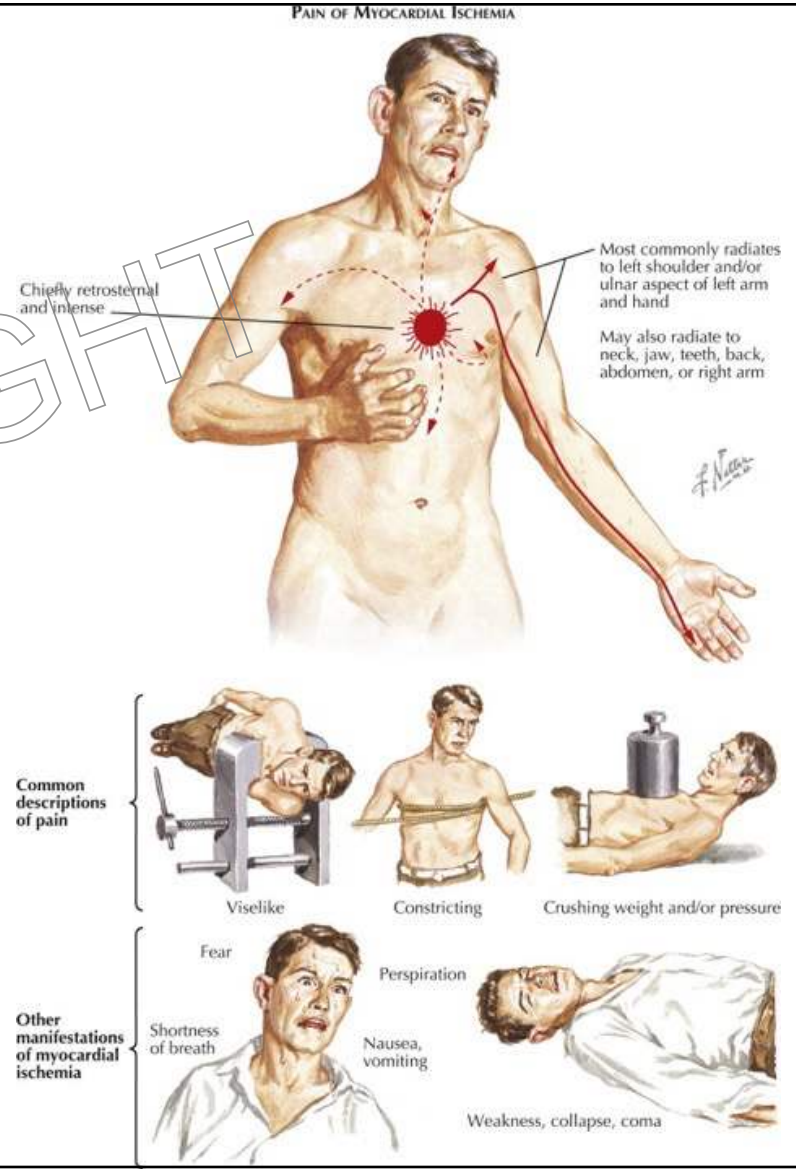
PCI	953	897	845	745	611	460	333	260	206
CABG	947	854	807	721	589	445	313	252	191

Farkouh, M.E. et al. J Am Coll Cardiol. 2019;73(6):629-38.

Kaplan-Meier estimates and survival curves including all patients enrolled in the FREEDOM (Future Revascularization Evaluation in Patients with Diabetes Mellitus: Optimal Management of Multivessel Disease) trial (whole cohort of patients). Coronary artery bypass grafting results in a long-term survival benefit in patients with diabetes and multivessel coronary disease when compared with revascularization with percutaneous coronary intervention with drug-eluting stents.

J Am Coll Cardiol 2019; 73: 629–38

Diabetics have atypical presentations of atherosclerotic coronary artery disease.



World J Cardiol 2014; 6: 802-813

Conclusion

1. Patients with diabetes are at high cardiovascular risk.
2. Diagnosing ASCVD requires a high index of suspicion due to atypical presentations of angina.
3. Prevention is the most important intervention and consists of good risk factor control (including gentle glucose lowering).
4. Additional CV risk reduction with SGLT2i and GLP-1RA is possible but the absolute risk reduction is generally quite low.
5. If revascularisation is considered → CABG is generally the better option.

Thank you for your attention.