Is CABG Really the Best Primary Approach to Multivessel / LMCA Disease
- A Surgeon's Viewpoint -

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Disclosure Statement of Financial Interest

I, Mario Gaudino DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

The “apparent” controversy

Published evidence consistently shows very different risk profiles and time-varying benefit for PCI and CABG.

In real world practice the majority of patients have clinical or anatomic characteristics that clearly drive the decision between the two treatment modalities

The key is individualization of treatment to the patient and the local expertise

Time to get over the controversy

THE LANCET

Coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with three-vessel disease and left main coronary disease: 5-year follow-up of the randomised, clinical SYNTAX trial

Friedrich W Mohr, Marie-Claude Morice, A Pieter Kappetein, Ted E Feldman, Elisabeth Ståhle, Antonio Colombo, Michael J Mack, David R Holmes Jr, Marie-angèle Morel, Nic Van Dyck, Vicki M Houle, Keith D Dawkins, Patrick W Serruys

Mohr FW et al. Lancet. 2013

THE LANCET

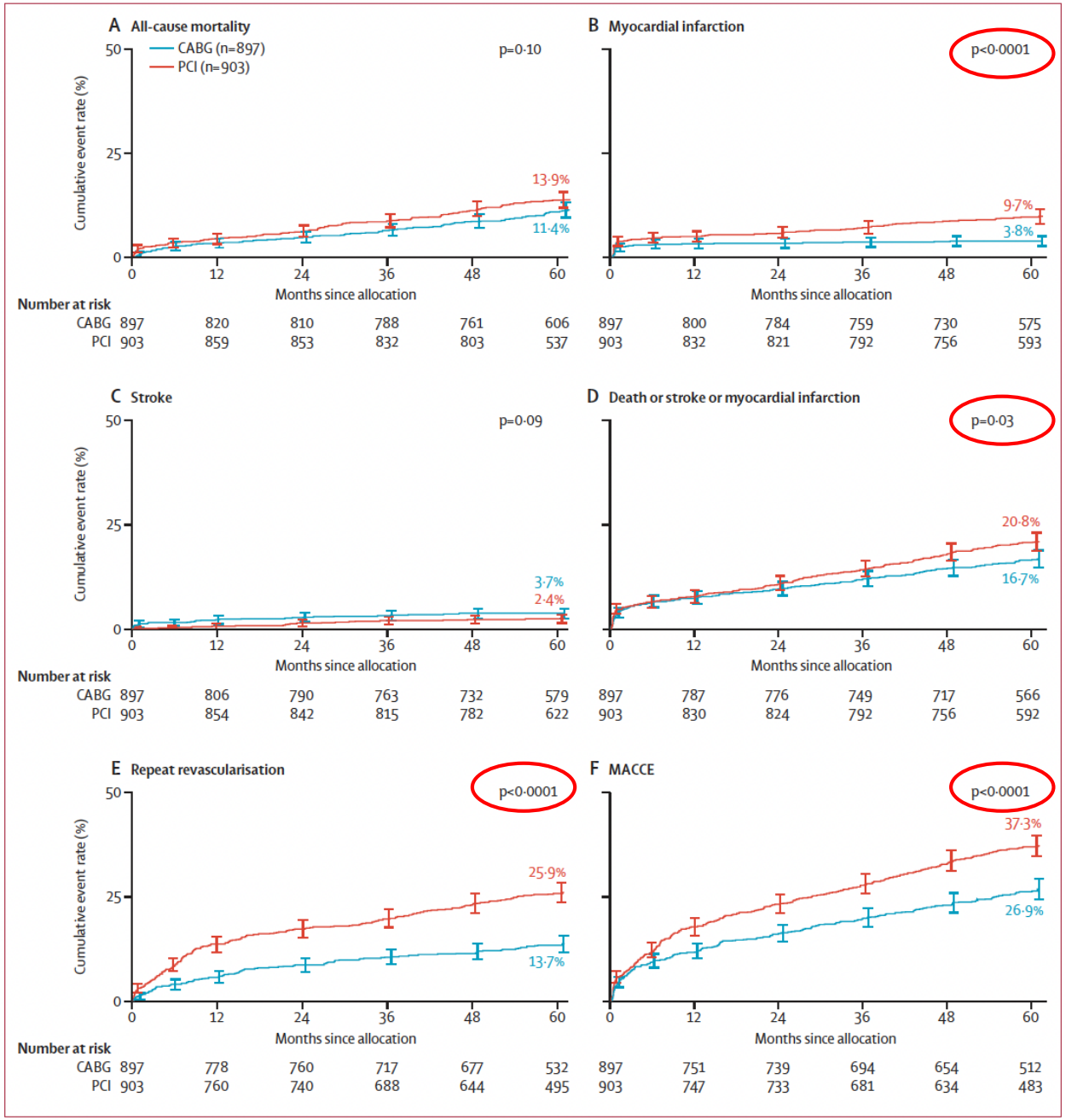


Figure 2: Kaplan-Meier cumulative event curves at 5 years' follow-up

Mohr FW et al. Lancet. 2013

THE LANCET

Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial

*Daniel J F M Thuijs, A Pieter Kappetein, Patrick W Serruys, Friedrich-Wilhelm Mohr, Marie-Claude Morice, Michael J Mack, David R Holmes Jr, Nick Curzen, Piroze Davierwala, Thilo Noack, Milan Milojevic, Keith D Dawkins, Bruno R da Costa, Peter Jüni, Stuart J Head, for the SYNTAX Extended Survival Investigators**

Thuijs DJFM et al. Lancet. 2019

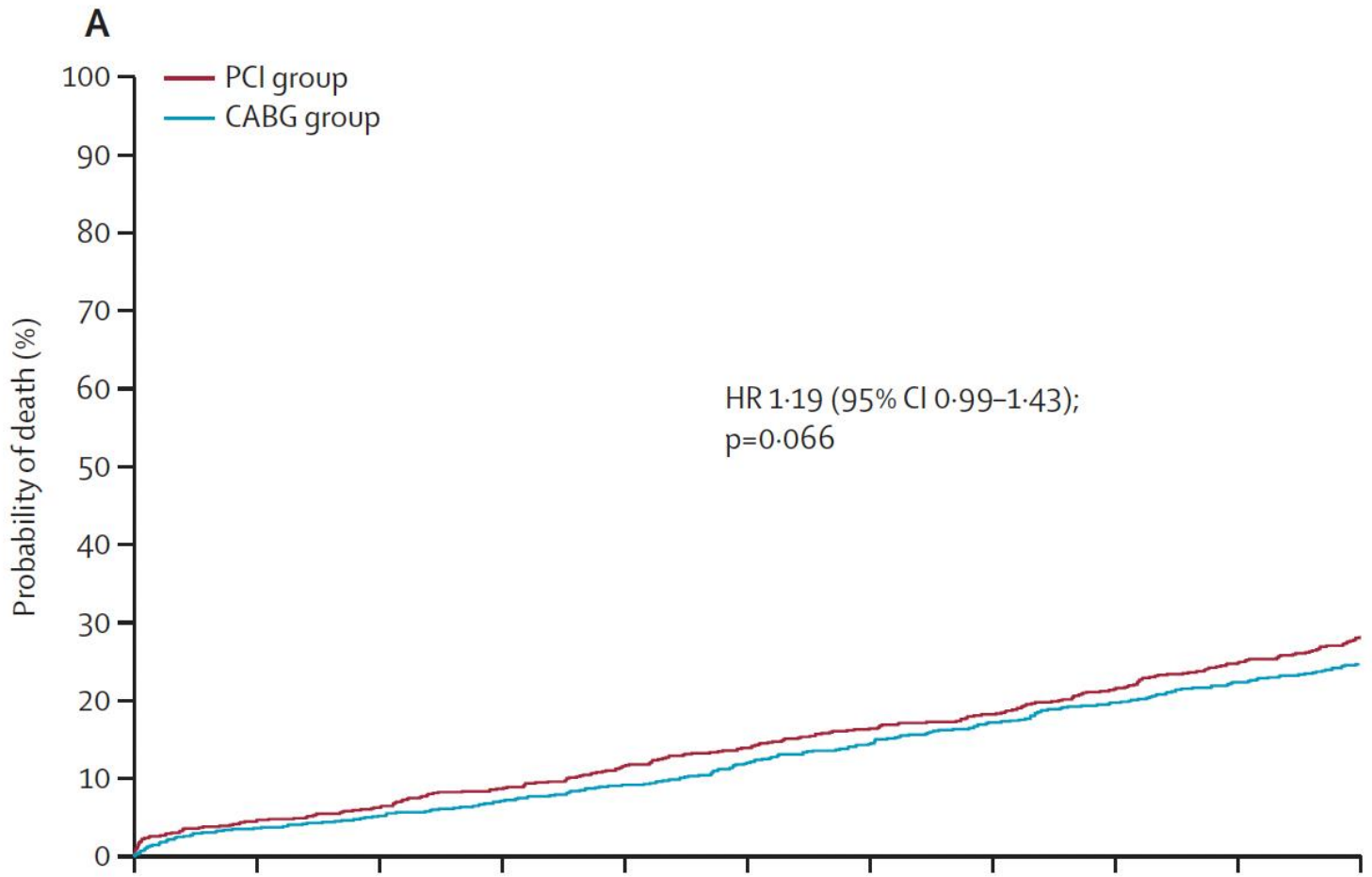


Figure 2: **Kaplan-Meier curves for primary analysis of 10-year all-cause death (intention-to-treat population)**

Thuijs DJFM et al. Lancet. 2019

	PCI group	CABG group	HR (95% CI)	$p_{interaction}$
Type of coronary disease				
Left main coronary artery disease	95/357	98/348	0·92 (0·69–1·22)	0·023
Three-vessel disease*	153/546	114/549	1·42 (1·11–1·81)	
Medically treated diabetes				
Yes	80/231	72/221	1·10 (0·80–1·52)	0·60
No	168/672	140/676	1·23 (0·98–1·53)	
Coronary disease complexity				
SYNTAX score ≤22	65/299	53/275	1·11 (0·77–1·60)	0·20†
SYNTAX score 23–32	80/310	72/300	1·07 (0·78–1·47)	
SYNTAX score ≥33	101/290	82/315	1·47 (1·10–1·96)	

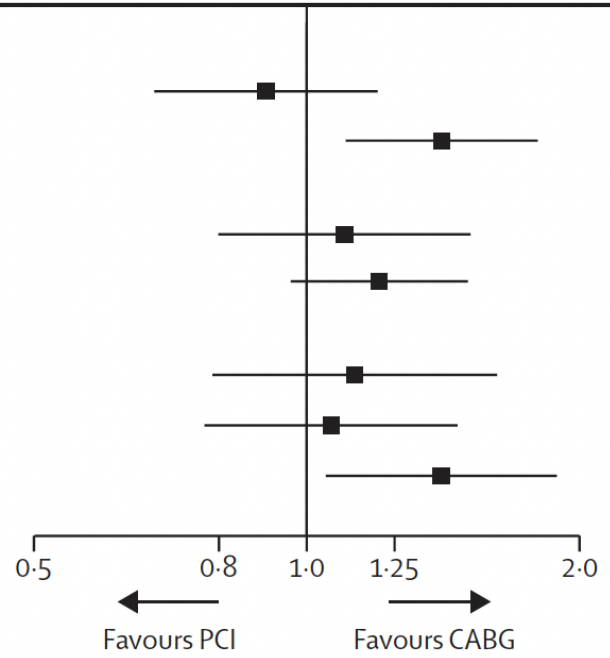
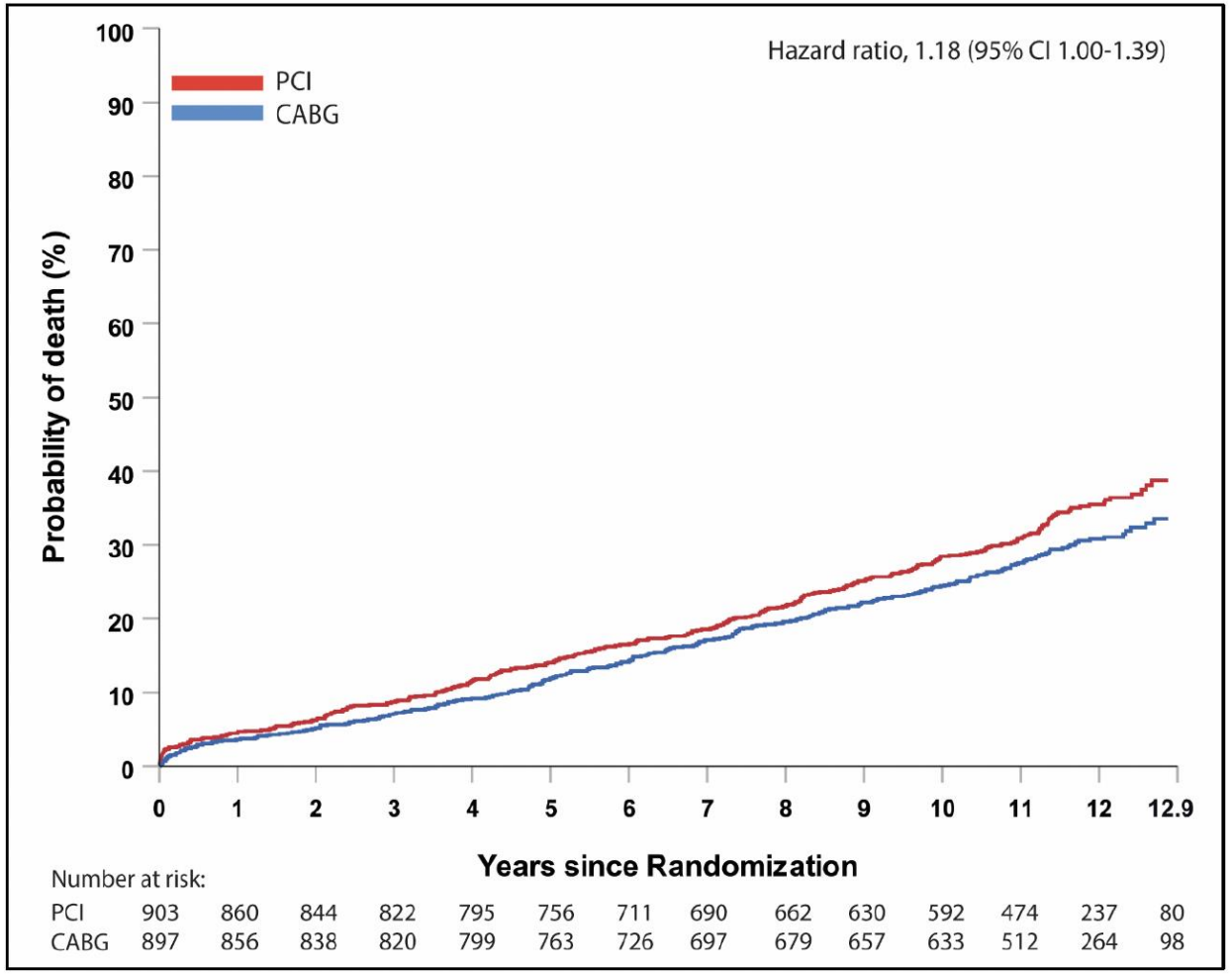


Figure 4: **Forest plot of prespecified subgroup analyses of 10-year all-cause death (intention-to-treat population)**

Thuijs DJFM et al. Lancet. 2019



Supplementary Appendix Figure S1. All-cause death at maximum follow-up of patients randomized to PCI versus CABG (intention-to-treat population).

Thuijs DJFM et al. Lancet. 2019

THE LANCET

Mortality after coronary artery bypass grafting versus percutaneous coronary intervention with stenting for coronary artery disease: a pooled analysis of individual patient data

Stuart J Head, Milan Milojevic, Joost Daemen, Jung-Min Ahn, Eric Boersma, Evald H Christiansen, Michael J Domanski, Michael E Farkouh, Marcus Flather, Valentin Fuster, Mark A Hlatky, Niels R Holm, Whady A Hueb, Masoor Kamalesh, Young-Hak Kim, Timo Mäkikallio, Friedrich W Mohr, Grigorios Papageorgiou, Seung-Jung Park, Alfredo E Rodriguez, Joseph F Sabik 3rd, Rodney H Stables, Gregg W Stone, Patrick W Serruys, Arie Pieter Kappetein

Head SJ et al. Lancet. 2018

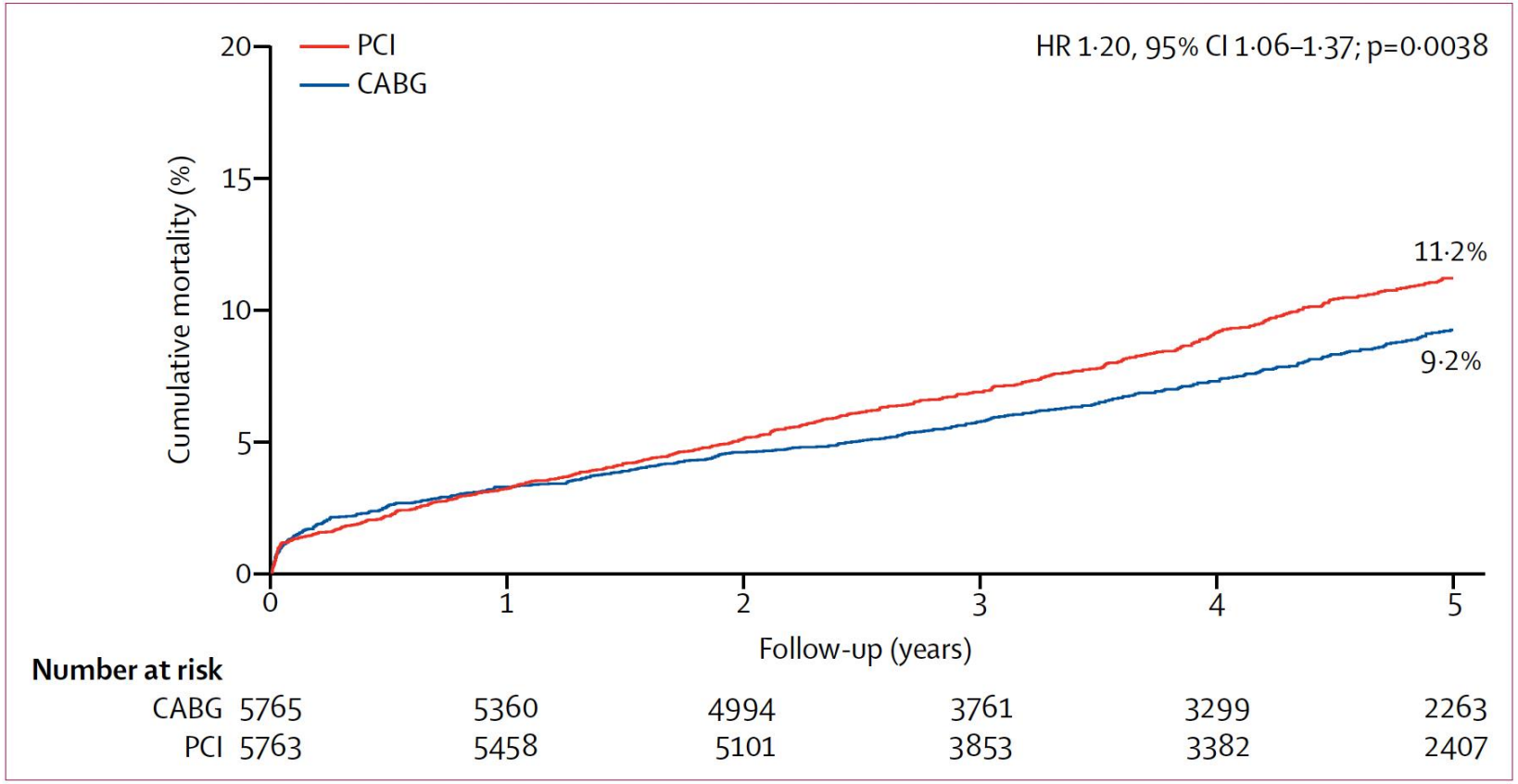


Figure 1: **Mortality after CABG versus after PCI during 5 years' follow-up**

Head SJ et al. Lancet. 2018

	PCI	CABG	HR (95% CI)	p value	$p_{interaction}$
Sex					
Male	387/4380 (10·7%)	318/4394 (8·8%)	1·20 (1·03–1·39)	0·0181	0·82
Female	152/1373 (12·7%)	119/1371 (10·6%)	1·23 (0·97–1·57)	0·0854	
Age at baseline (years)					
<65	200/2971 (8·0%)	160/2940 (6·4%)	1·23 (1·00–1·51)	0·0534	0·98
≥65	339/2782 (14·8%)	277/2825 (12·5%)	1·19 (1·02–1·40)	0·0284	
Body-mass index (kg/m²)					
<30	373/3958 (11·2%)	304/3953 (9·4%)	1·20 (1·04–1·40)	0·0156	0·43
≥30	148/1548 (12·1%)	106/1558 (8·6%)	1·35 (1·05–1·73)	0·0179	
Hypertension					
Yes	391/3880 (12·2%)	332/3913 (10·6%)	1·16 (1·00–1·34)	0·0527	0·25
No	145/1859 (9·1%)	103/1835 (6·6%)	1·37 (1·06–1·76)	0·0144	
Hypercholesterolaemia					
Yes	364/3982 (11·0%)	288/3862 (9·1%)	1·19 (1·02–1·39)	0·0272	0·76
No	173/1744 (11·6%)	148/1873 (9·5%)	1·24 (1·00–1·55)	0·0527	
Diabetes					
Yes	278/2215 (15·7%)	185/2171 (10·7%)	1·44 (1·20–1·74)	0·0001	0·0077
No	261/3538 (8·7%)	252/3594 (8·4%)	1·02 (0·86–1·21)	0·81	
Peripheral vascular disease					
Yes	75/424 (20·7%)	58/440 (16·0%)	1·35 (0·96–1·90)	0·0869	0·66
No	428/4734 (10·6%)	346/4724 (8·7%)	1·21 (1·05–1·39)	0·0094	
Previous myocardial infarction					
Yes	183/1438 (14·2%)	146/1417 (11·6%)	1·21 (0·97–1·50)	0·0852	0·97
No	318/3700 (10·2%)	257/3739 (8·4%)	1·22 (1·03–1·44)	0·0180	
Left-ventricular ejection fraction					
≥50%	356/4447 (9·6%)	311/4597 (8·3%)	1·14 (0·98–1·32)	0·0974	0·65
30–49%	132/807 (19·3%)	95/779 (15·1%)	1·41 (1·08–1·84)	0·0122	
<30%	18/49 (57·3%)	16/54 (34·4%)	1·25 (0·64–2·46)	0·52	
SYNTAX score					
0–22	105/1533 (8·8%)	100/1585 (8·1%)	1·02 (0·77–1·34)	0·91	0·21
23–32	163/1677 (12·4%)	122/1545 (10·9%)	1·20 (0·94–1·51)	0·14	
≥33	117/871 (16·5%)	83/927 (11·6%)	1·52 (1·15–2·02)	0·0029	

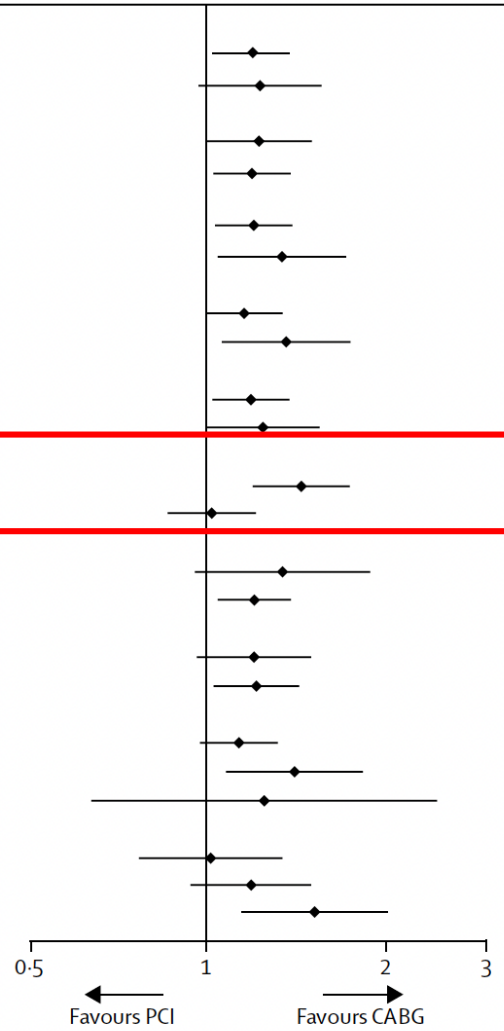
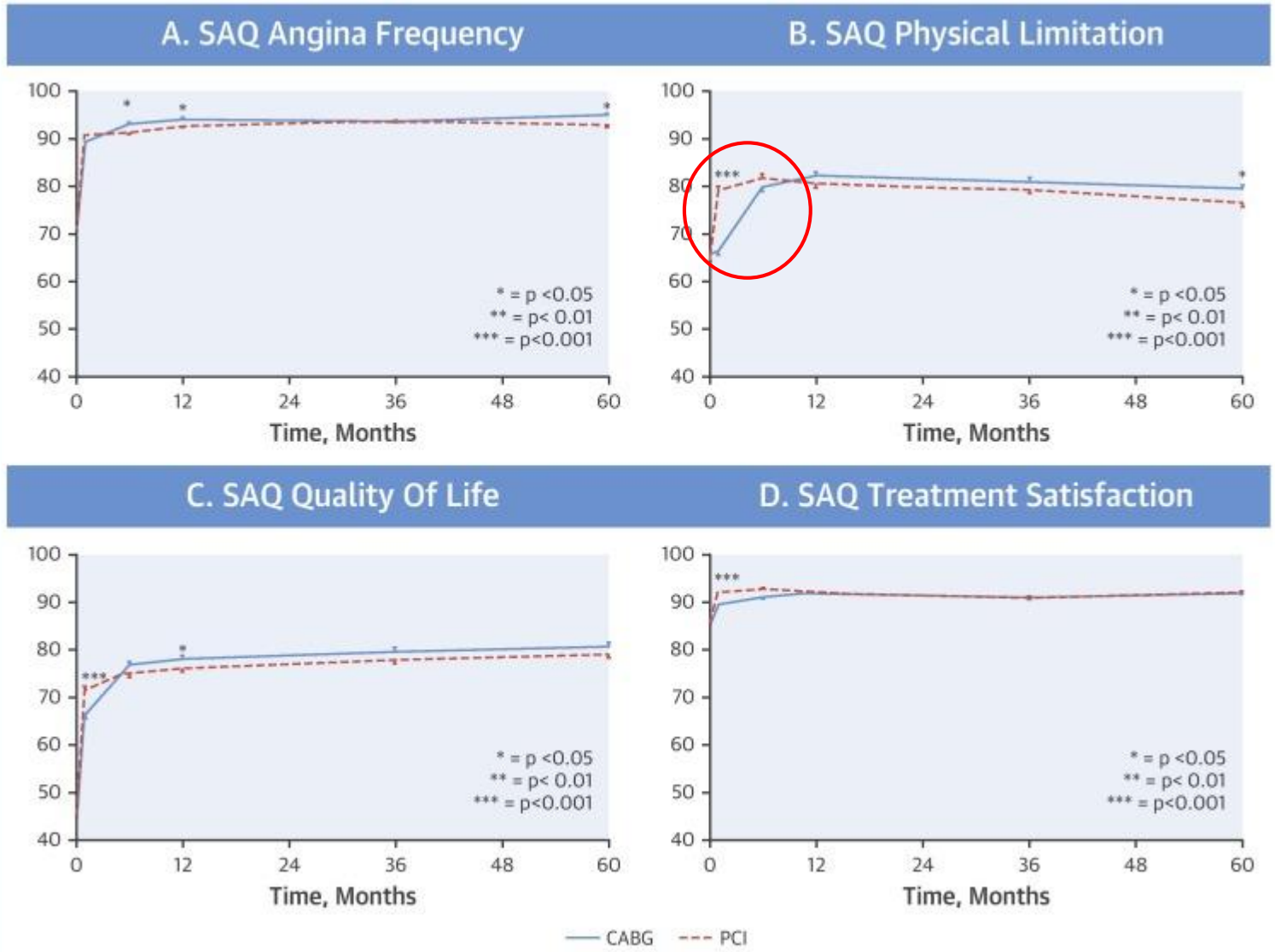


Figure 2: **Mortality after CABG versus after PCI during 5 years' follow-up, by subgroup**

Head SJ et al. Lancet. 2018

CENTRAL ILLUSTRATION: SAQ: Health Status After PCI Versus CABG



Abdallah, M.S. et al. J Am Coll Cardiol. 2017;69(16):2039-50.

The NEW ENGLAND JOURNAL of MEDICINE

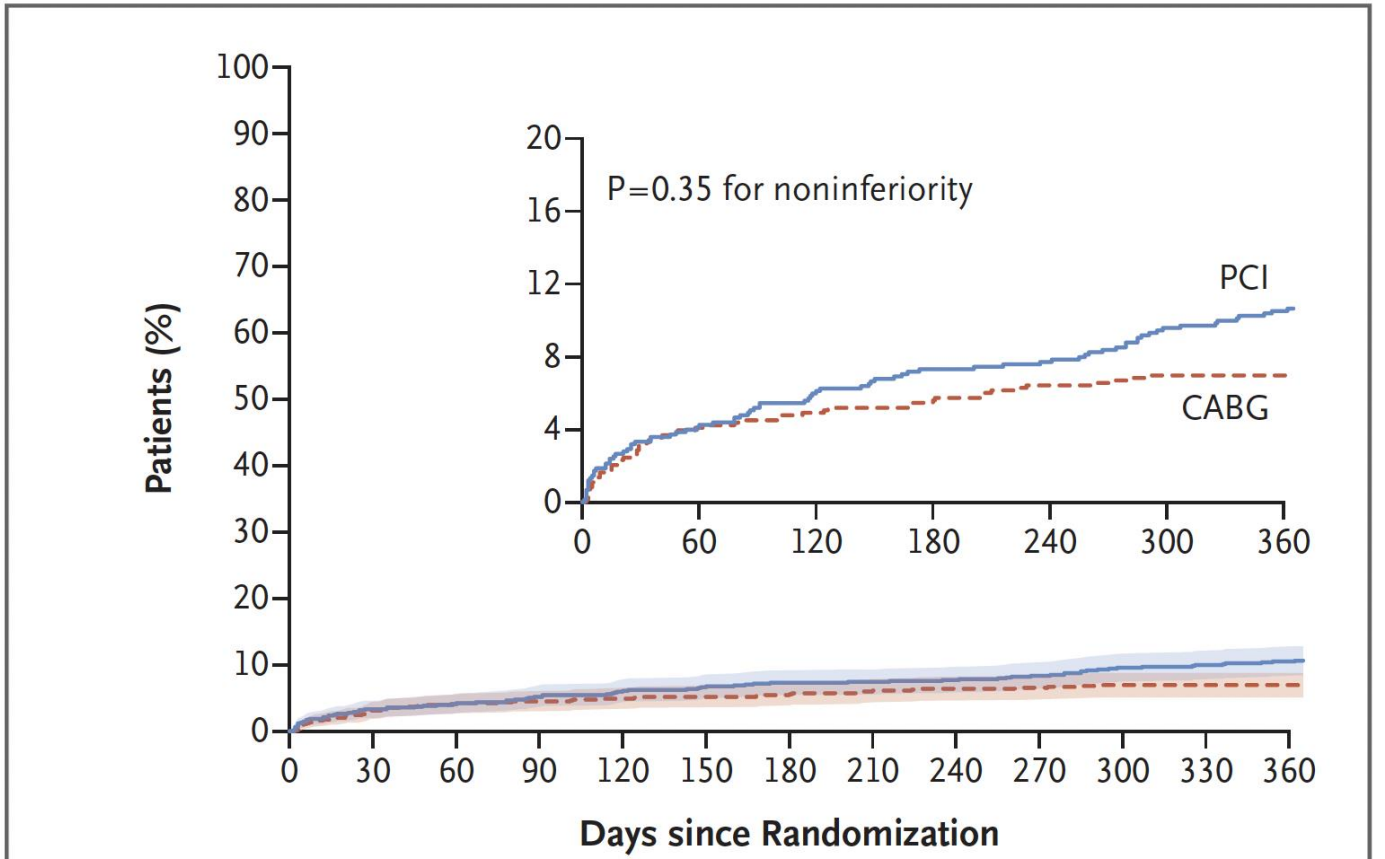
ORIGINAL ARTICLE

Fractional Flow Reserve–Guided PCI as Compared with Coronary Bypass Surgery

W.F. Fearon, F.M. Zimmermann, B. De Bruyne, Z. Piroth, A.H.M. van Straten, L. Szekely, G. Davidavičius, G. Kalinauskas, S. Mansour, R. Kharbanda, N. Östlund-Papadogeorgos, A. Aminian, K.G. Oldroyd, N. Al-Attar, N. Jagic, J.-H.E. Dambrink, P. Kala, O. Angerås, P. MacCarthy, O. Wendler, F. Casselman, N. Witt, K. Mavromatis, S.E.S. Miner, J. Sarma, T. Engstrøm, E.H. Christiansen, P.A.L. Tonino, M.J. Reardon, D. Lu, V.Y. Ding, Y. Kobayashi, M.A. Hlatky, K.W. Mahaffey, M. Desai, Y.J. Woo, A.C. Yeung, and N.H.J. Pijls, for the FAME 3 Investigators*

Fearon WF et al. NEJM. 2021

The NEW ENGLAND JOURNAL of MEDICINE



No. at Risk

PCI	757	728	721	713	707	702	697	696	693	687	678	674	670
CABG	743	709	701	698	695	693	691	686	683	682	679	679	679

Figure 1. Kaplan–Meier Curves for the Primary End Point.

Fearon WF et al. NEJM. 2021

Subgroup	PCI	CABG	PCI	CABG
	total no.		*1-yr incidence (%)*	
All patients	757	743	10.6	6.9
Age				
≥65 yr	434	409	9.4	8.1
<65 yr	323	334	12.1	5.4
Sex				
Female	141	124	11.3	13.7
Male	616	619	10.4	5.5
Diabetes				
No	543	529	9.4	7.0
Yes	214	214	13.6	6.5
NSTE-ACS				
No	456	454	10.1	5.9
Yes	300	287	11.3	8.4
LVEF				
>50%	616	610	10.4	6.6
30–50%	137	130	10.9	8.5
Previous PCI				
No	658	637	9.3	6.8
Yes	98	104	19.4	7.7
SYNTAX score				
0–22	237	245	5.5	8.6
23–32	365	343	13.7	6.1
≥33	132	122	12.1	6.6

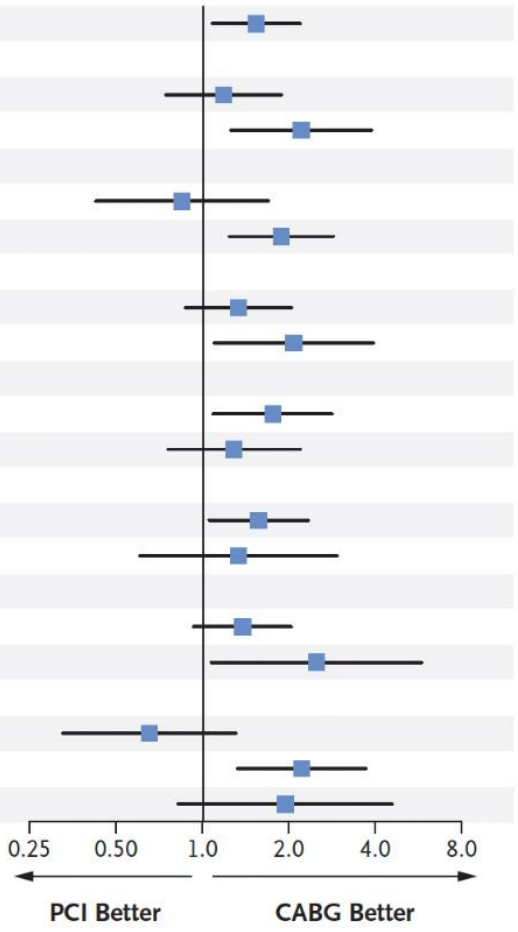


Figure 2. Subgroup Analyses of the Primary End Point.

Fearon WF et al. NEJM. 2021

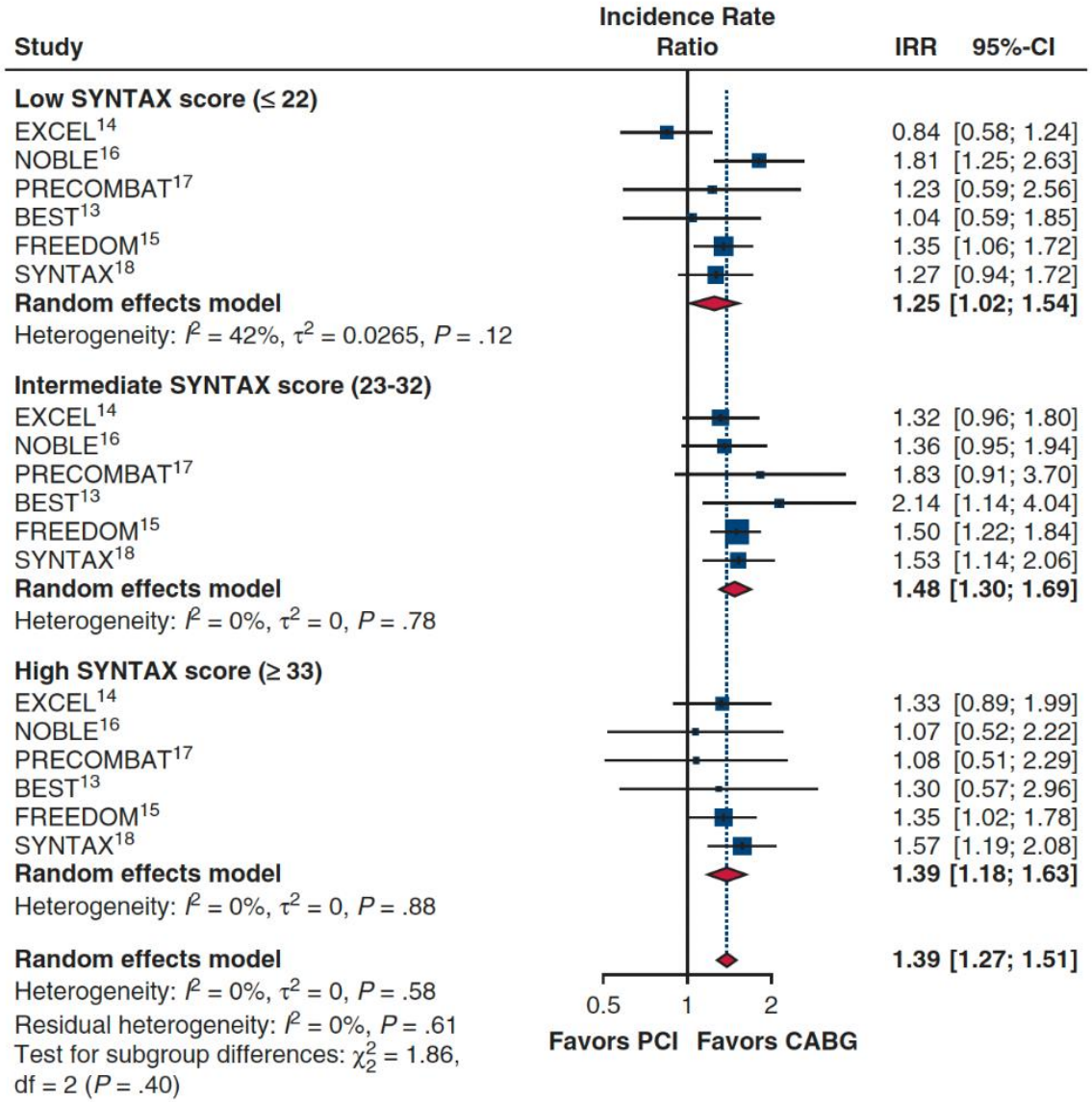
THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY

Comparison of SYNTAX score strata effects of percutaneous and surgical revascularization trials: A meta-analysis

Mario Gaudino, MD, PhD,[a] Irbaz Hameed, MD,[a,b] Antonino Di Franco, MD,[a] Ajita Naik, MD,[a] Michelle Demetres, MLIS,[c] Giuseppe Biondi-Zoccai, MD, MStat,[d,e] and Sripal Bangalore, MD, MHA[f]

Gaudino et al. J Thorac Cardiovasc Surg 2021

THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY



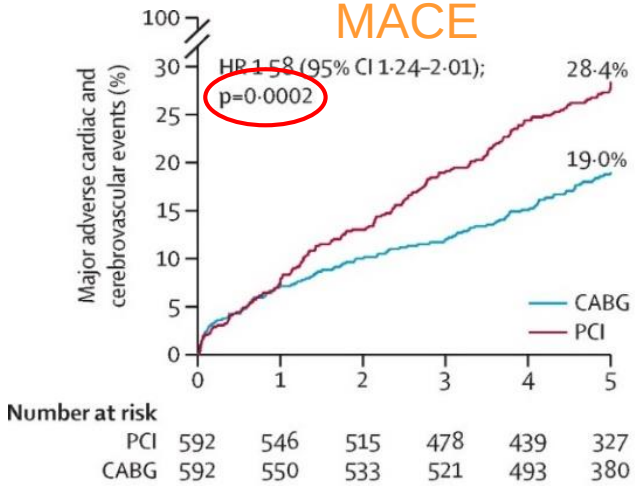
Comparison of the risk of major adverse cardiac and cerebrovascular events in different SYNTAX score groups in randomized trials comparing PCI versus CABG, using IRR (an estimator of the hazard ratio) as effect of choice

Gaudino et al. J Thorac Cardiovasc Surg 2021

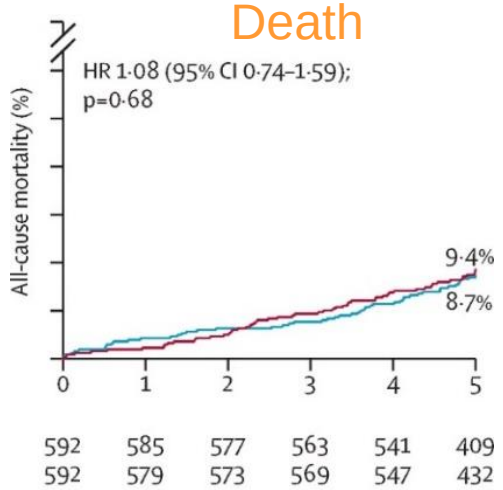
Left main CAD

Kaplan-Meier estimates of 5-year clinical outcomes in intention-to-treat population – NOBLE trial

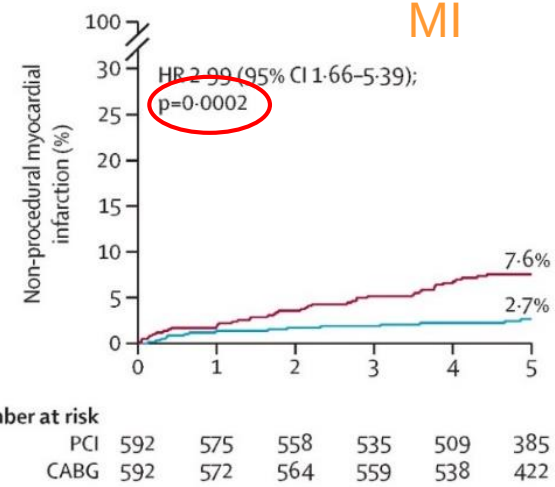
MACE



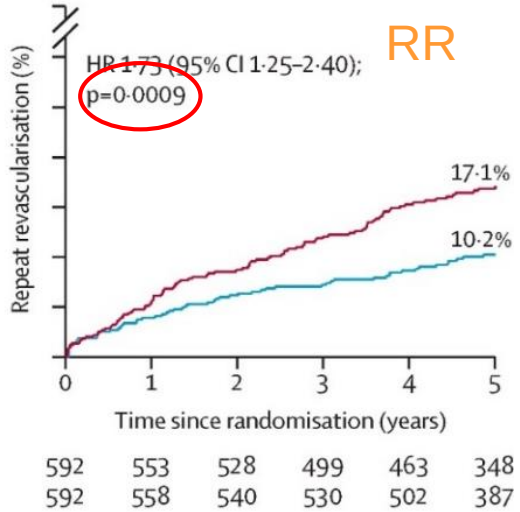
Death



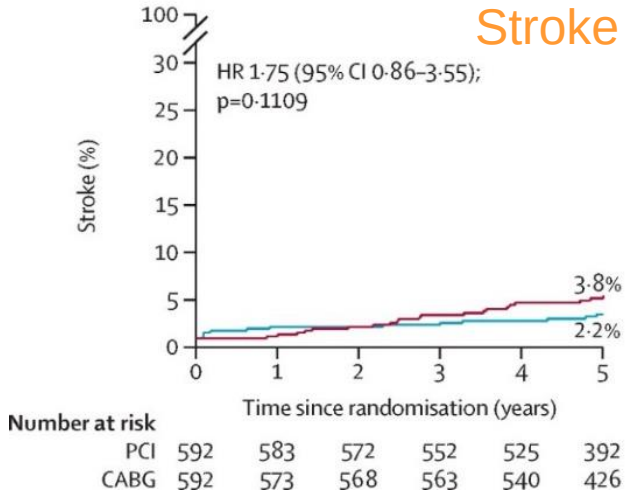
MI



RR

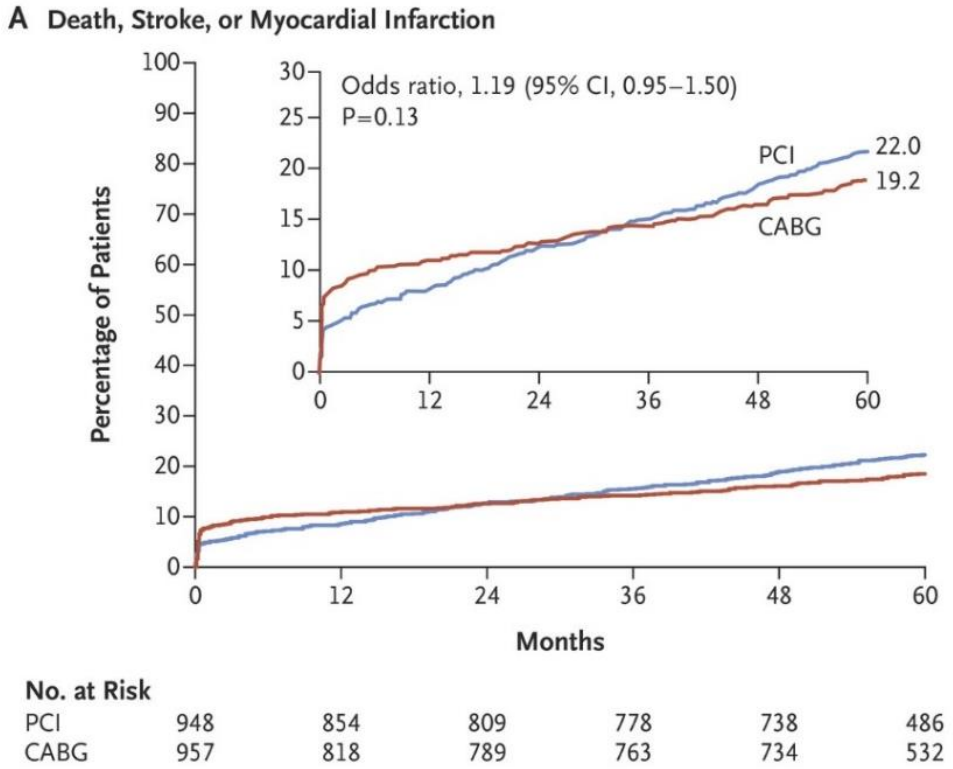


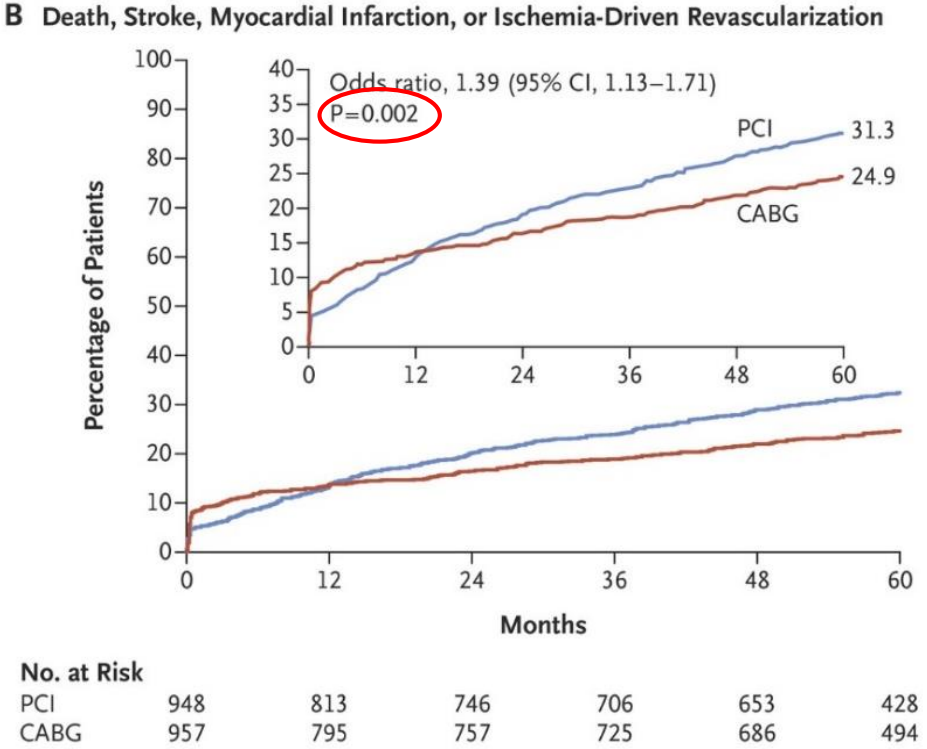
Stroke



Holm et al. Lancet, 2019

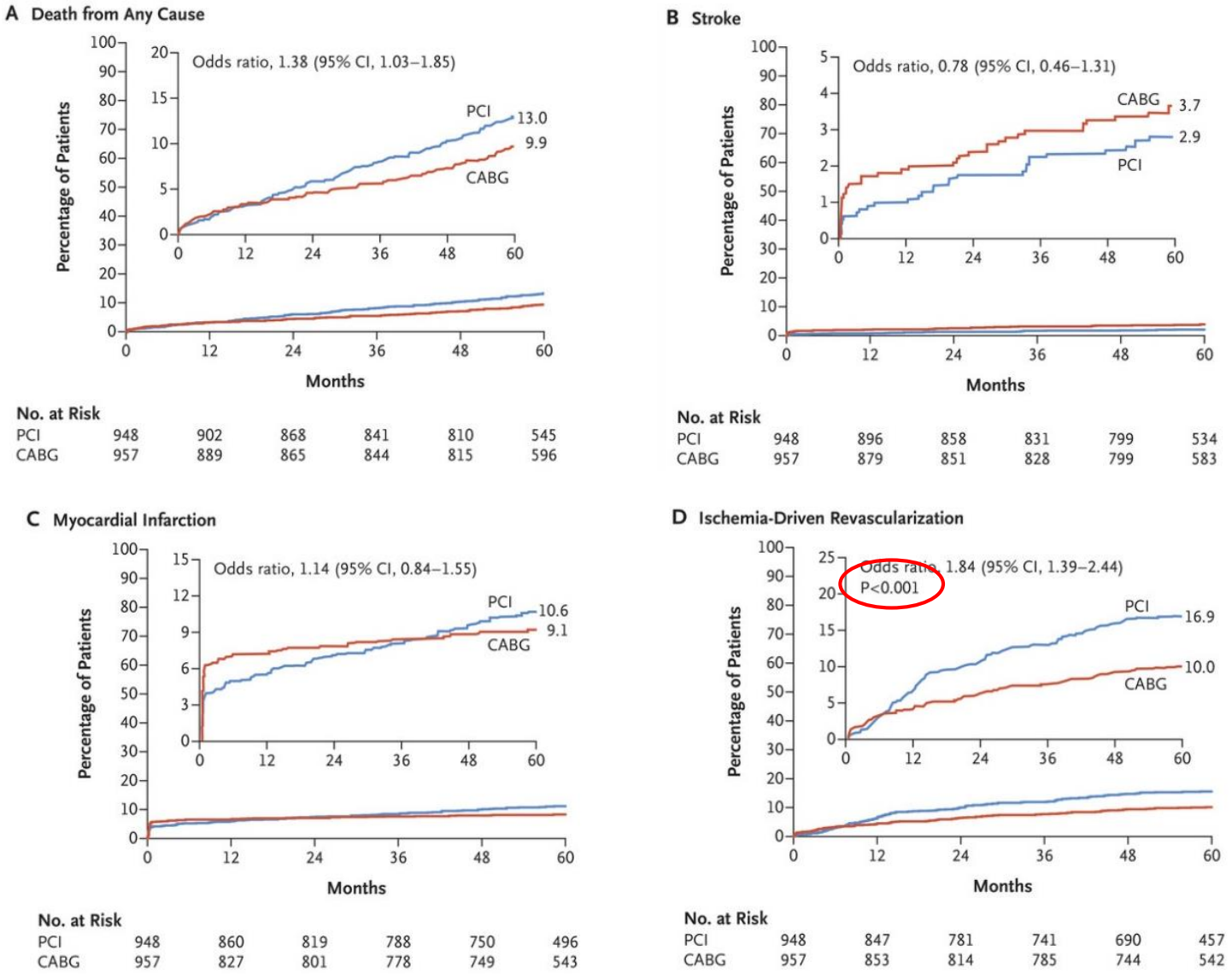
Time-to-First-Event Curves for the Primary and Secondary Composite Outcomes through 5-Year Follow-up – EXCEL trial





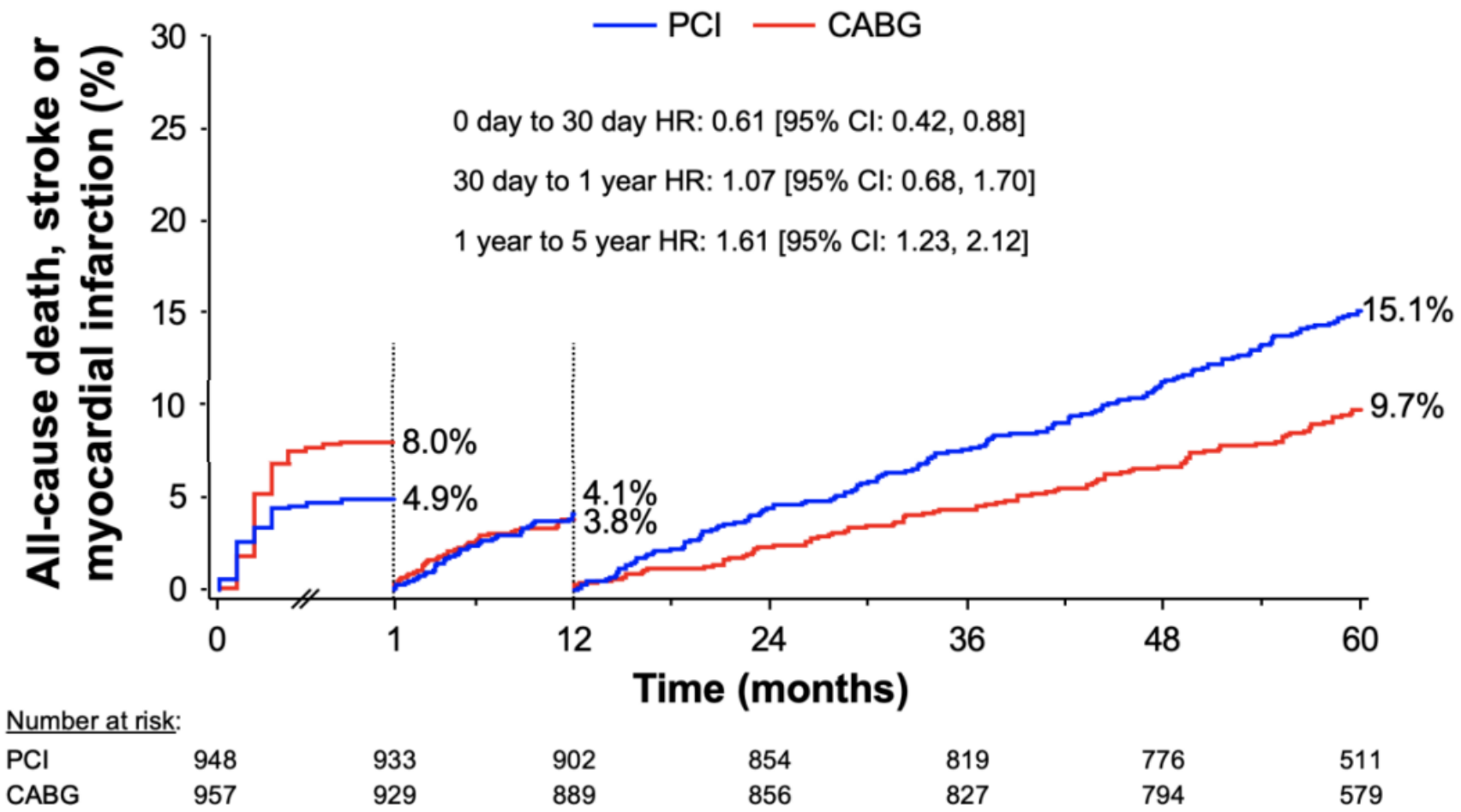
Stone et al. NEJM, 2019

Time-to-First-Event Curves for the Components of the Primary and Secondary Composite Outcomes through 5-Year Follow-up – EXCEL trial



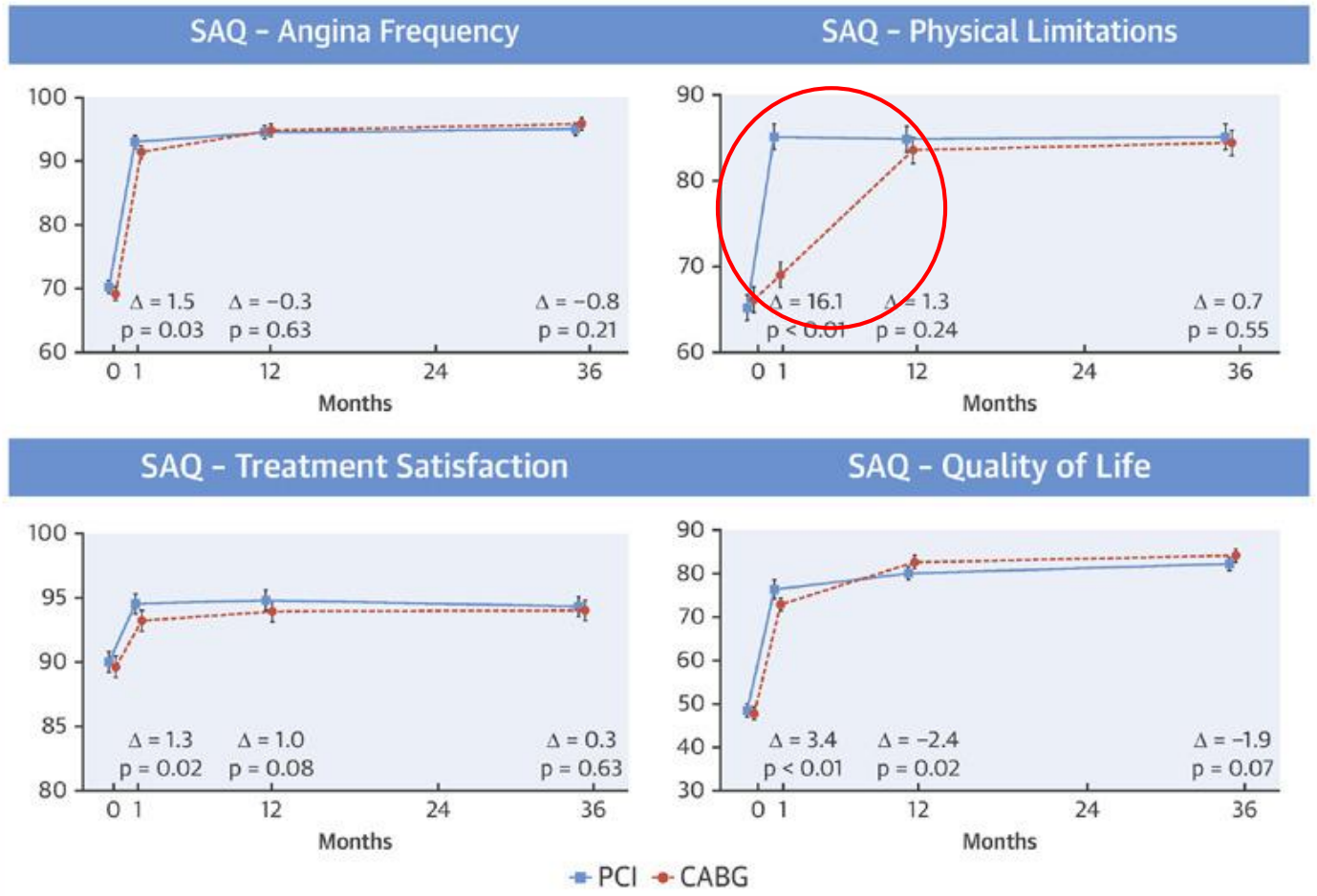
Stone et al. NEJM, 2019

Piecewise analysis for the primary composite outcome of death, stroke or myocardial infarction from 0 to 30 days, 30 days to 1 year, and 1 year to 5 years – EXCEL trial



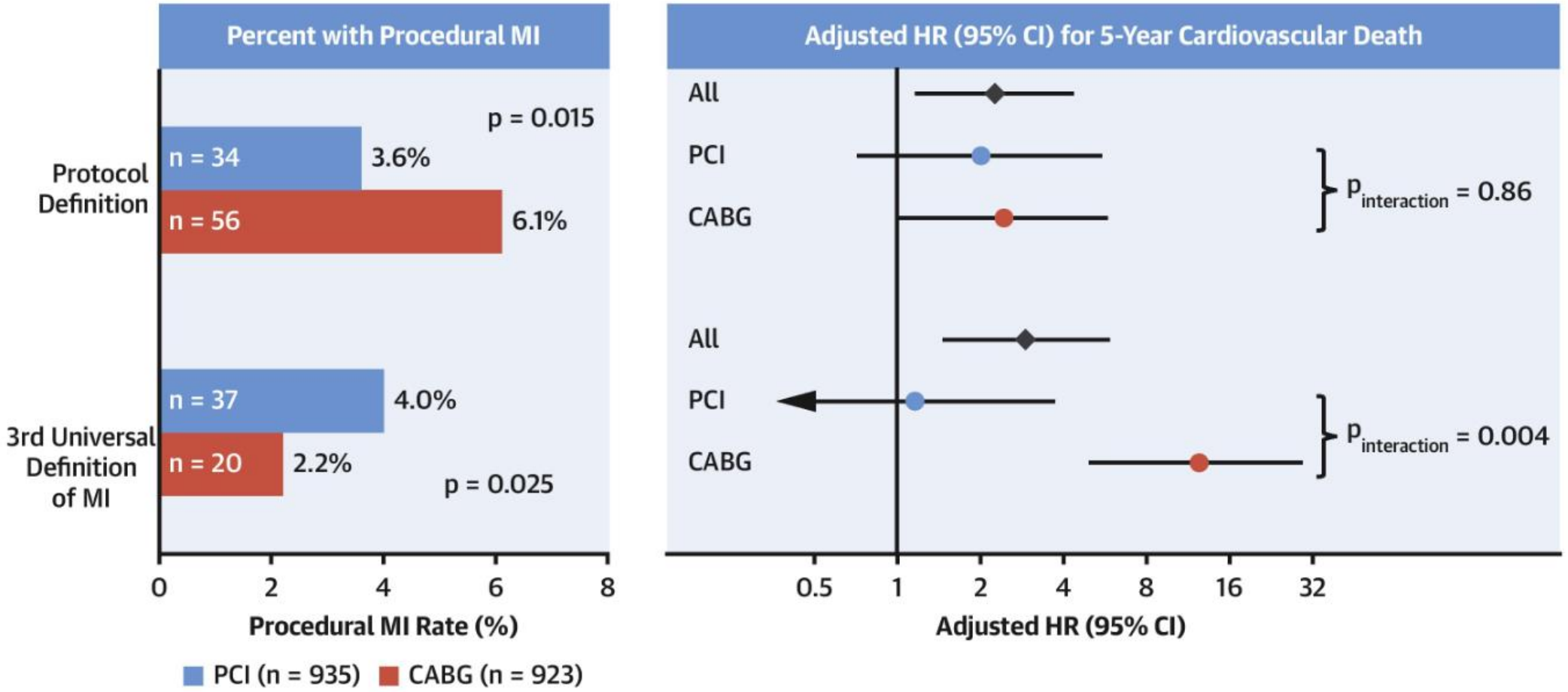
Stone et al. NEJM, 2019

CENTRAL ILLUSTRATION: Disease-Specific Health Status After PCI Versus CABG as Measured by the SAQ



Baron, S.J. et al. J Am Coll Cardiol. 2017;70(25):3113-22.

Incidence of different definitions of procedural myocardial infarction and their impact on cardiovascular mortality by treatment in the EXCEL Trial



Gregson et al, JACC, 2020

THE LANCET

Percutaneous coronary intervention with drug-eluting stents versus coronary artery bypass grafting in left main coronary artery disease: an individual patient data meta-analysis

Marc S Sabatine, Brian A Bergmark*, Sabina A Murphy, Patrick T O'Gara, Peter K Smith, Patrick W Serruys, A Pieter Kappetein, Seung-Jung Park, Duk-Woo Park, Evald H Christiansen, Niels R Holm, Per H Nielsen, Gregg W Stone, Joseph F Sabik, Eugene Braunwald*

Sabatine MS et al. Lancet. 2021

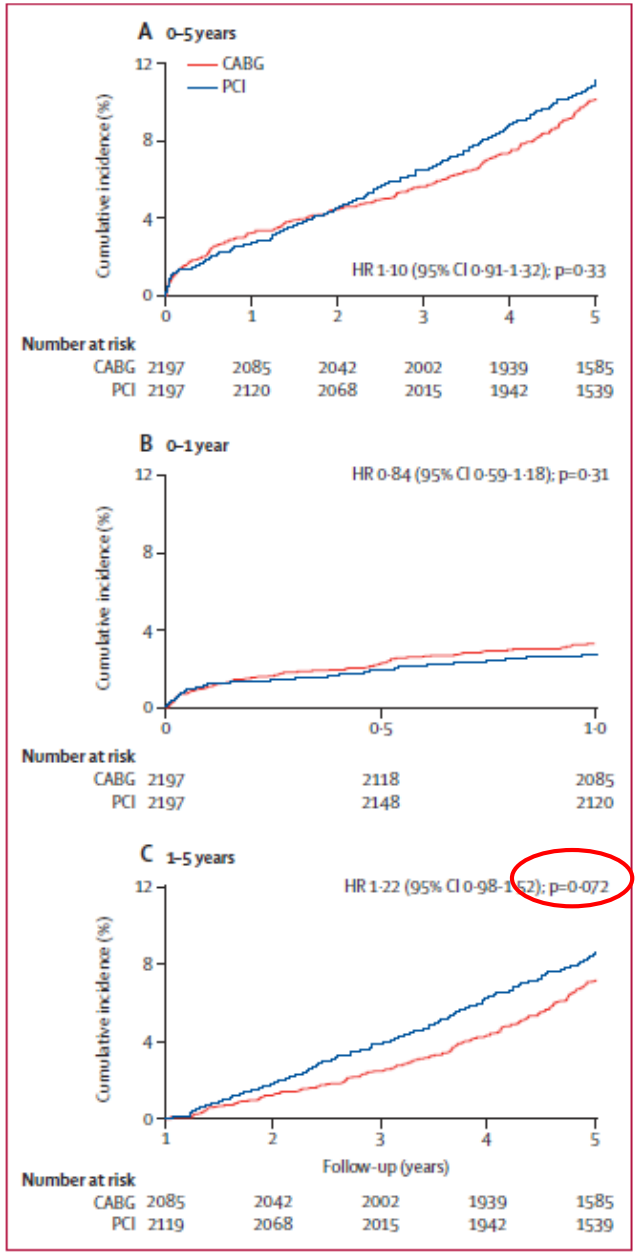


Figure 1: Cumulative incidence of all-cause deaths
Among patients with left main coronary artery disease treated with PCI or CABG,

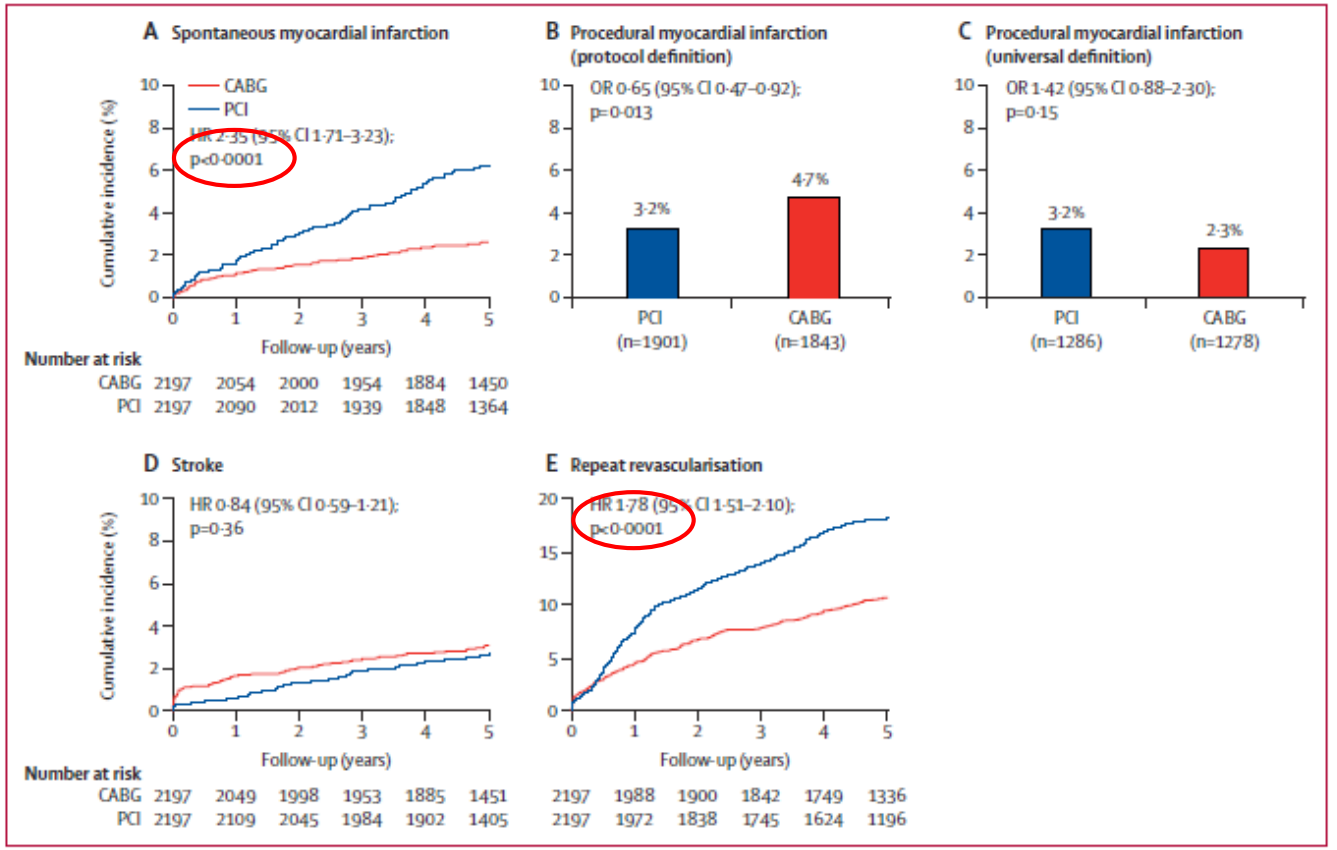
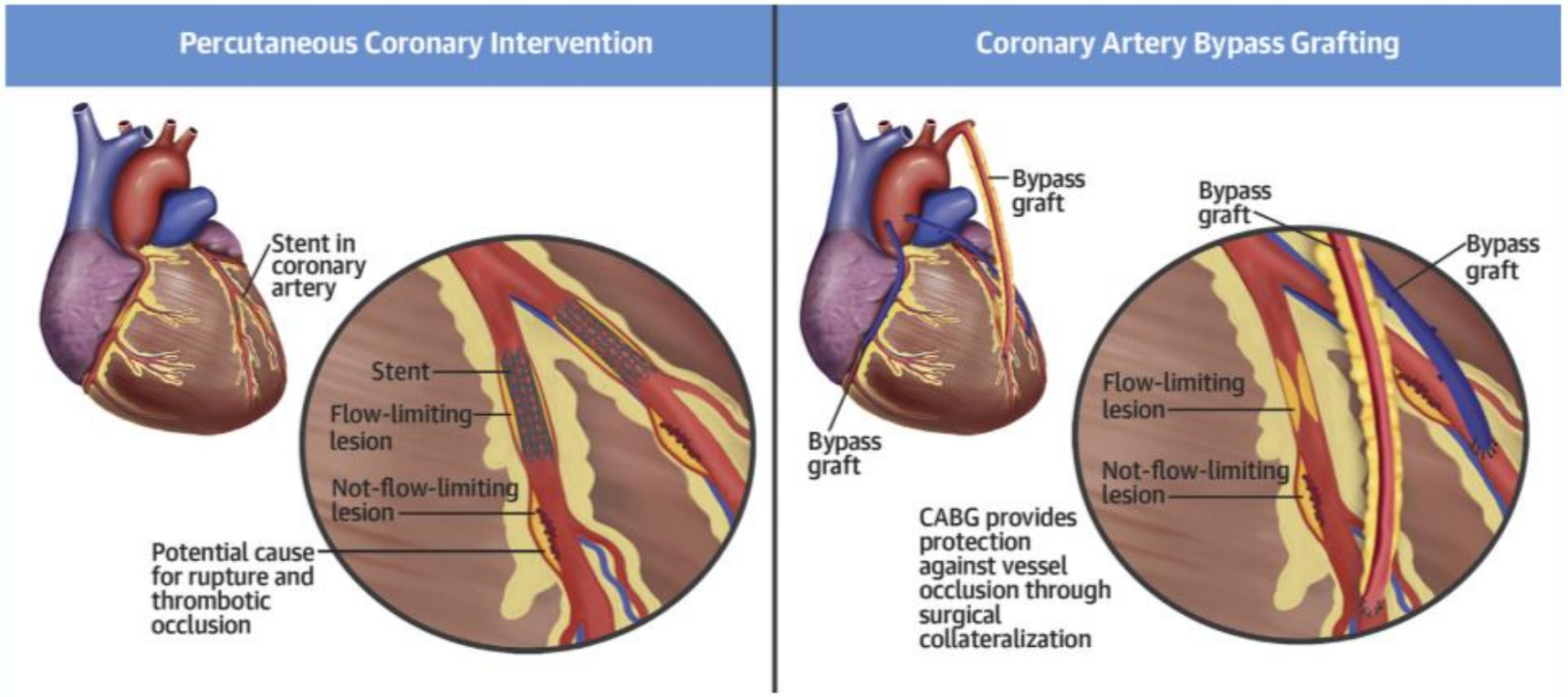


Figure 2: Cumulative incidence of key clinical outcomes

Sabatine MS et al. Lancet. 2021

CENTRAL ILLUSTRATION **Infarct Prevention Through Bypass Grafting**



Doenst, T. et al. J Am Coll Cardiol. 2019;73(8):964-76.

Schematic illustration of mechanistic differences between percutaneous coronary intervention and coronary artery bypass grafting (CABG). Although both stents and bypass grafts provide revascularization to vascular territories affected by flow-limiting stenoses, only CABG also provides protection against vessel occlusions (i.e., myocardial infarctions) from non-flow-limiting stenoses, because the majority of bypass graft insertions are performed distal to the plaque location.

Doenst et al. J Am Coll Cardiol, 2019

Conclusions/Take-home message

- In patients with MVD and LMD amenable to PCI and CABG, surgery has consistently been associated with improved long term outcomes at the price of increased periprocedural risk and longer recovery
- The absolute differences between the two interventions are small (except for RR) and become evident in the long-term follow-up
- The difference in favor of surgery is particularly evident among diabetics and patients with complex disease

Conclusions/Take-home message

PCI and CABG are different interventions that are performed in different patients with different aims.

Surgery is associated with higher peri-procedural risk and discomfort and better clinical outcomes in the long term

PCI assures outcomes comparable to surgery in the first 1-2 years after the procedure with lower invasiveness.

The two interventions are complementary, not antagonists.

Thank you for your attention