21st TCTAP 2016

Future Role of CABG for LM and MVD

David P Taggart
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Conflicts of Interest:
(i) **Clinical**: Cardiac Surgeon
(ii) **Academic**: ESC/EACTS Guideline Writer; Chair Surgical Cttee EXCEL trial)
(ii) **Commercial**: Consultant to VGS, Medistim, Somahlution
(Research Funding, Speaking Fees, Share Options in VGS)

Future Role of CABG for LM and MVD:

'Must Knows '

① Are study patients 'typical' (? Parallel registry: SYNTAX,EXCEL)

② Duration of Follow-Up (must be > 5 years)

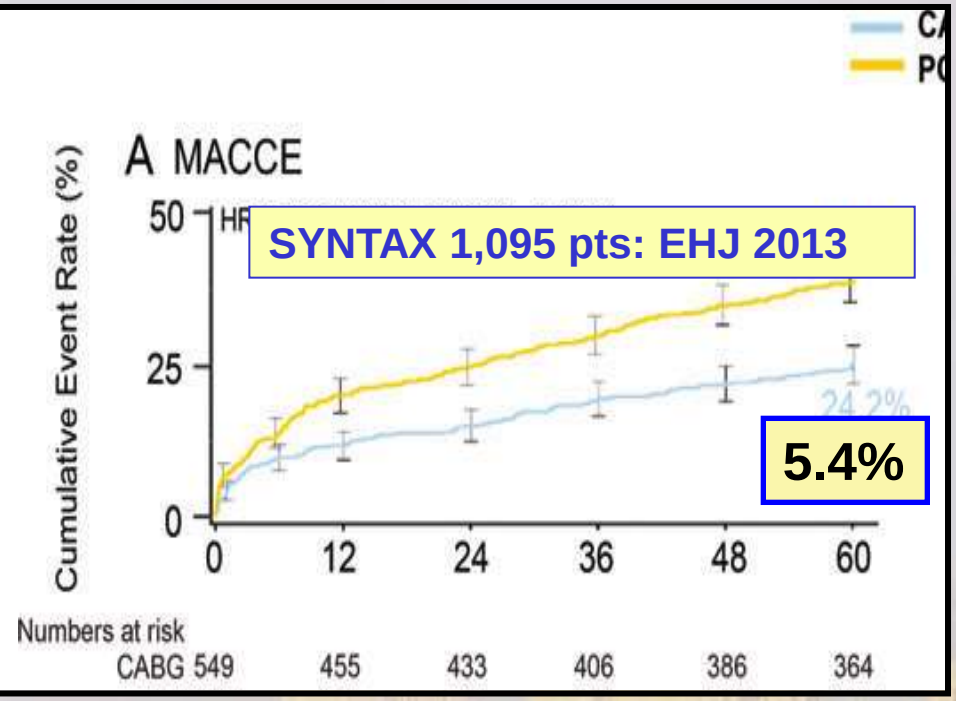
③ Guideline Based Medical Therapy (always worse with CABG)

④ Patients with Diabetes, Poor Ventricles

⑤ Pathophysiological difference between PCI and CABG

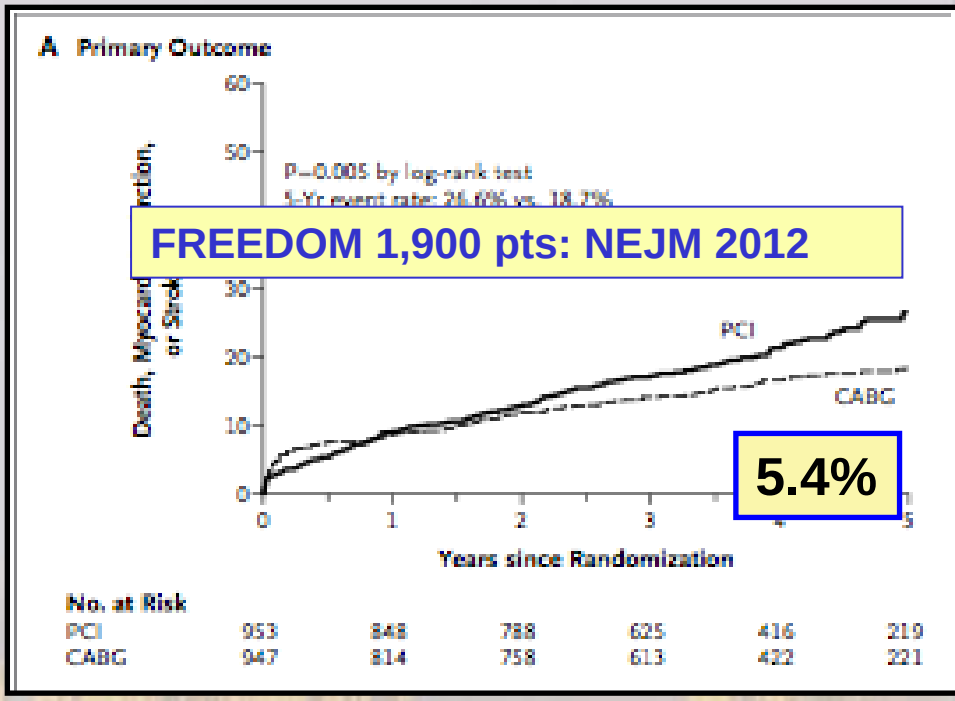
⑥ CABG vs PCI in MVD + LM (Guidelines)

CABG **Survival** vs PCI increasingly diverges with time (< 5 yr is 'interim' analyses)



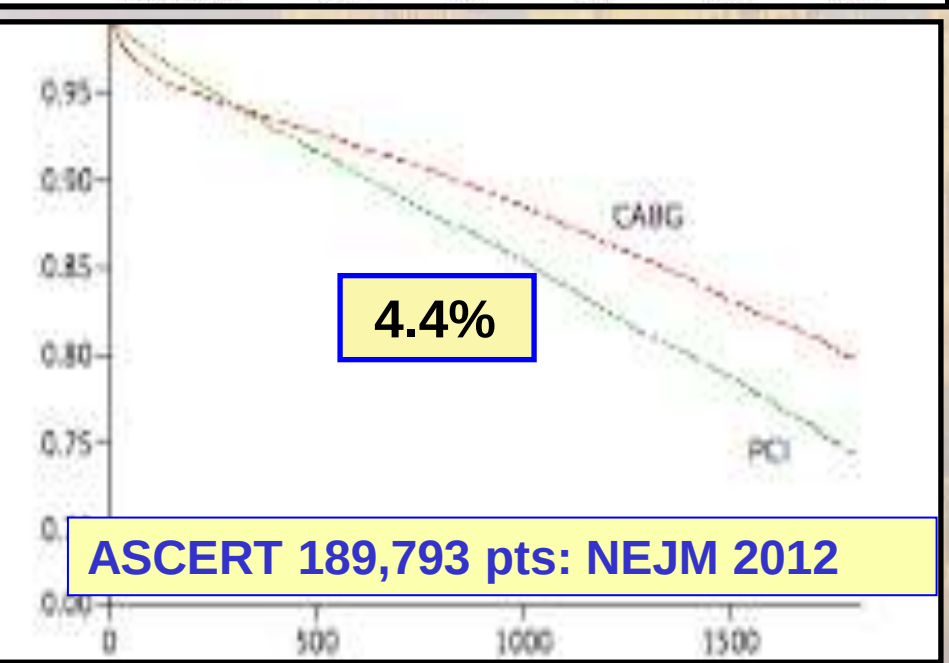
SYNTAX 1,095 pts: EHJ 2013

5.4%



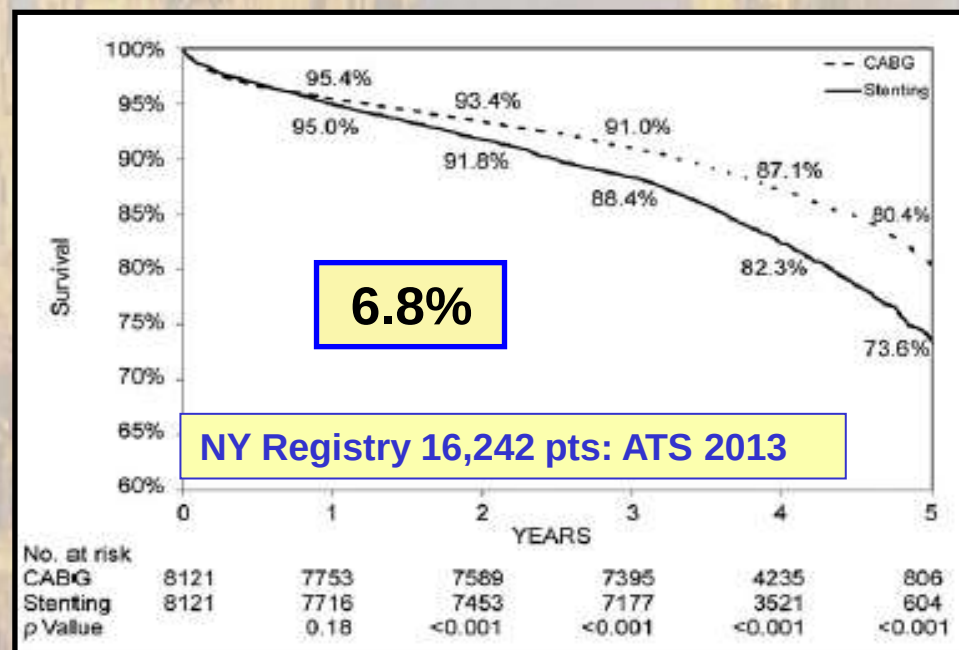
FREEDOM 1,900 pts: NEJM 2012

5.4%



4.4%

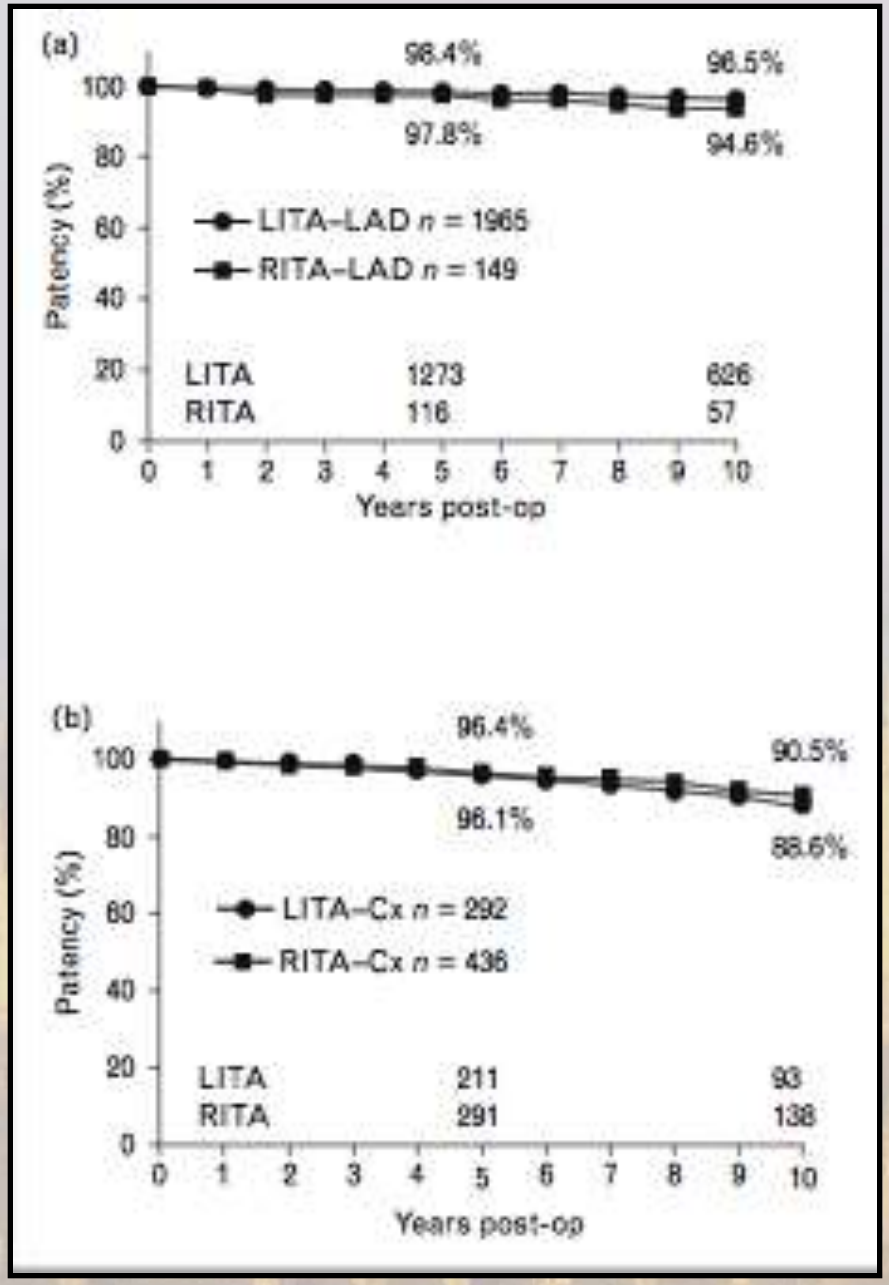
ASCERT 189,793 pts: NEJM 2012

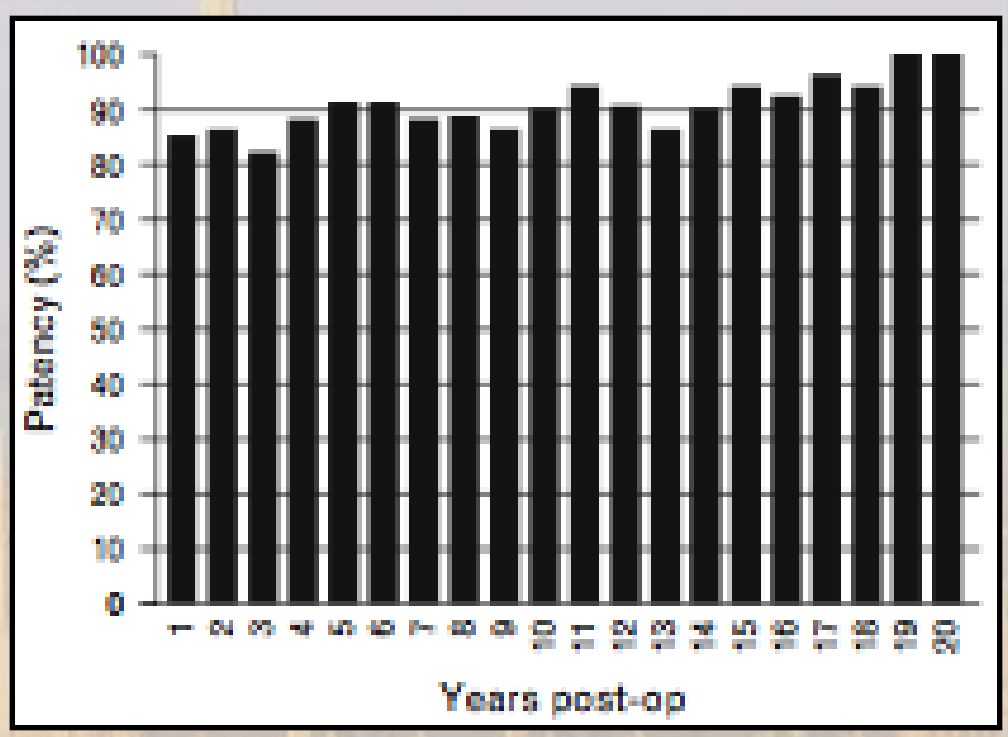


6.8%

NY Registry 16,242 pts: ATS 2013

Patency of BIMA to 20 years [Tatoulis, Buxton et al Curr Op Cardiol 2011]



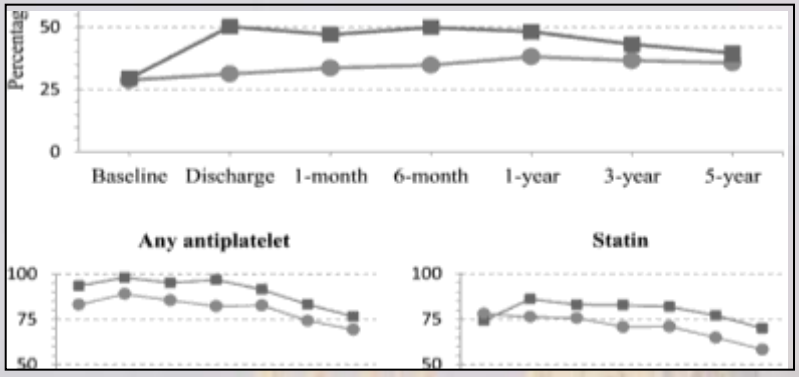


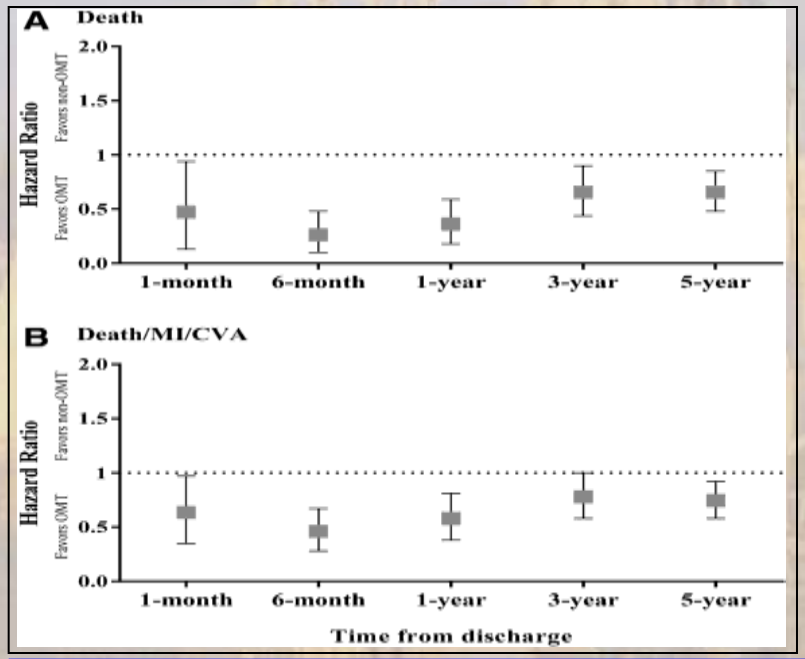
Optimal Medical Therapy Improves Clinical Outcomes in Patients Undergoing Revascularization With Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting

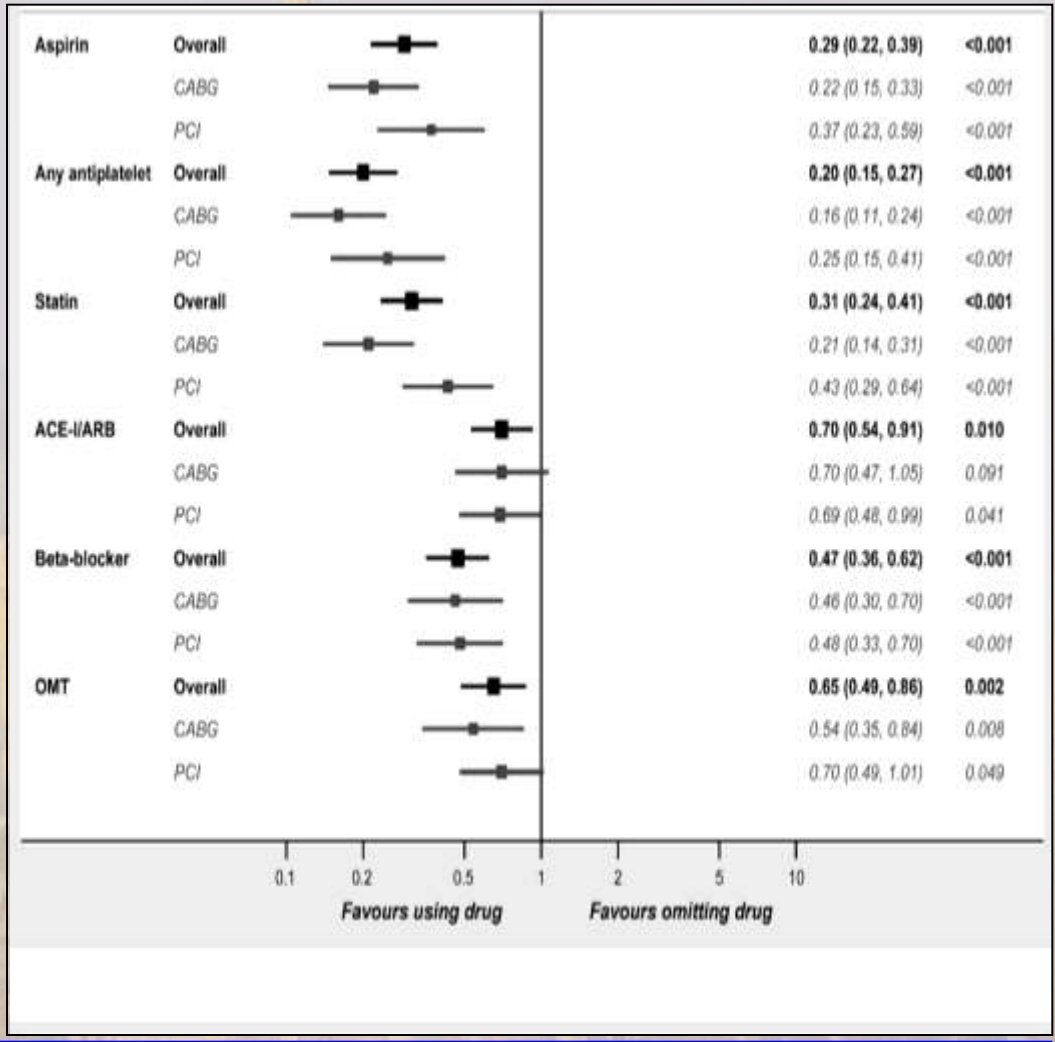
Insights From the Synergy Between Percutaneous Coronary Intervention With TAXUS and Cardiac Surgery (SYNTAX) Trial at the 5-Year Follow-Up

CIRC 2015

Javaid Iqbal, MRCP, PhD*; Yao-Jun Zhang, MD*; David R. Holmes, MD;







Substantially inferior OMT in CABG group: ↑ mortality and MACCE

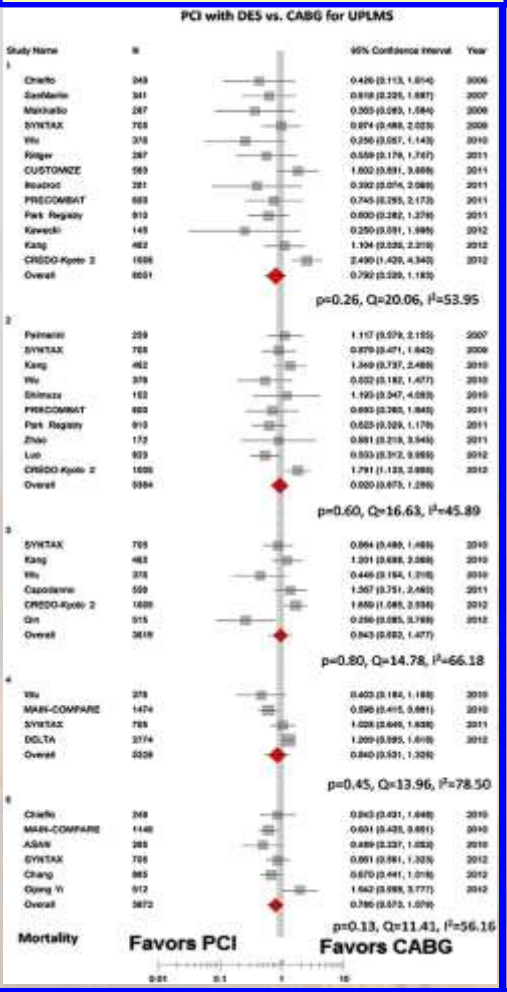
Left Main Coronary Artery Stenosis

A Meta-Analysis of Drug-Eluting Stents Versus Coronary Artery Bypass Grafting

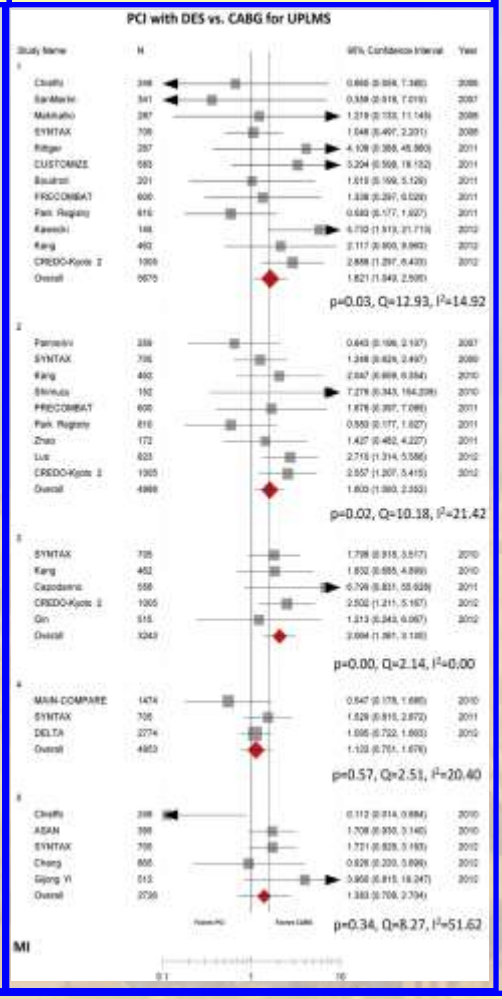
[JACC Cardiovasc Intervention 2013]

24 studies (3 RCT) with 14,203 patients followed to 5 years

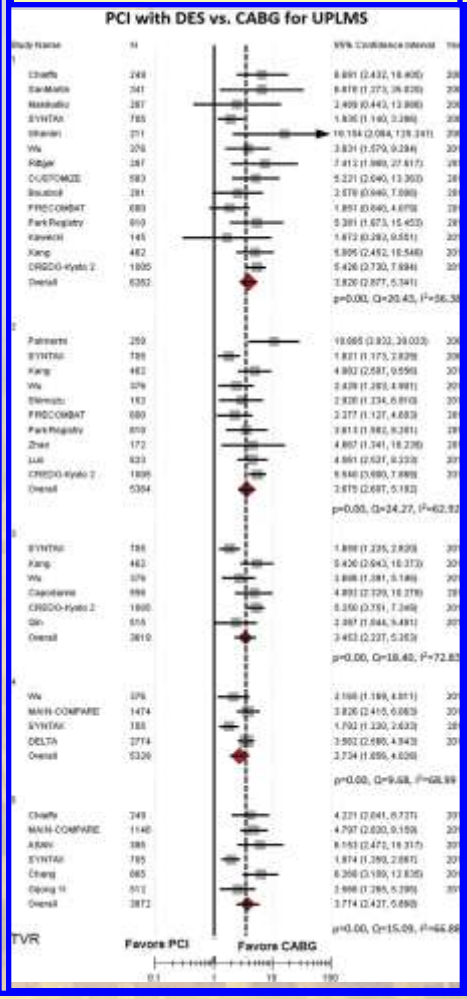
DEATH (5 yr): No Difference



MI: (↑ PCI @ 1-3yrs)

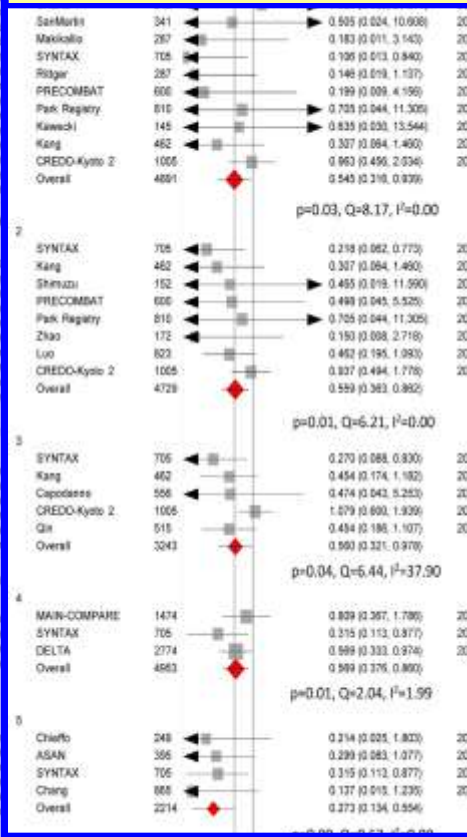


TVR: (↑ PCI @ 1-5 yr)



CVA: (↑ CABG @ 1-5yr)

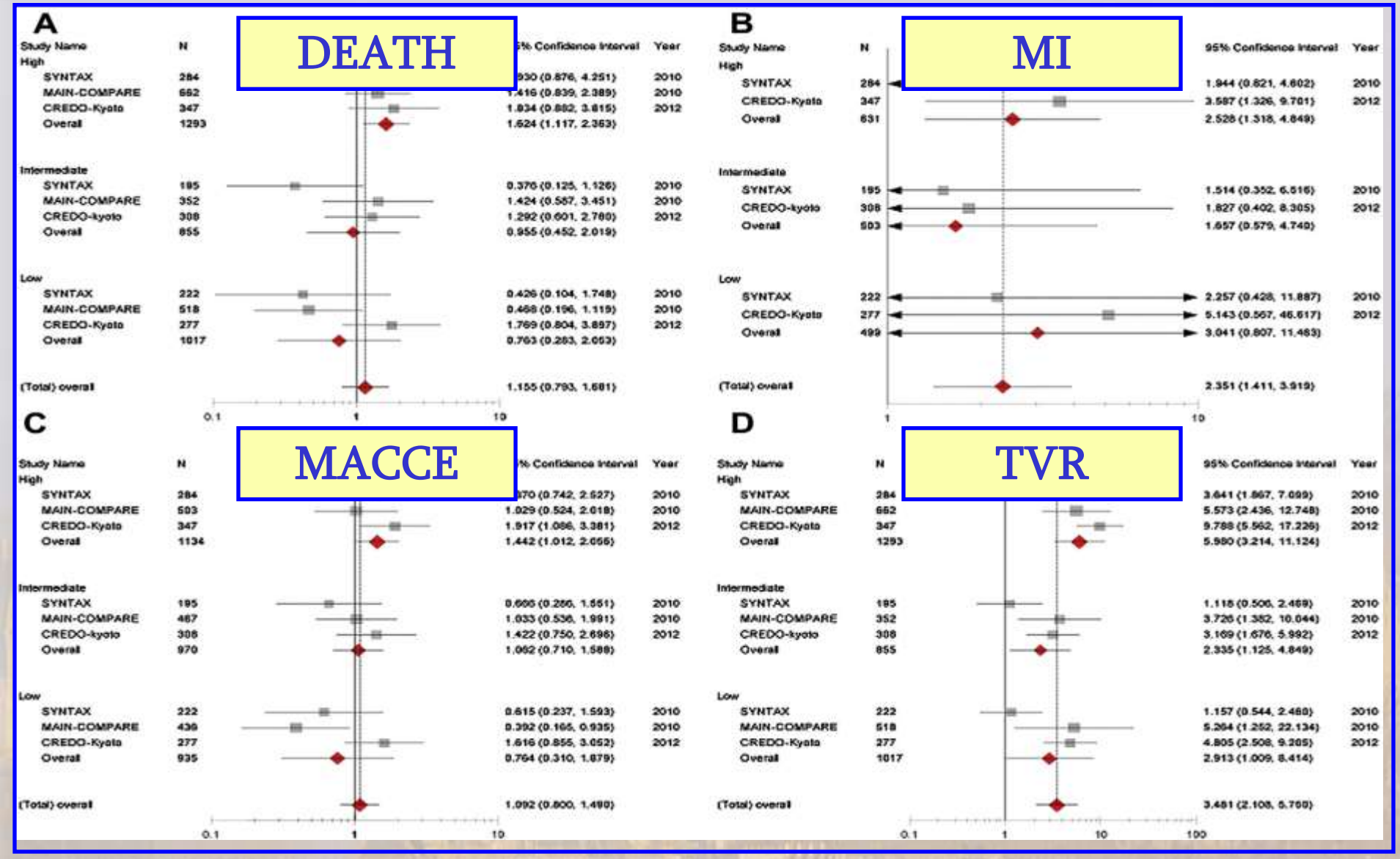
1 yr: 0.8% vs 2.8%



5 yr:1.7% vs 4.7%

Different from 3VD where CABG ↓death, MI, RR BUT +0.9% for CVA

LM: CABG BEST ONLY FOR HIGH TERCILES (>32)



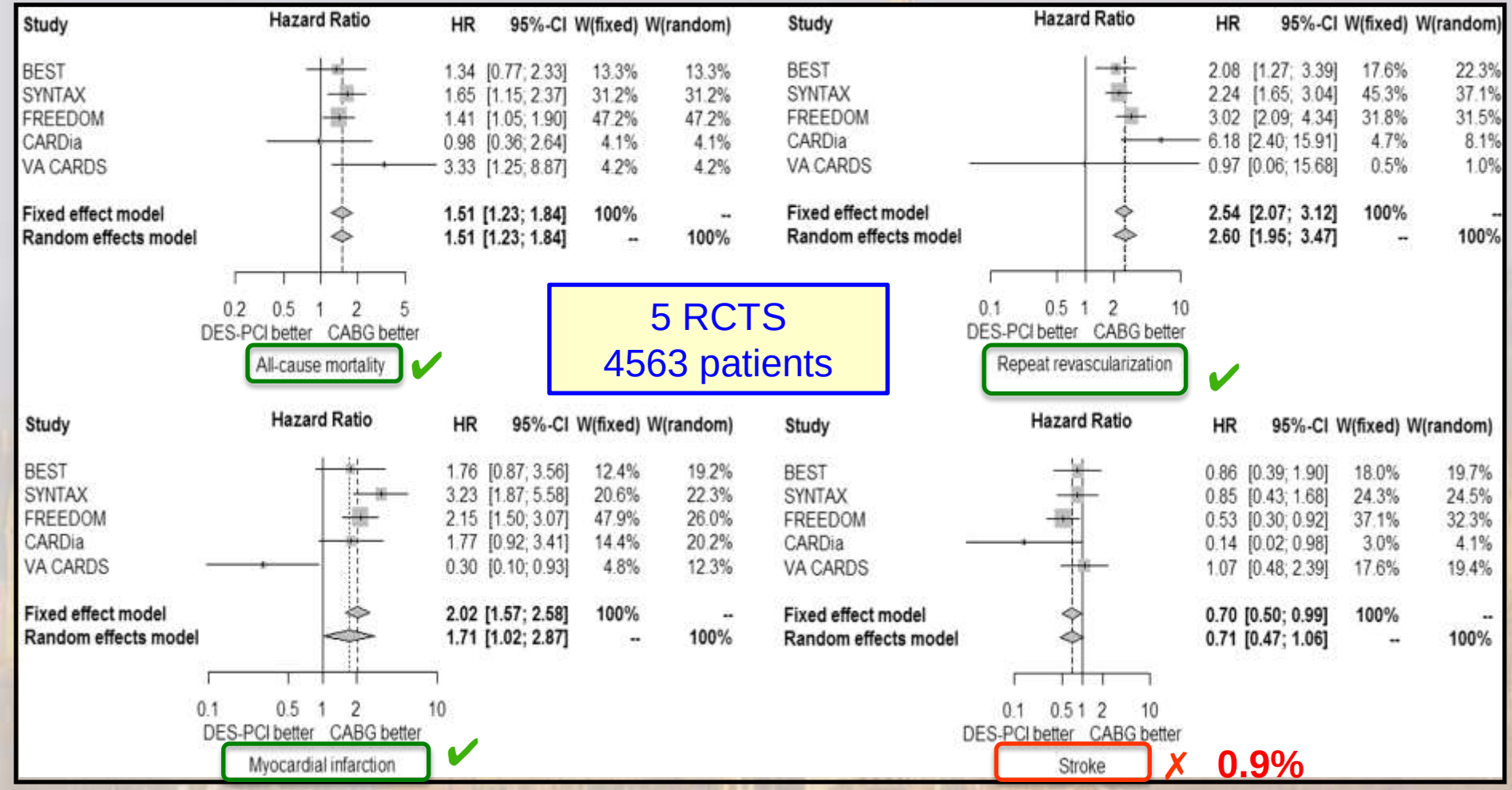
In LM @ SYNTAX <32 (ie less proximal CAD) ? Excess competitive flow

2 completed trials of LM: NOBLE and EXCEL will report TCT 2016

Coronary surgery is superior to drug eluting stents in multivessel disease. Systematic review and meta-analysis of contemporary randomized controlled trials☆,☆☆,☆☆☆

[IJC 2016]

Umberto Benedetto [a,*,1], Mario Gaudino [b,1], Colin Ng [a], Giuseppe Biondi-Zoccai [c,d], Fabrizio D'Ascenzo [e], Giacomo Frati [c,f], Leonard N. Girardi [b], Gianni D. Angelini [a], David P. Taggart [g]



All RCTs and Propensity Matched studies show superior survival with CABG over PCI that continues to increase past 5 years with diverging survival curves

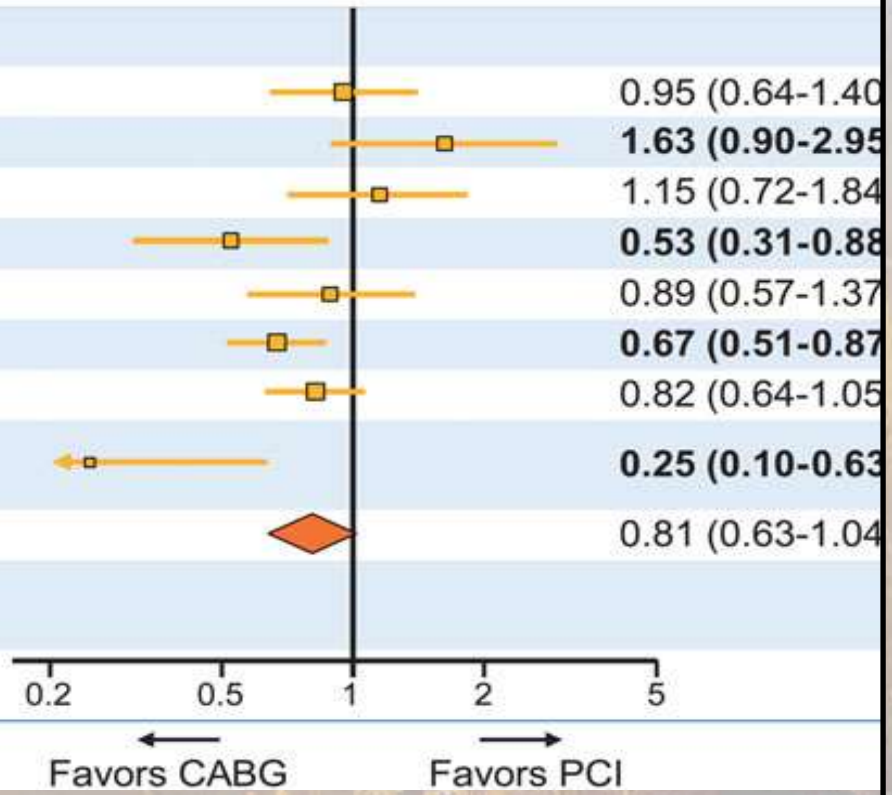
Comparison of coronary artery bypass surgery and percutaneous coronary intervention in patients with diabetes: a meta-analysis of randomised controlled trials

Verma S et al: **[LANCET DIABETES and ENDOCRINOLOGY 2013]**

CABG & PCI in Diabetes
All-Cause Mortality at 5-Year Follow-up

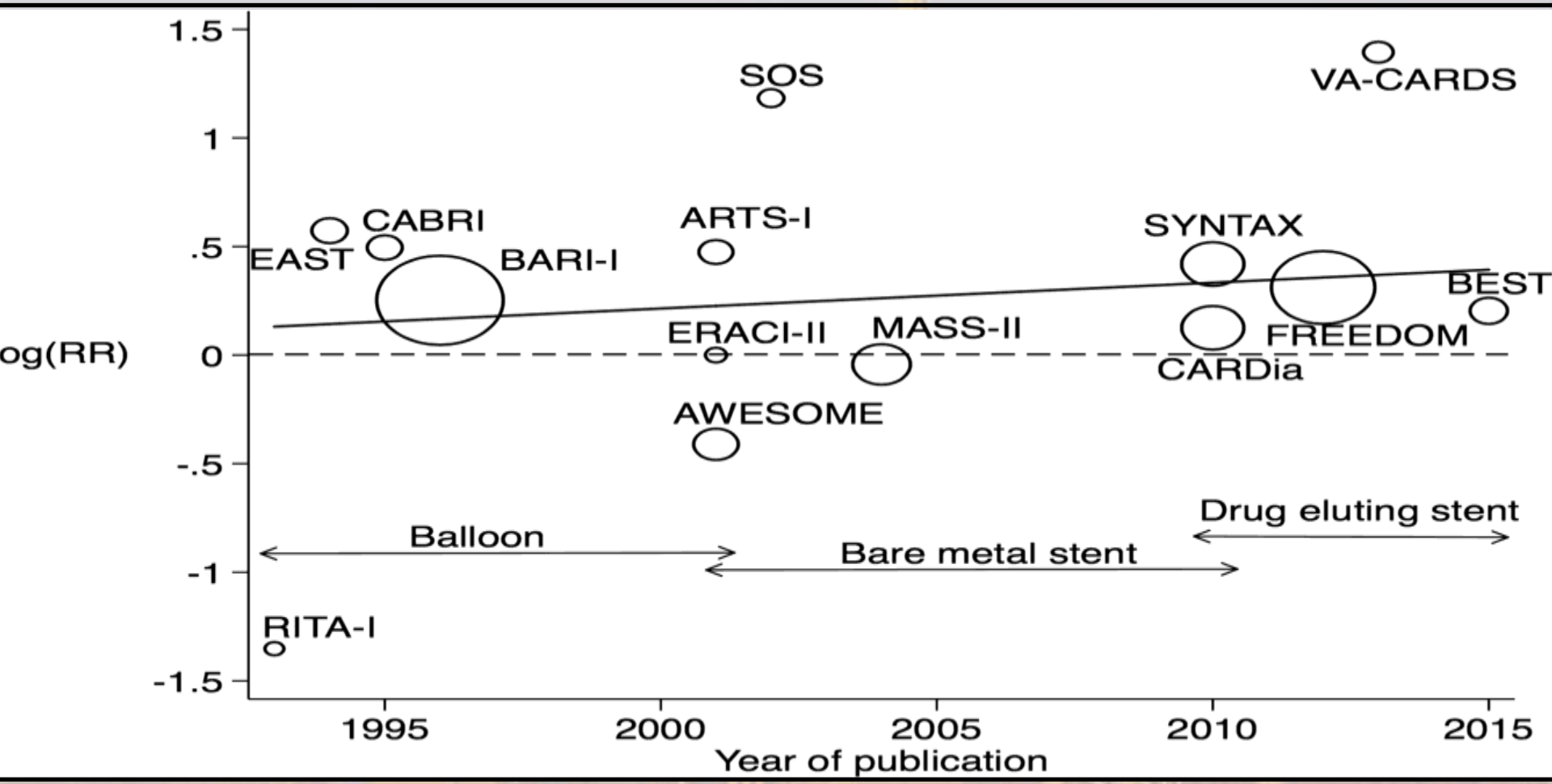
8 trials with 3612 patients

	CABG		PCI		Weight (%)	RR (95% CI)
	Events	Total	Events	Total		
Diabetic and non-diabetic						
ARTS	46	605	48	600	14.1	0.95 (0.64-1.40
ERACI II	**26**	**225**	**16**	**225**	**9.6**	**1.63 (0.90-2.95**
MASS II	32	203	28	205	12.1	1.15 (0.72-1.84
SoS	**21**	**500**	**39**	**488**	**11.1**	**0.53 (0.31-0.88**
CARDia	32	248	37	254	12.8	0.89 (0.57-1.37
FREEDOM	**83**	**761**	**114**	**699**	**17.4**	**0.67 (0.51-0.87**
SYNTAX	94	826	123	884	17.7	0.82 (0.64-1.05
VA CARDS (2 years)	**5**	**97**	**21**	**101**	**5.2**	**0.25 (0.10-0.63**
Subtotal	339	3465	426	3456	100.0	0.81 (0.63-1.04
Heterogeneity: τ^2=0.07; χ^2=19.16, df=7 (P=0.008): **I^2=63%**						
Test for overall effect: Z=1.67 (P=0.10)						



Has the difference in mortality between percutaneous coronary intervention and coronary artery bypass grafting in people with heart disease and diabetes changed over the years? A systematic review and meta-regression

Peter Herbison, Cheuk-Kit Wong **[BMJ 2015]**

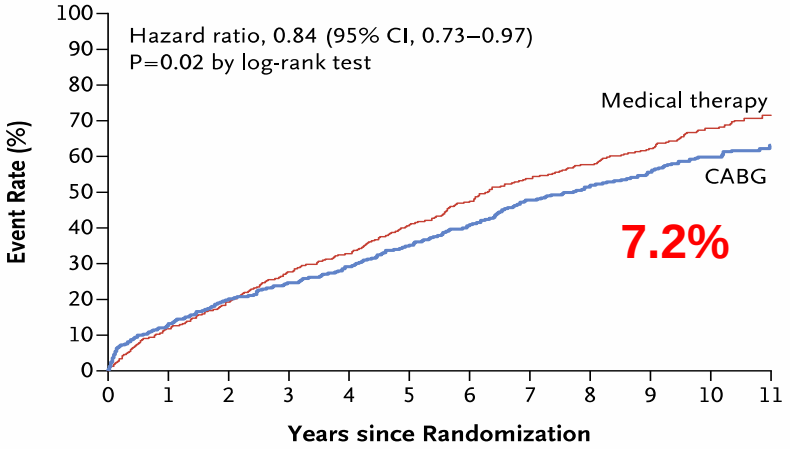


In DM even with 3rd generation stents CABG still has strong survival advantage

Coronary-Artery Bypass Surgery in Patients with Ischemic Cardiomyopathy

Eric J. Velazquez, M.D., Kerry L. Lee, Ph.D., Robert H. Jones, M.D.,

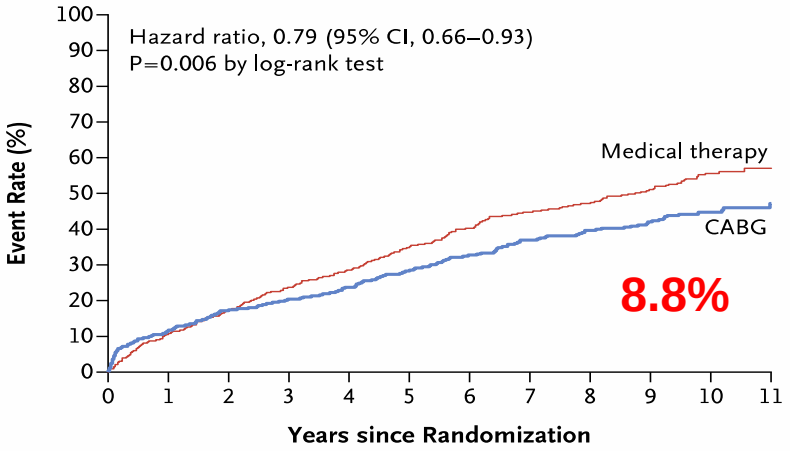
A Death from Any Cause (Primary Outcome)

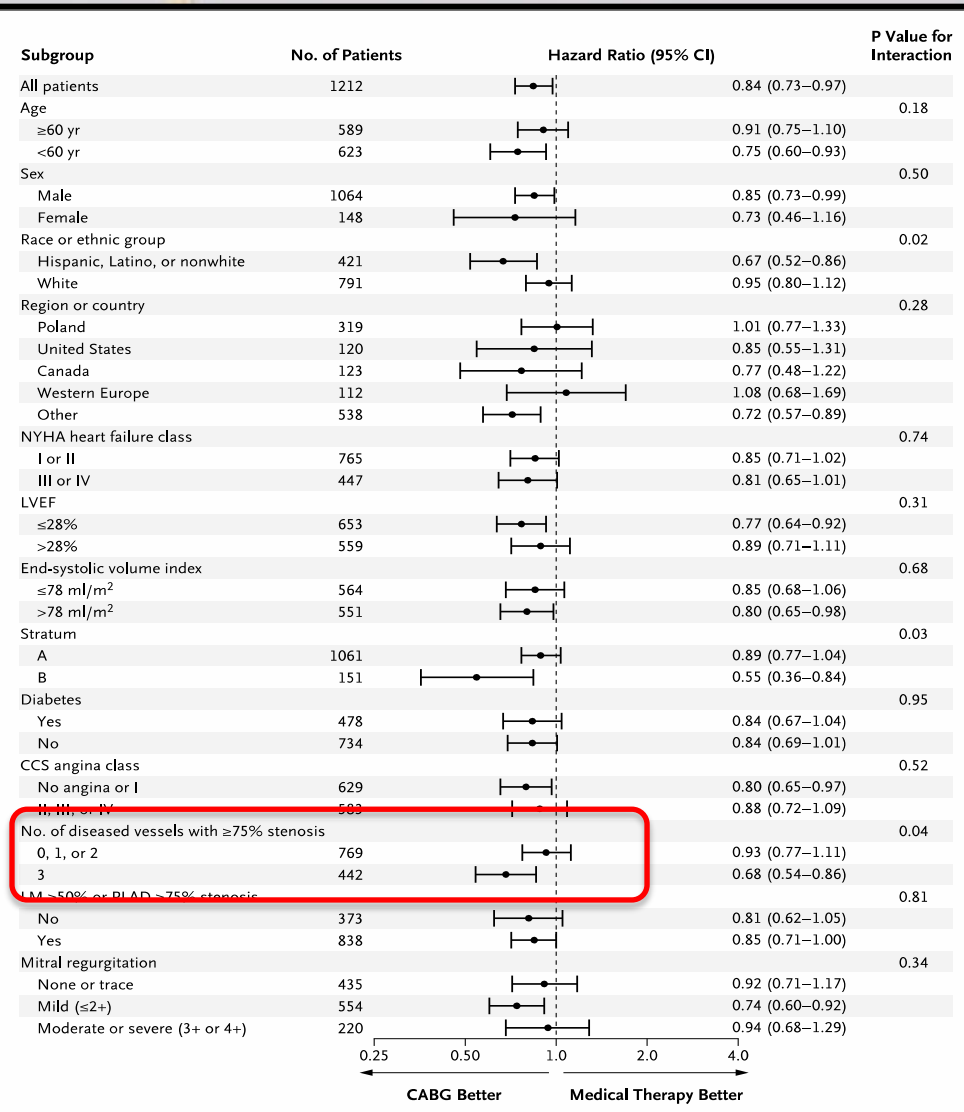


No. at Risk

Medical therapy	602	532	487	435	404	357	315	274	248	164	82	37
CABG	610	532	487	460	432	392	356	312	286	205	103	42

B Death from Cardiovascular Causes





THE 3 REASONS CABG HAS SUCH A SURVIVAL BENEFIT OVER PCI

1. **Anatomically, atheroma is mainly located in the proximal coronary arteries**
Placing bypass grafts to the **MID CORONARY VESSEL** has **TWO** effects
(i) Complexity of proximal '**CULPRIT**' lesion is irrelevant
(ii) over the long term offers prophylaxis against **FUTURE** 'culprit' lesions
In contrast, PCI only treats **'SUITABLE'** localised proximal 'culprit' lesions but has **NO PROPHYLACTIC BENEFIT** against new disease

462 THE NEW ENGLAND JOURNAL OF MEDICINE Aug. 25, 1988

2 IMA elutes NO into coronary circulation reducing risk of further disease

DIFFERENCE BETWEEN ENDOTHELIUM-DEPENDENT RELAXATION IN ARTERIAL AND IN VENOUS CORONARY BYPASS GRAFTS

THOMAS F. LÜSCHER, M.D., DENNIS DIEDERICH, M.D., ROBERT SIEBENMANN, M.D., KURT LEHMANN, M.D.,

Drug-Eluting Stent and Coronary Thrombosis
Biological Mechanisms and Clinical Implications **[CIRC 2007]**

Thomas F. Lüscher, MD; Jan Steffel, MD; Franz R. Eberli, MD; Michael Joner, MD;

impairs re-endothelialization, downstream endothelial function and creates pro-thrombotic milieu

3. PCI means incomplete revascularization (Hannan Circ 2006)
- Of 22,000 PCI 69% had incomplete revascularization
- >2 vessels (+/- CTO) HR for mortality 1.4 (95% CI = 1.1-1.7)
- Residual SYNTAX score > 8 increases mortality and MACCE (Farooq, Serruys CIRC 2013)

PCI will 'never' match the results of CABG for LM/MVD (POBA;BMS;DES)

European Heart Journal (2014) 35, 2541–2819
doi:10.1093/eurheartj/ehu278

ESC/EACTS GUIDELINES

2014 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Recommendations according to extent of CAD Complex CAD should be discussed by Heart Team IC	CABG		PCI	
	Class[a]	Level[b]	Class[a]	Level[b]
One or two-vessel disease without proximal LAD stenosis.	IIb	C	I	C
One-vessel disease with proximal LAD stenosis.	I	A	I	A
Two-vessel disease with proximal LAD stenosis.	I	B	I	C
Left main disease with a SYNTAX score ≤ 22.	I	B	I	B
Left main disease with a SYNTAX score 23–32.	I	B	IIa	B
Left main disease with a SYNTAX score >32.	I	B	III	B
Three-vessel disease with a SYNTAX score ≤ 22.	I	A	I	B
Three-vessel disease with a SYNTAX score 23–32.	I	A	III	B
Three-vessel disease with a SYNTAX score >32.	I	A	III	B

66%

79%

CABG superior even although most grafts are veins and despite inferior OMT

State of the Art in Coronary Artery Revascularization: Evidence Basis in 2016 for

① CABG Best in 79% MVD + 66% LM (Guidelines)

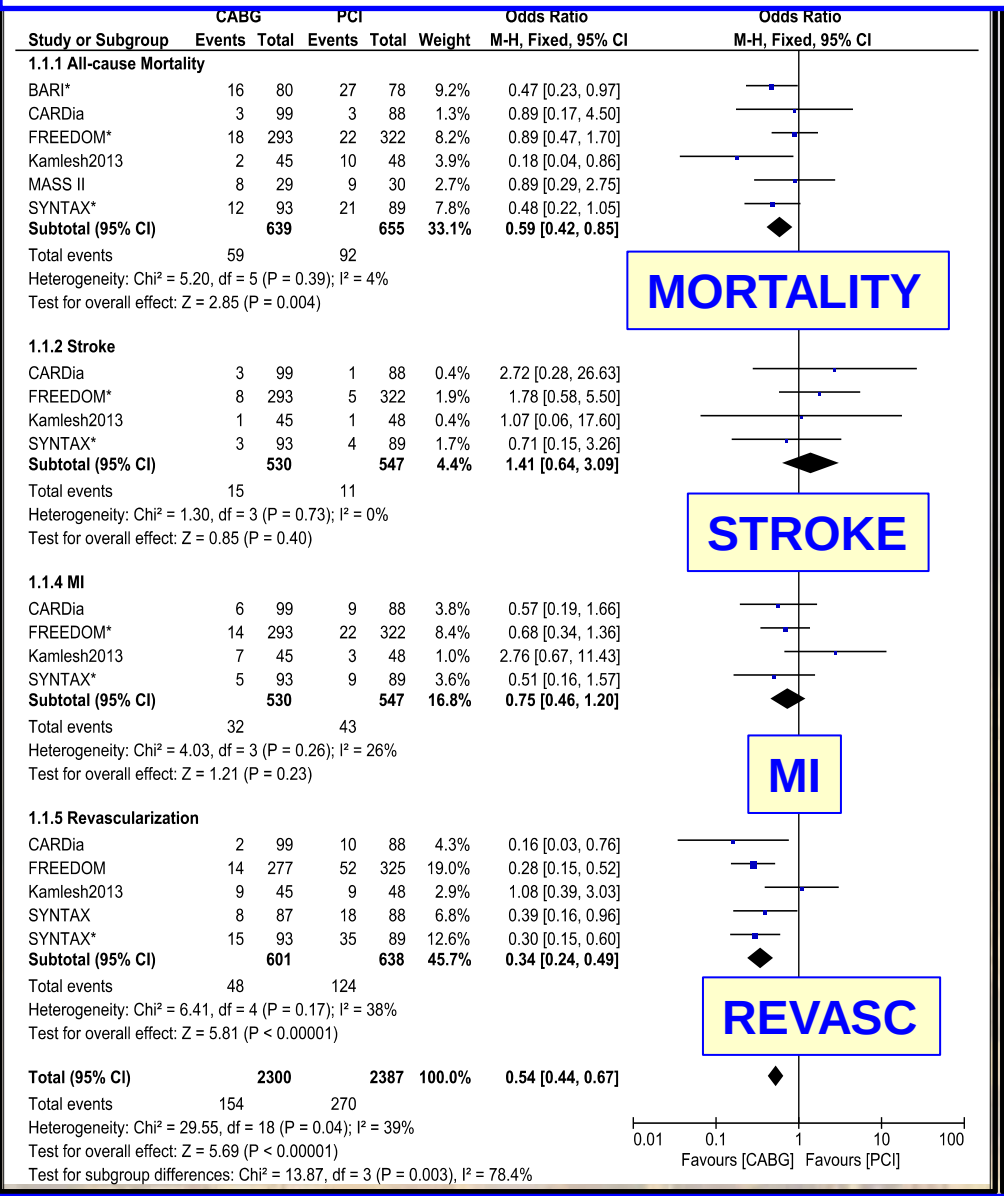
② CABG benefits greater in Diabetes and Poor Ventricles

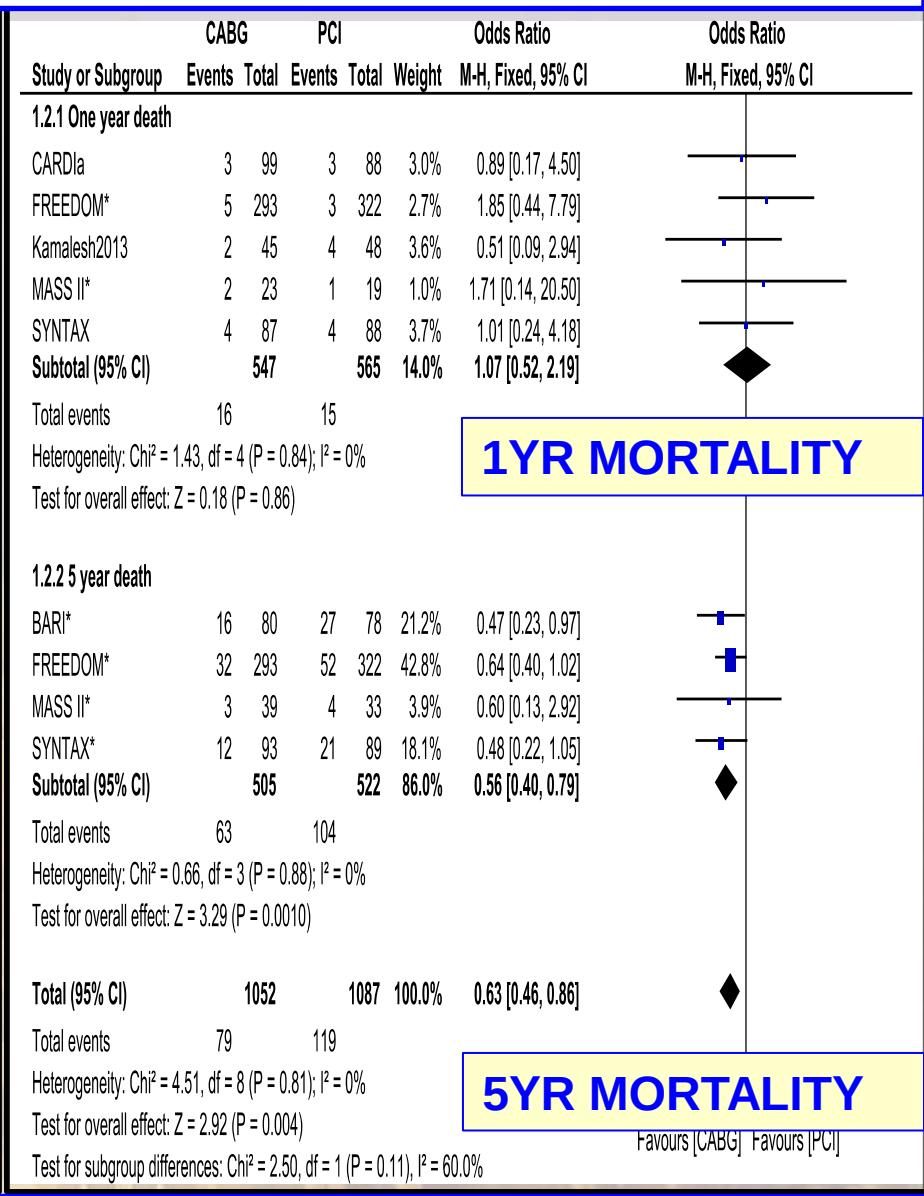
③ Importance of Duration of Follow-Up (>5years)

④ Importance of Guideline Based Medical Therapy in CABG

⑤ Fundamental pathophysiological difference PCI vs CABG

Coronary artery bypass surgery compared with percutaneous coronary interventions in patients with insulin-treated type 2 diabetes mellitus a systematic review and meta-analysis of 6 randomized controlled trials. PK Bundhun, ZJ Wu, MH Chen **[Cardiovasc Diabet 2016]**





CABG decreases mortality and repeat revasc (> at 5 yrs); NS for MI and stroke

Effectiveness of Percutaneous Coronary Intervention With Drug-Eluting Stents Compared With Bypass Surgery in Diabetics With Multivessel Coronary Disease: Comprehensive Systematic Review and Meta-analysis of Randomized Clinical Data

[JAHA 2013]

Abdul Hakeem, MD; Nadish Garg, MD; Sabha Bhatti, MD; Naveen Rajpurohit, MD; Zubair Ahmed, MD; Barry F. Uretsky, MD

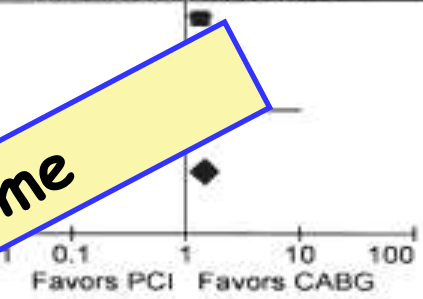
(A)

Study or Subgroup	PCI Events	PCI Total	CABG Events	CABG Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
FREEDOM trial	114	953	83	947	37.7%	1.36 [1.04, 1.78]	2012
SYNTAX TRIAL	44	231	26	221	25.9%	1.62 [1.03, 2.54]	2012
CARDIA Study	37	254	32	248	26.4%	1.13 [0.73, 1.75]	2013
VA CARDS	21	101	5	97	9.9%	4.03 [1.58, 10.27]	2013
Total (95% CI)		1539		1513	100.0%	1.51 [1.09, 2.10]	
Total events	216		146				

Heterogeneity: Tau² = 0.06; Chi² = 6.28, df = 3 (P = 0.10); I² = 52%

Test for overall effect: Z = 2.47 (P = 0.01)

DEATH



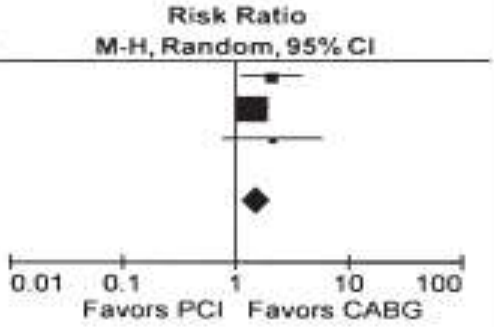
(B)

Study or Subgroup	PCI Events	PCI Total	CABG Events	CABG Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
SYNTAX TRIAL	28	231	13	221		2.06 [1.10, 3.87]	2012
FREEDOM trial	73	953	52			1.40 [0.99, 1.97]	2012
VA CARDS	11	101				2.11 [0.76, 5.86]	2013
Total (95% CI)		1285			100.0%	1.57 [1.17, 2.09]	
Total events	112						

Heterogeneity: Tau² = 0.00; … (P = 0.47); I² = 0%

Test for overall effect: Z …

CARDIAC DEATH



Benefits of surgery increase with time

Study …	PCI Events	PCI Total	CABG Events	CABG Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
SYN…	75	231	28	221	25.5%	2.56 [1.73, 3.80]	2012
FREE…	117	953	42	947	26.1%	2.77 [1.97, 3.89]	2012
CARDI… dy	57	254	23	248	24.6%	2.42 [1.54, 3.80]	2013
VA CARDS	19	101	29	97	23.8%	0.63 [0.38, 1.04]	2013
Total (95% CI)		1539		1513	100.0%	1.85 [1.00, 3.40]	
Total events	268		122				

Heterogeneity: Tau² = 0.34; Chi² = 25.69, df = 3 (P < 0.0001); I² = 88%

Test for overall effect: Z = 1.97 (P = 0.05)

REVASC