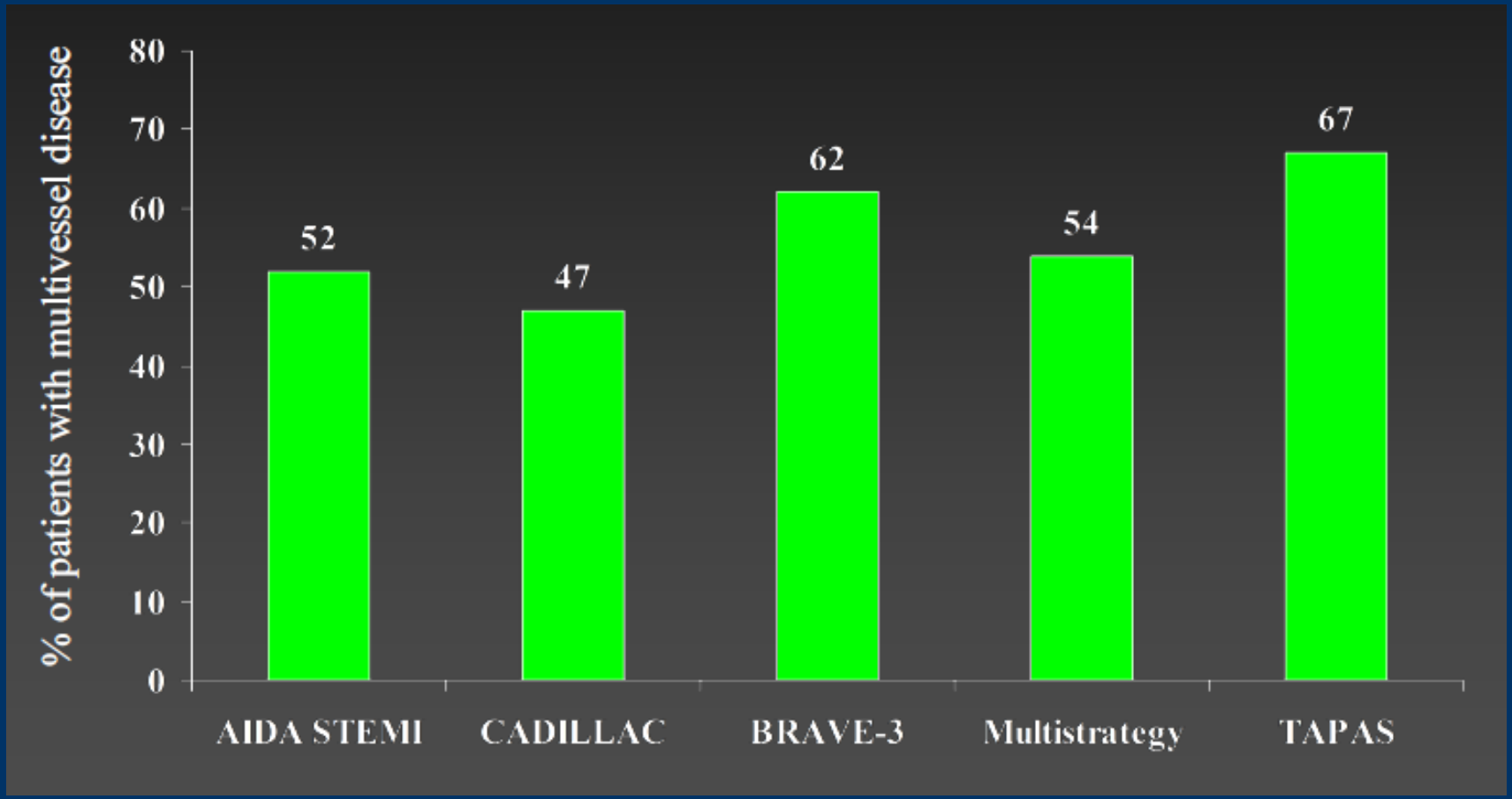
Impact of Multivessel Revascularization on Health Status Outcomes in ST-segment Elevation Myocardial Infarction Patients

Jae-Sik Jang, MD, PhD
Division of Cardiology,
Inje University Busan Paik Hospital

Incidence of Multivessel CAD

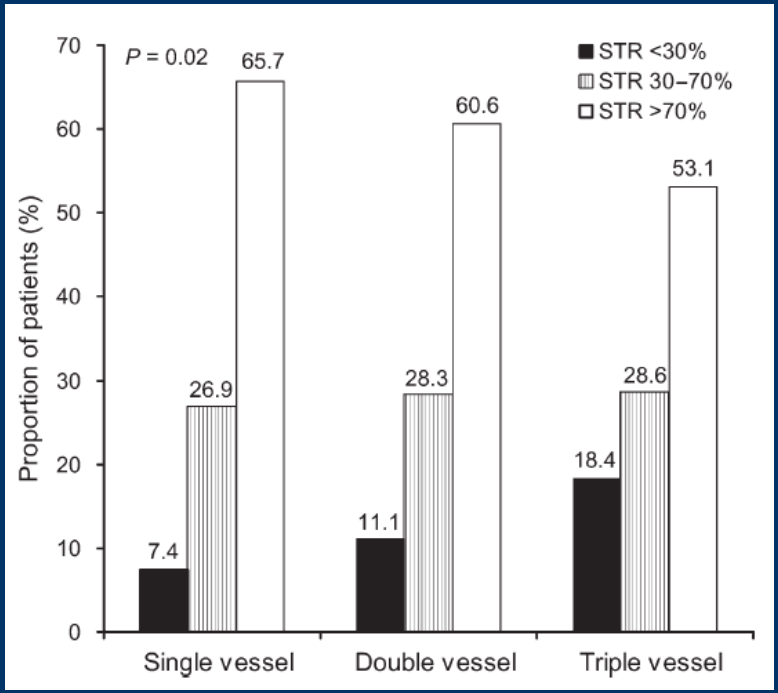
STEMI without Shock



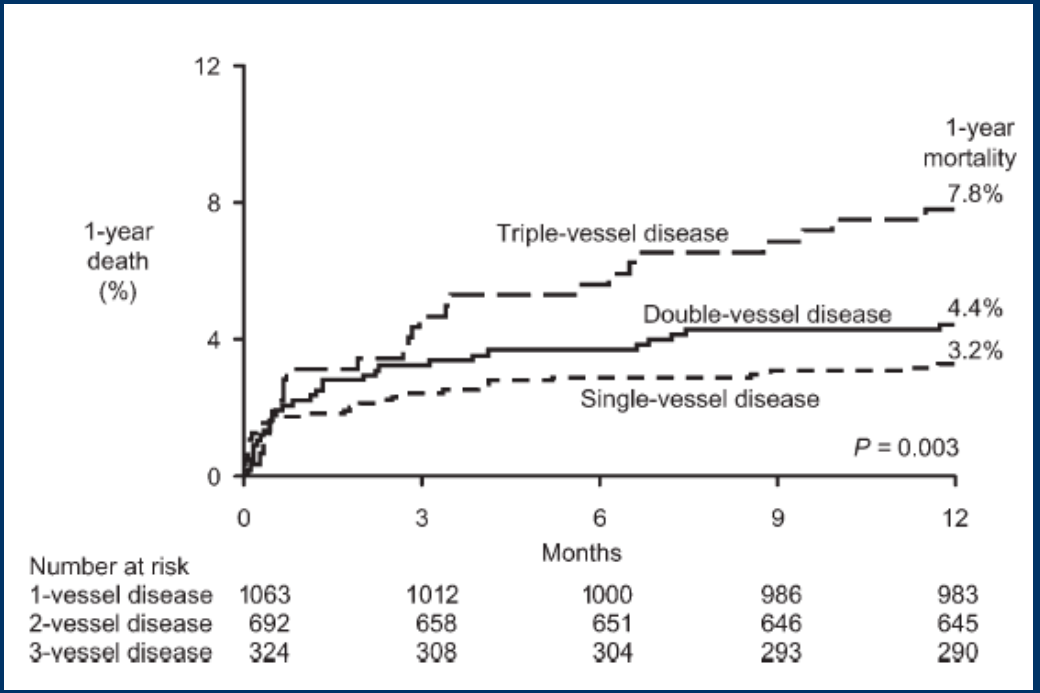
CADILAC trial

2,082 non-shock STEMI <12 h

ST-Resolution



1-Year Mortality

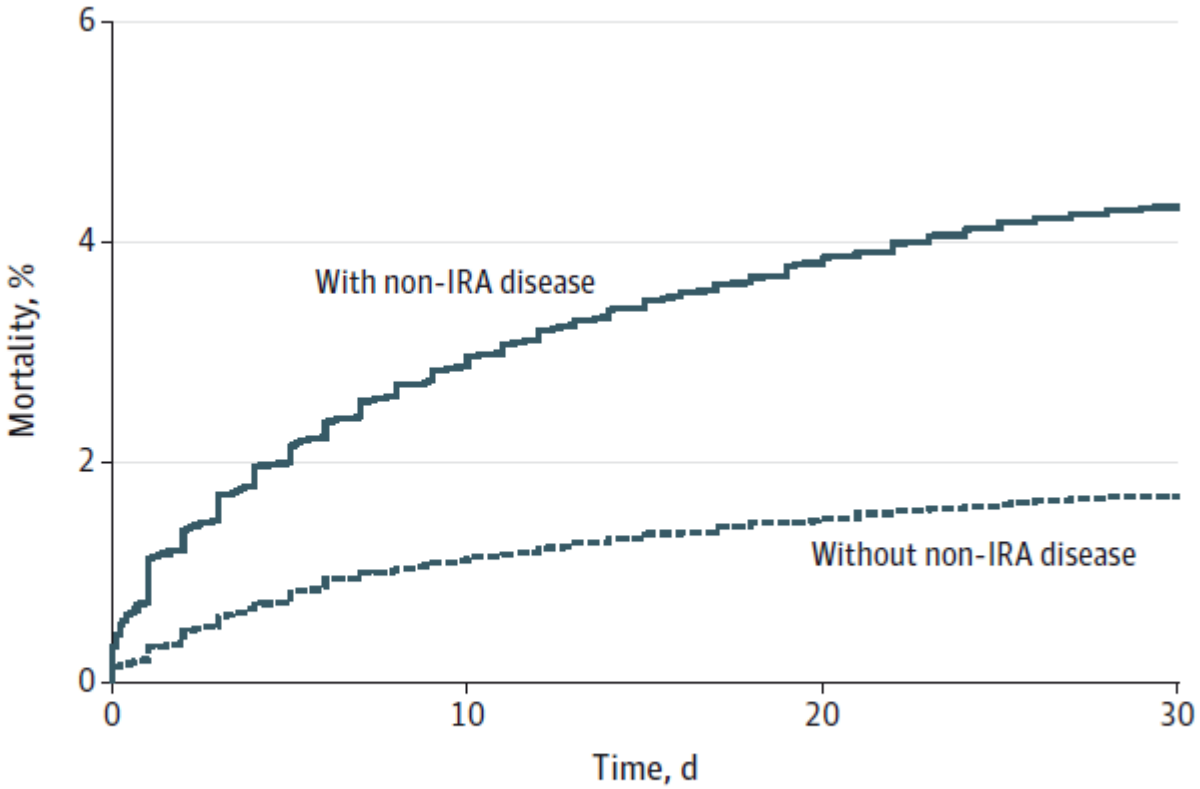


Sorajja et al. Eur Heart J 2007;28:1709

Non-Infarct-Related CAD in STEMI Pts

Pooled Analysis of 28,282 Pts from 8 RCTs

30-day Mortality: With vs. Without *non-IRA disease*



No. at risk				
With non-IRA disease	14916	14479	14335	14115
Without non-IRA disease	13351	13201	13141	13001

Park DW, et al. JAMA. 2014;312(19):2019-2027

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)

Class IIa: (Benefit > Harm)

1. PCI should be limited to the culprit vessel with the exception of cardiogenic shock and persistent ischemia ater PCI of the supposed culprit lesion. (*Level of Evidence: B*)
2. Staged revascularization of non-culprit lesions should be considered in STEMI patients with multivessel disease in case of symptom or ischemia within days to weeks after primary PCI *(Level of Evidence: B)*

Class IIb: (Harm > Benefit)

1. Immediate revascularization of significant non-culprit lesions during the same procedure as primary PCI of the culprit vessel may be considered in selected patients. (*Level of Evidence: B*)

Eur Heart J 2014, EuroIntervention 2014 Ahead of Print

2013 ACCF/AHA Guldelines

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

Class III: Harm

1. PCI should not be performed in a noninfarct artery at the time of primary PCI in patients with STEMI who are hemodynamically stable. (*Level of Evidence: B*)

Circulation. 2013;127:e362-e425

2015 ACC/AHA/SCAI Focused Update on Primary Percutaneous Coronary Intervention for Patients With ST-Elevation Myocardial Infarction: An Update of the 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention and the 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

Class IIb

PCI of a noninfarct artery may be considered in selected patients with STEMI and multivessel disease who are hemodynamically stable, either at the time of primary PCI or as a planned staged procedure. *(Level of Evidence: B-R)*

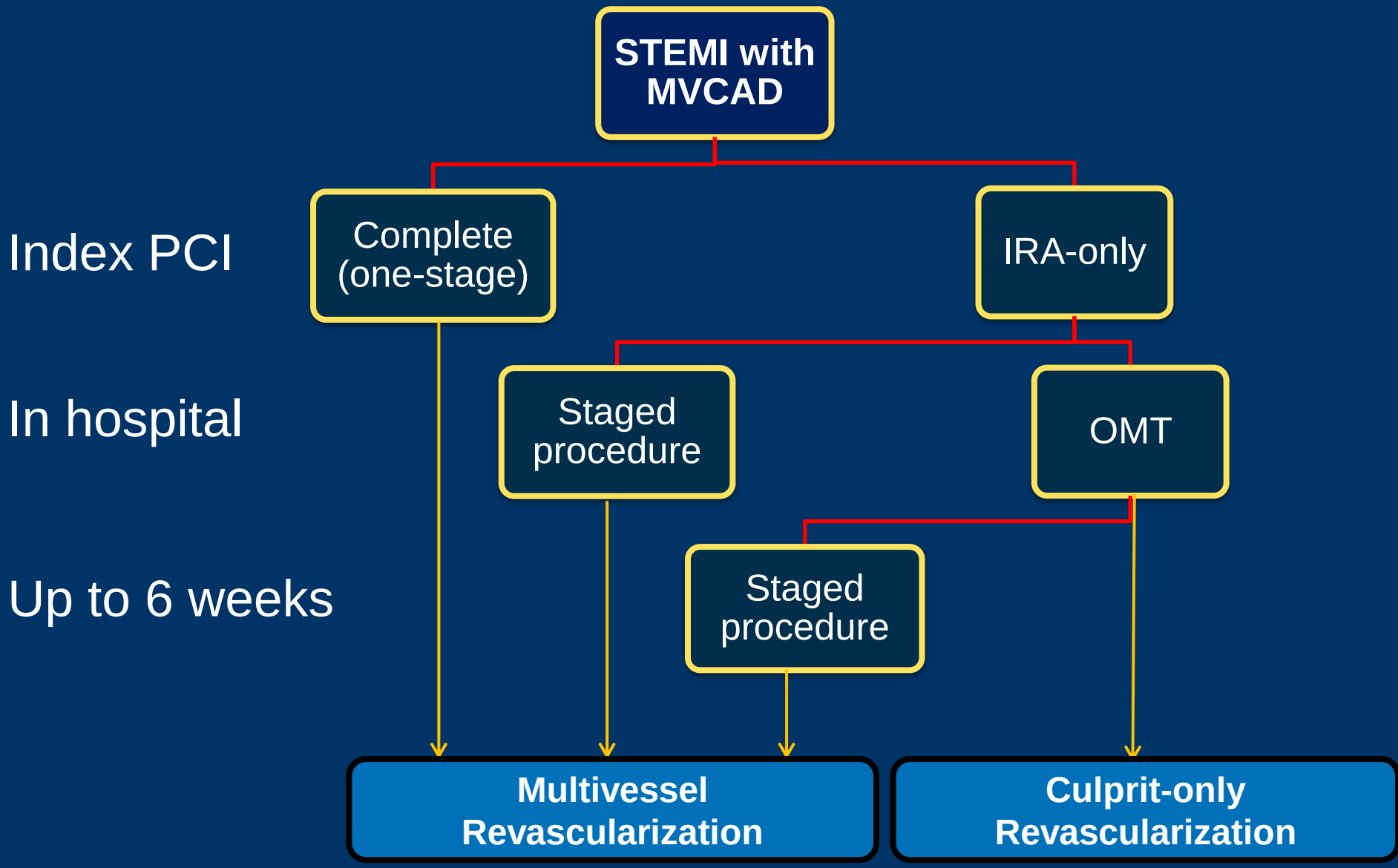
- Not endorsing *routine* MV PCI in all patients with STEMI and MVD
- Integrate clinical data, lesion severity/complexity, and risk of CIN.

Levine GN, et al. 2015 ACC/AHA/SCAI Focused Update on Primary PCI. JACC 2015

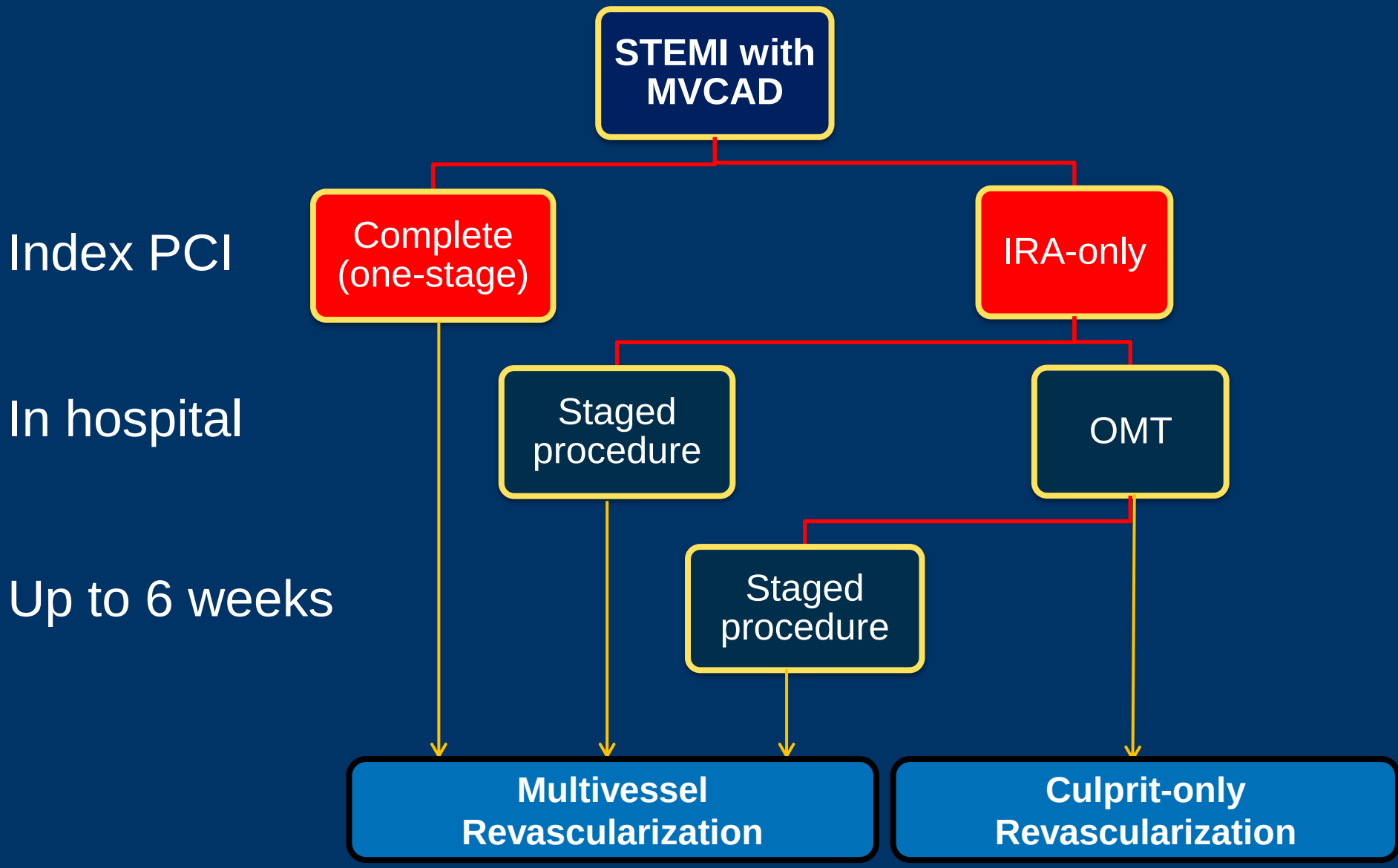
Strategies for STEMI Pts with MV CAD

Culprit Only	• PCI to IRA only
One-stage Multivessel PCI	• PCI to IRA and other significant non-IRA at primary PCI
Staged PCI within 1st stay	• PCI to IRA and other significant non-IRA in a later session during index hospital stay
Staged PCI within 2nd stay	• PCI to IRA and other significant non-IRA during 2nd admission

Timing of Revascularization



IRA-only vs. One Stage MV PCI



Intervention of the non-culprit vessels during primary PCI

ADVANTAGES

- Reduction of total ischemic burden
  ; Better LVEF
- Treatment of all unstable plaque by treating non-culprit vessel
  ; less future MACE
- Less future hospitalizations and procedures
  ; cost saving

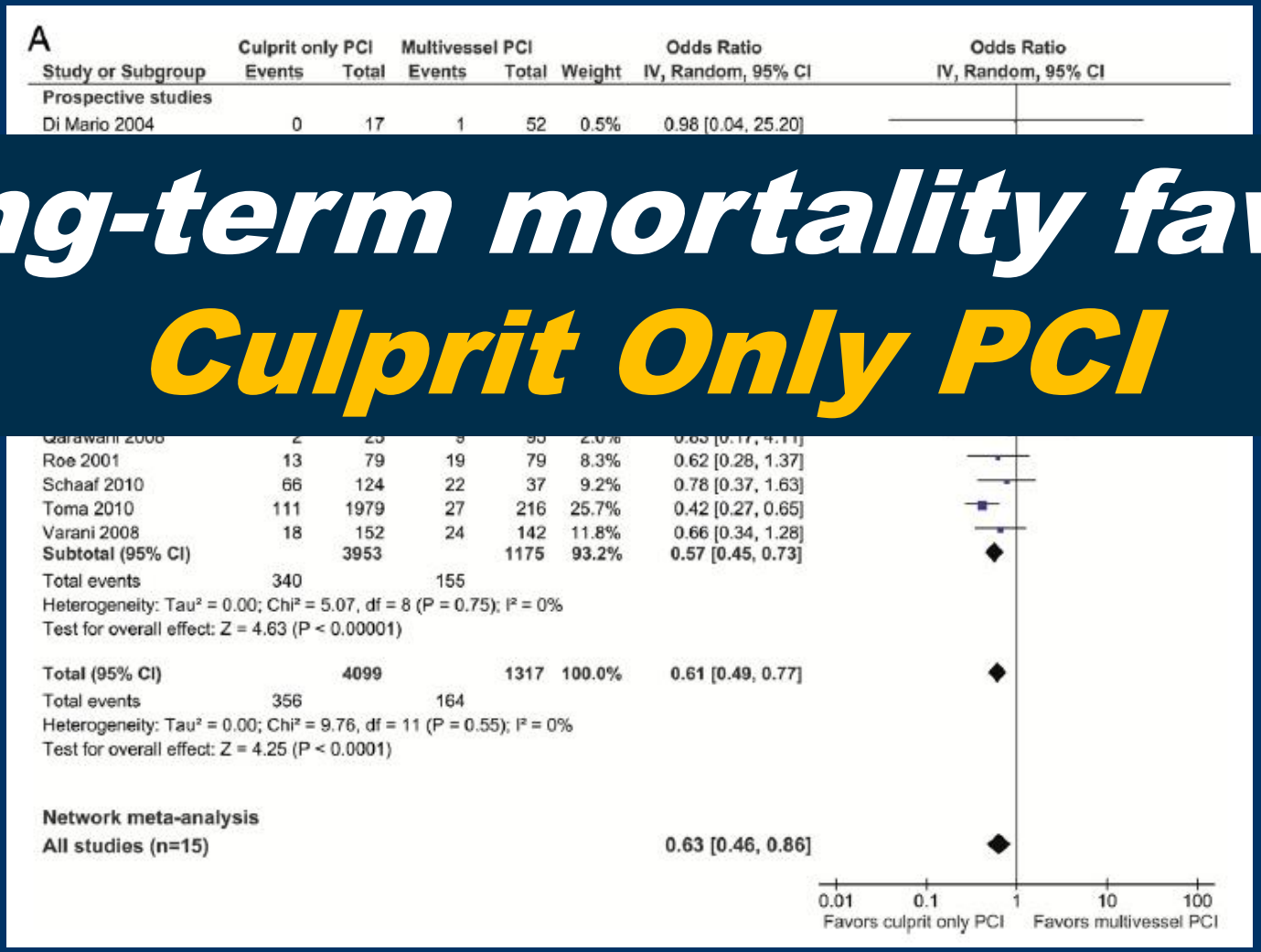
DISADVANTAGES

- Extension of infarcted m.
  ; acute complications (dissection, thrombosis)
- Lesion severity in non-IRA ***overestimated*** (vasoconstriction and endothelial dysfunction)
- ***Hemodynamic compromise***
- ***Contrast load***

Culprit only PCI vs. MV-PCI

Pairwise and Network Meta-Analysis

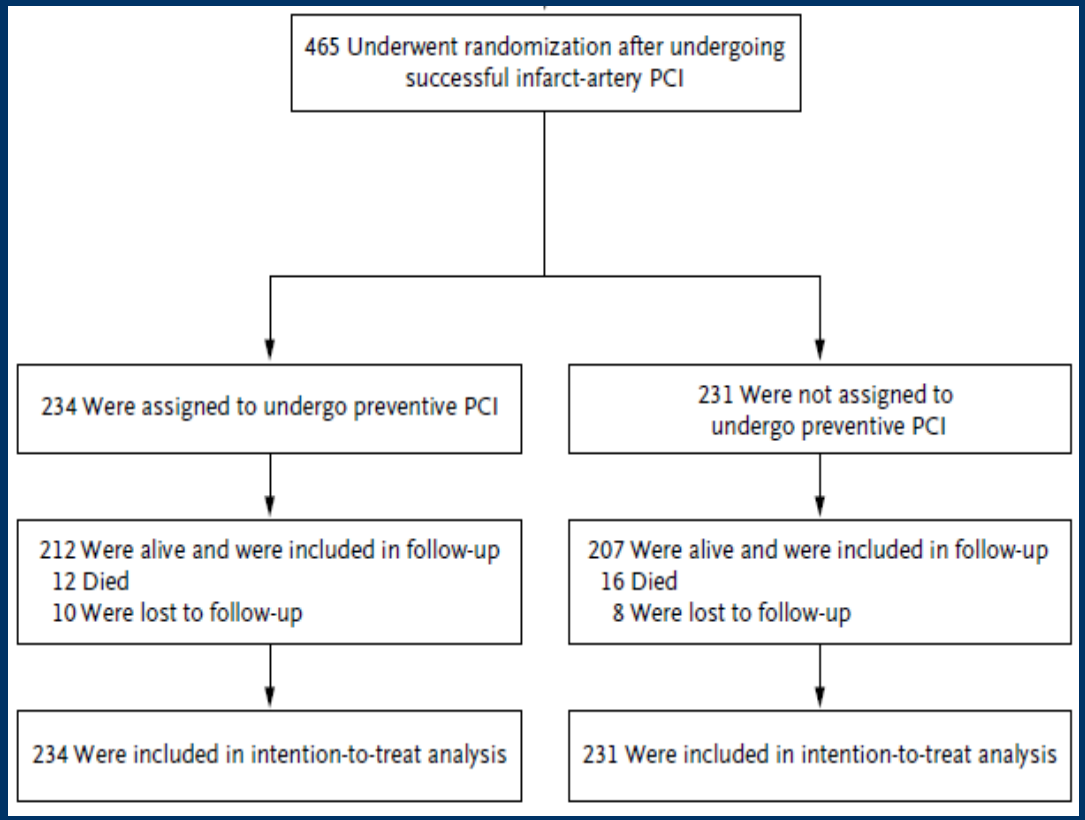
Long-term mortality favors Culprit Only PCI



Vlaar et al. J Am Coll Cardiol 2011;58:692-7

PRAMI: "Preventative" PCI of Non-culprit Lesions after Culprit Lesion Primary PCI in STEMI

465 non-shock STEMI pts with MVD at 5 UK sites



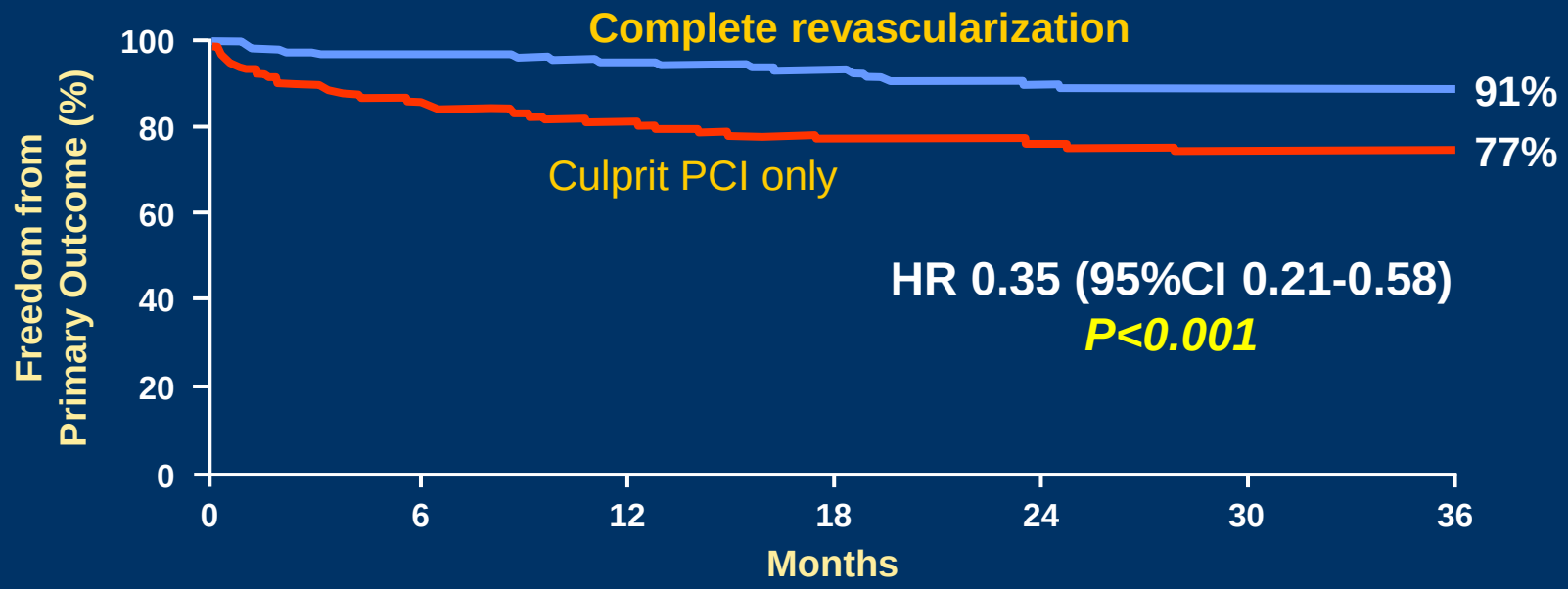
- **Staged PCI** in patients without angina was *discouraged*
- Further PCI only in cases of refractory angina

Primary endpoint: Cardiac death, MI or refractory angina

Wald DS et al. *NEJM* 2013

PRAMI: "Preventative" PCI of Non-culprit Lesions after Culprit Lesion Primary PCI in STEMI

465 non-shock STEMI pts with MVD at 5 UK sites

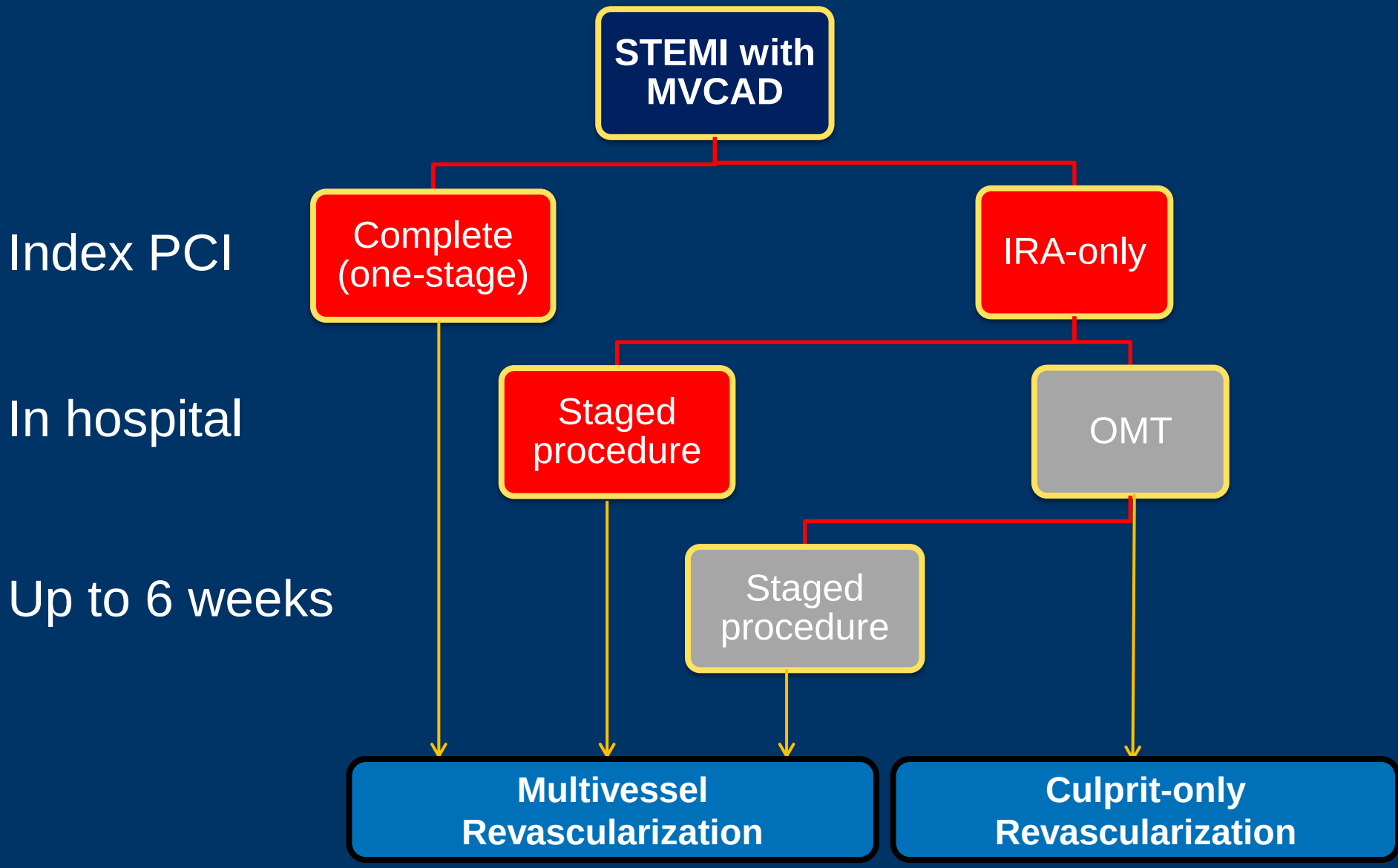


No. at Risk							
Preventive PCI	234	196	166	146	118	89	67
No Preventive PCI	231	168	144	122	96	74	50

600 pts planned; DSMB stopped trial early after 465 pts enrolled (2008-2013)

Wald DS et al. *NEJM* 2013

IRA-only vs. MV PCI before discharge



Should we intervene the non-culprit vessels as a Staged-PCI?

ADVANTAGES

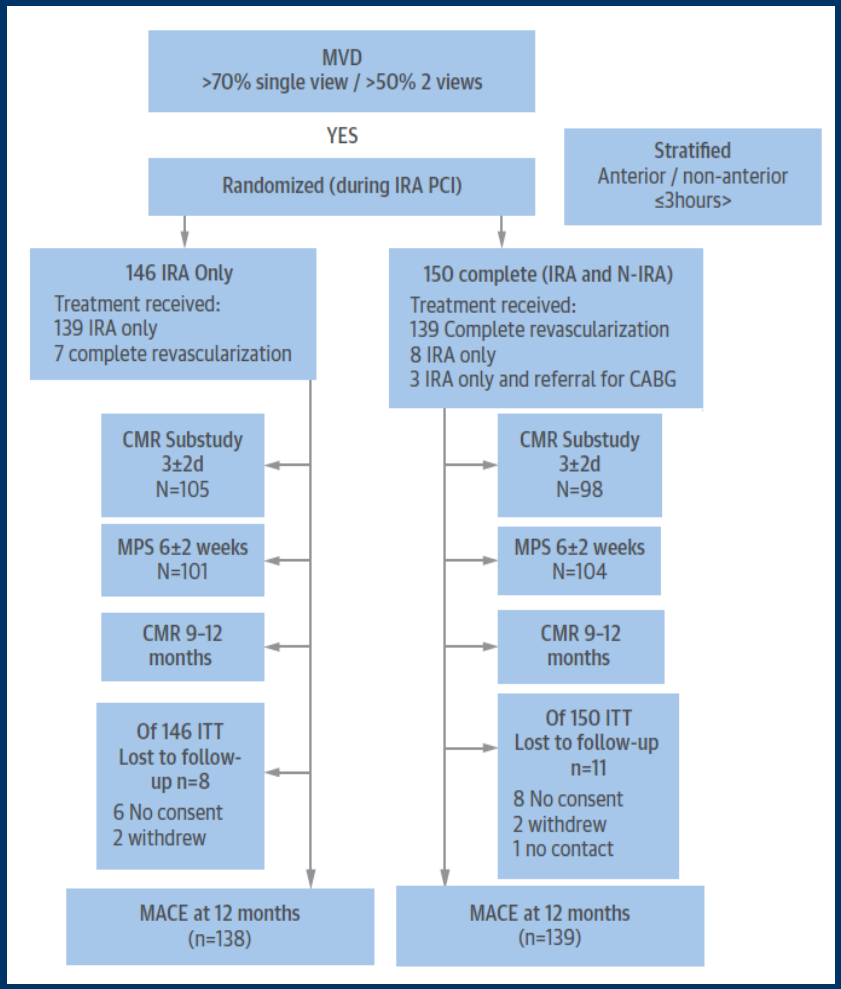
- Reduction of total ischemic burden
  ; Better LVEF
- Treatment of all unstable plaque by treating non-culprit vessel
  ; less future MACE
- ***Increased safety*** **in stabilized patients**

DISADVANTAGES

- Increased cost by additional admission
- No proven benefit if patients are asymptomatic
- Expose patients to further complication of PCI
- Uncertain timing of 2nd PCI/admission

CvLPRIT: Complete vs. Lesion-Only Primary PCI trial

296 STEMI pts at 7 UK Centers



- ***CR Group***

- Treat IRA first
- CR recommended at same setting
- Staged procedure during the index admission

Gershlick et al. J Am Coll Cardiol2015;65:963–72

CvLPRIT: Complete vs. Lesion-Only Primary PCI trial

296 STEMI pts at 7 UK Centers

Clinical Outcomes at 12 Months

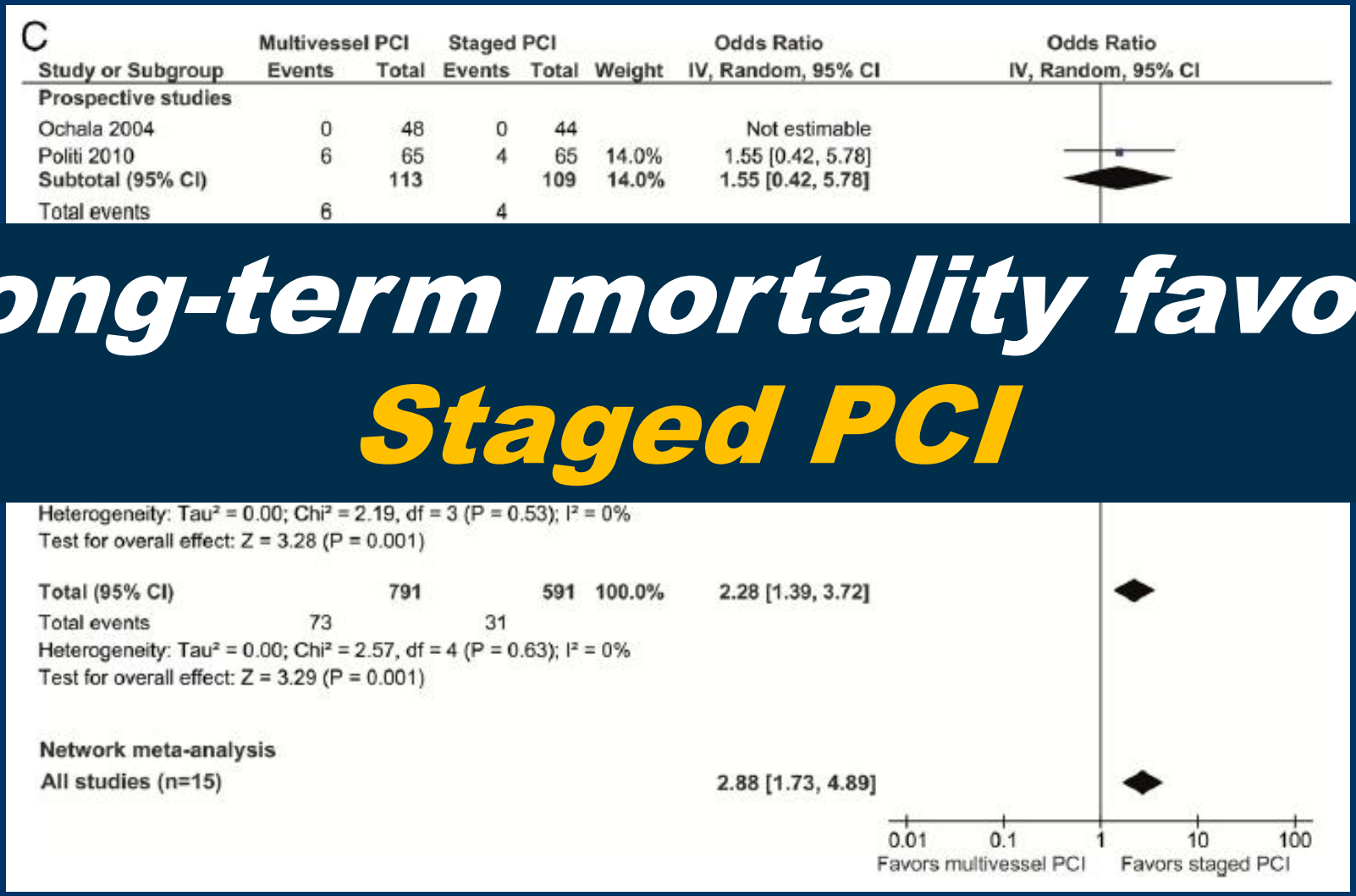
Variable	IRA only (N=146)	Complete Revascularisation (N=150)	HR (95% CI)	P value
Time to First Event				
MACE N= (%)	31 (21.2)	15 (10.0)	0.45 (0.24, 0.84)	0.009
Components N=(%)				
All-cause mortality	6 (4.1)	2 (1.3)	0.32 (0.06, 1.60)	0.14
Recurrent MI	4 (2.7)	2 (1.3)	0.48 (0.09, 2.62)	0.39
Heart failure	9 (6.2)	4 (2.7)	0.43 (0.13, 1.39)	0.14
Repeat Revascularisation	12 (8.2)	7 (4.7)	0.55 (0.22, 1.39)	0.2

55% reduced hazards of MACE by complete revascularization

Gershlick et al. J Am Coll Cardiol2015;65:963–72

MV-PCI vs. Staged PCI

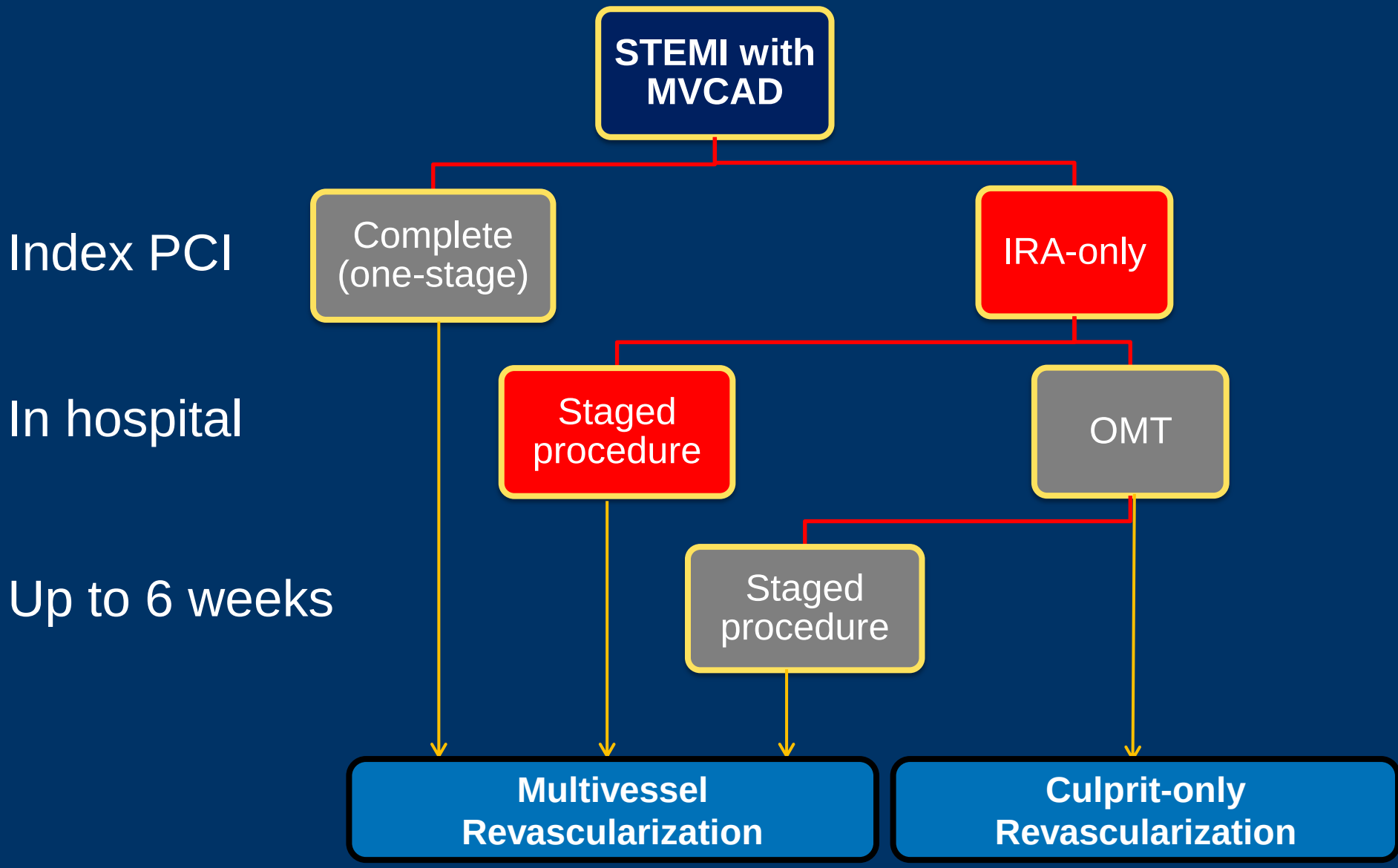
Pairwise and Network Meta-Analysis



Long-term mortality favors Staged PCI

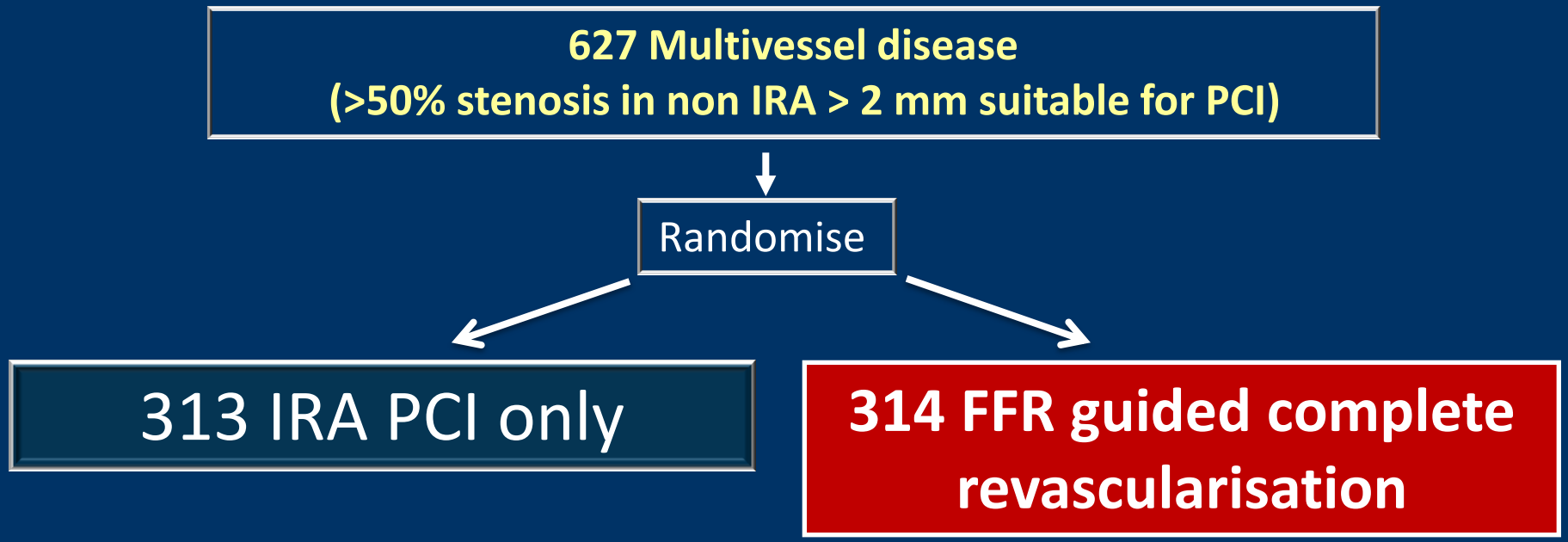
Vlaar et al. J Am Coll Cardiol 2011;58:692-7

IRA-only vs. In-hospital Staged PCI



DANAMI3-PRIMULTI

627 STEMI Pts with MVD from 2011 to 2014



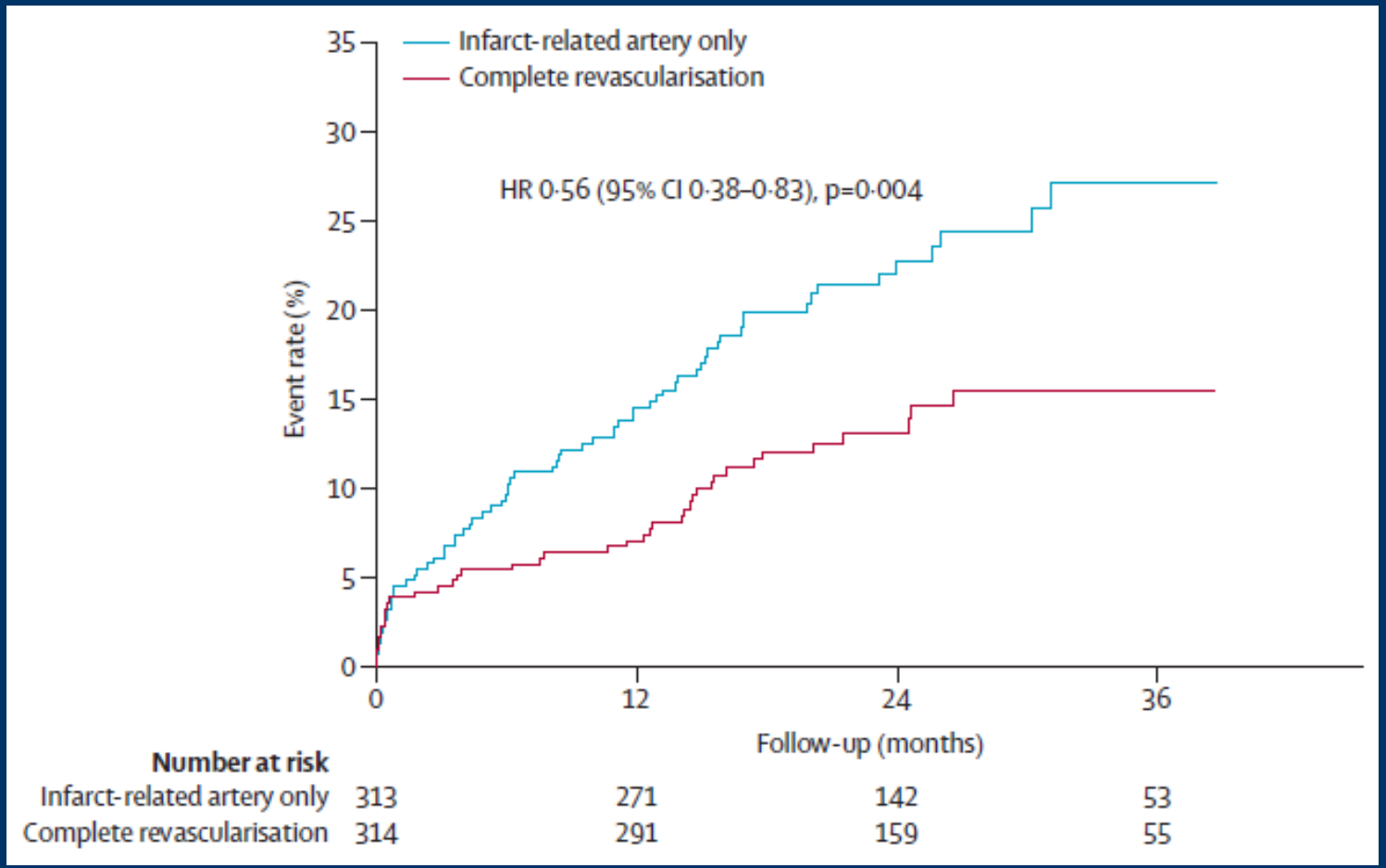
*** Additional PCI procedures 2 days after the initial PCI before discharge**

Engstrøm, et al. Lancet 2015; 386: 665–71

DANAMI3-PRIMULTI

627 STEMI Pts with MVD from 2011 to 2014

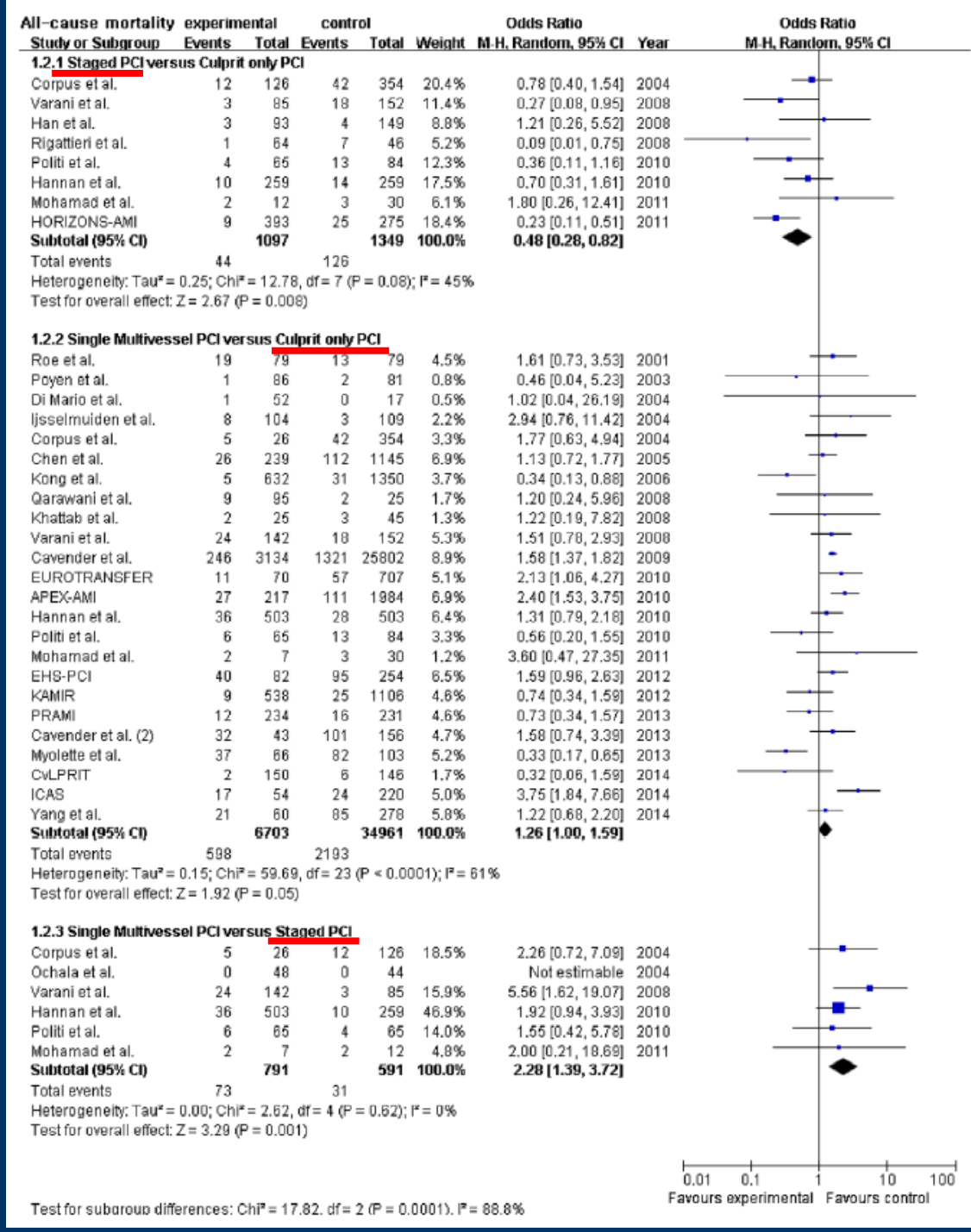
All-cause mortality, NFMI, and Ischemia-driven revascularization



Engstrøm, et al. Lancet 2015; 386: 665–71

Updated Meta-Analysis
All-cause death

- Culprit only PCI < Staged
- One-time < Culprit only PCI
- One-time < Staged PCI



Song YJ, Jang JS, et al. J Interven Cardiol 2015;28:1-13

Background

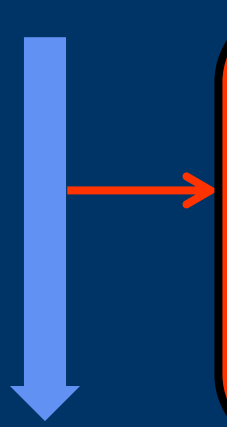
- Previous studies **have focused upon mortality and no insights into the long-term health status** of STEMI patients managed with culprit-only or complete revascularization have been reported.

Aims & Objectives

- To define the potential patient-centered benefits of complete revascularization
  - **the patterns of treating non-infarct vessels**
  - **patient characteristics associated with multivessel revascularization**
  - **variation in practice across hospitals**
  - **independent association of multivessel revascularization with 1-year health-related QoL and mortality**

Methods

TRIUMPH patients (All AMI patients, April 2005-December 2008), N = 4,340



Exclude patients with:
- Prior CABG (n=537)
- No CAG, not MVCAD (n=2,218)
- No PCI (n=511)
- In-hospital death (n=4)
- NSTEMI (n=406)

Final Study Population

664, STEMI patients with multivessel CAD

QoL Outcomes

- **Seattle Angina Questionnaire (baseline/1-year);**
  - 19-item patient-reported health status instrument
  - recall period of 4 weeks

- Angina Frequency (SAQ AF)

- Quality of Life (SAQ QoL)

- Physical Limitation

- Treatment Satisfaction

Clinical Outcomes

- **All-cause mortality:** phone follow-up and the Social Security death master index
- **Myocardial infarction**
- **Repeat revascularization procedures:** PCI or CABG
- **Severe angina:** having more than 3 episodes of angina per week as defined by a SAQ AF score of ≤40

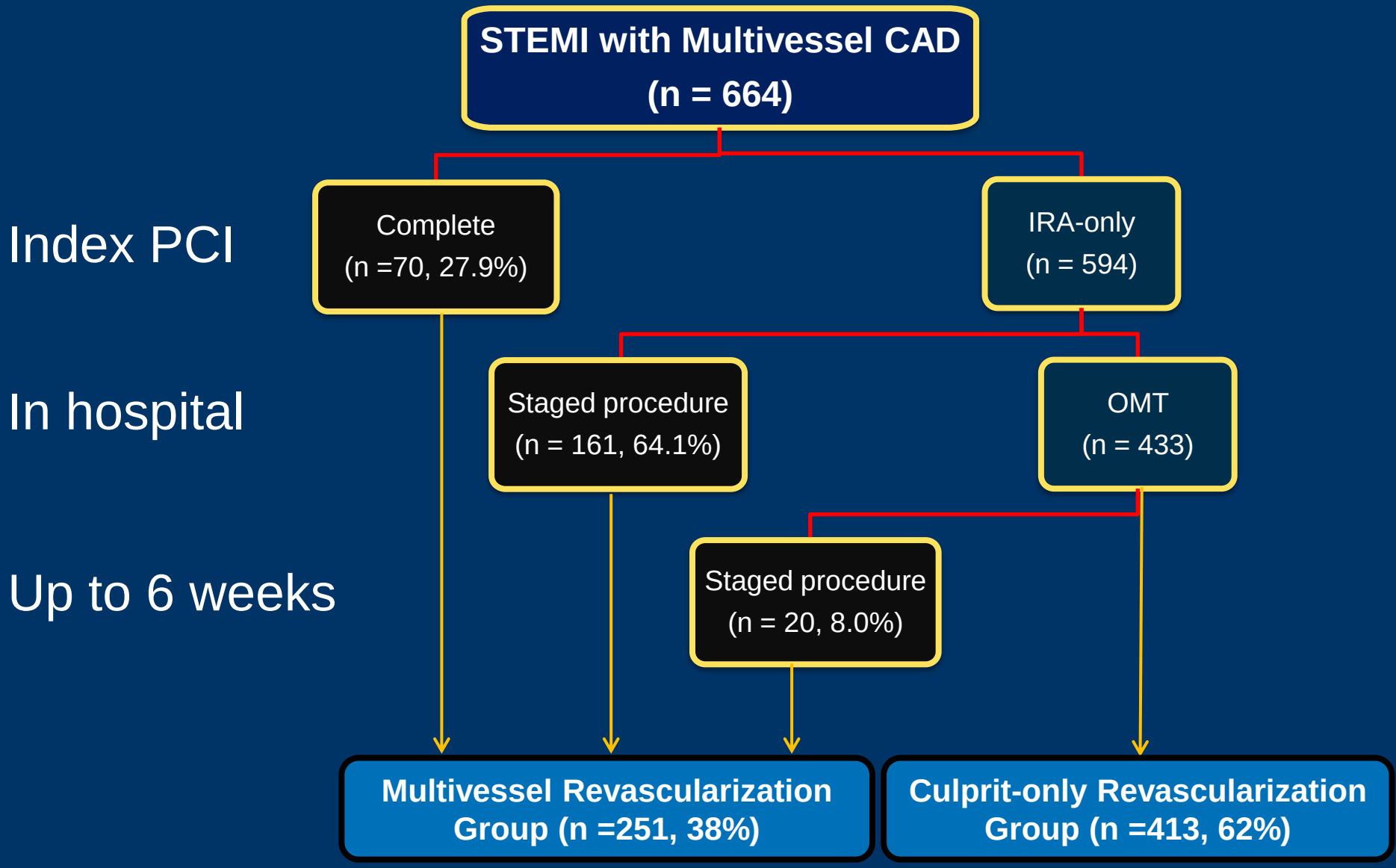
Statistical Analysis (1)

- Baseline clinical and demographic characteristics using t-test or Mann-Whitney U tests for continuous variables and chi-square or Fisher's exact test for categorical variables
- Multivariable, hierarchical (adjusting for site as a random effect) modified Poisson regression model to identify factors associated with multivessel revascularization
- Median rate ratio (MRR) to assess variation in the practice of multivessel revascularization across the study sites

Statistical Analysis (2)

- Hierarchical (adjusting for site as a random effect) multivariable linear regression models for each health status outcome (SAQ AF and SAQ QoL) to evaluate the association of multivessel revascularization with 1-year health status outcomes
- Kaplan-Meier survival analysis and the log-rank test to assess the associations of multivessel revascularization with 1-year mortality, myocardial infarction, and repeat revascularization
- Sensitivity analysis excluding patients undergoing CABG to determine whether our results were comparable in the PCI-only patients

Timing of Revascularization



Baseline Demographics

	Multivessel n = 251 (38%)	Culprit-only n = 413 (62%)	P-Value
Age	56.4 ± 10.0	58.7 ± 12.1	0.012
Caucasian	197 (79.4%)	299 (72.7%)	0.053
Female gender	62 (24.7%)	108 (26.2%)	0.678
Insurance: None/Self-Pay	58 (23.7%)	92 (22.9%)	0.830
Diabetes	59 (23.5%)	106 (25.7%)	0.532
Hypertension	144 (57.4%)	242 (58.6%)	0.756
Dyslipidemia	115 (45.8%)	190 (46.0%)	0.962
Prior PCI	29 (11.6%)	78 (18.9%)	0.012
Chronic heart failure	5 (2.0%)	8 (1.9%)	1.000
Peripheral vascular disease	5 (2.0%)	16 (3.9%)	0.179
Smoking	156 (62.2%)	252 (61.0%)	0.770
In-hospital heart failure	15 (6.0%)	15 (3.6%)	0.158
LV dysfunction (EF < 40%)	43 (18.4%)	79 (21.0%)	0.438
Peak troponin I/T (ng/dL): (Median)	23.8	13.7	< 0.001
Hemoglobin (g/dL): Initial (Median)	15.0	14.7	0.035
Systolic BP (mmHg): Initial (Median)	142.0	140.0	0.443

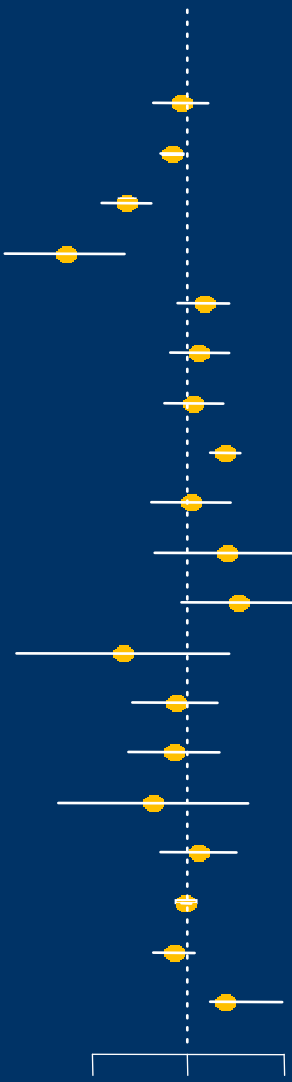
Baseline Demographics

	Multivessel n = 251 (38%)	Culprit-only n = 413 (62%)	P-Value
Number of diseased vessels	2.5 ± 0.7	2.4 ± 0.6	< 0.001
Number of vessels treated	1.9 ± 0.6	1.0 ± 0.0	< 0.001
Distribution of culprit vessels			< 0.001
Left main coronary artery	1 (0.4%)	3 (0.7%)	
Proximal LAD artery	45 (17.9%)	31 (7.5%)	
Mid to distal LAD artery	42 (16.7%)	116 (28.1%)	
Left circumflex artery	23 (9.2%)	50 (12.1%)	
Right coronary artery	109 (43.4%)	181 (43.8)	
LAD artery culprit	87 (34.7%)	147 (35.6%)	0.807
Distribution of non-culprit vessels			
Left main coronary artery	10 (4.0%)	18 (4.4%)	0.815
Proximal LAD artery	25 (10.0%)	12 (2.9%)	< 0.001
Mid to distal LAD artery	119 (47.4%)	169 (40.9%)	0.101
Left circumflex artery	112 (44.6%)	206 (49.9%)	0.188
Right coronary artery	74 (29.5%)	134 (32.4%)	0.424
Number of bare-metal stents	0.8 ± 1.2	0.7 ± 0.9	0.556
Number of drug-eluting stents	1.6 ± 1.6	0.7 ± 0.9	< 0.001

Baseline and 1-year Health Status

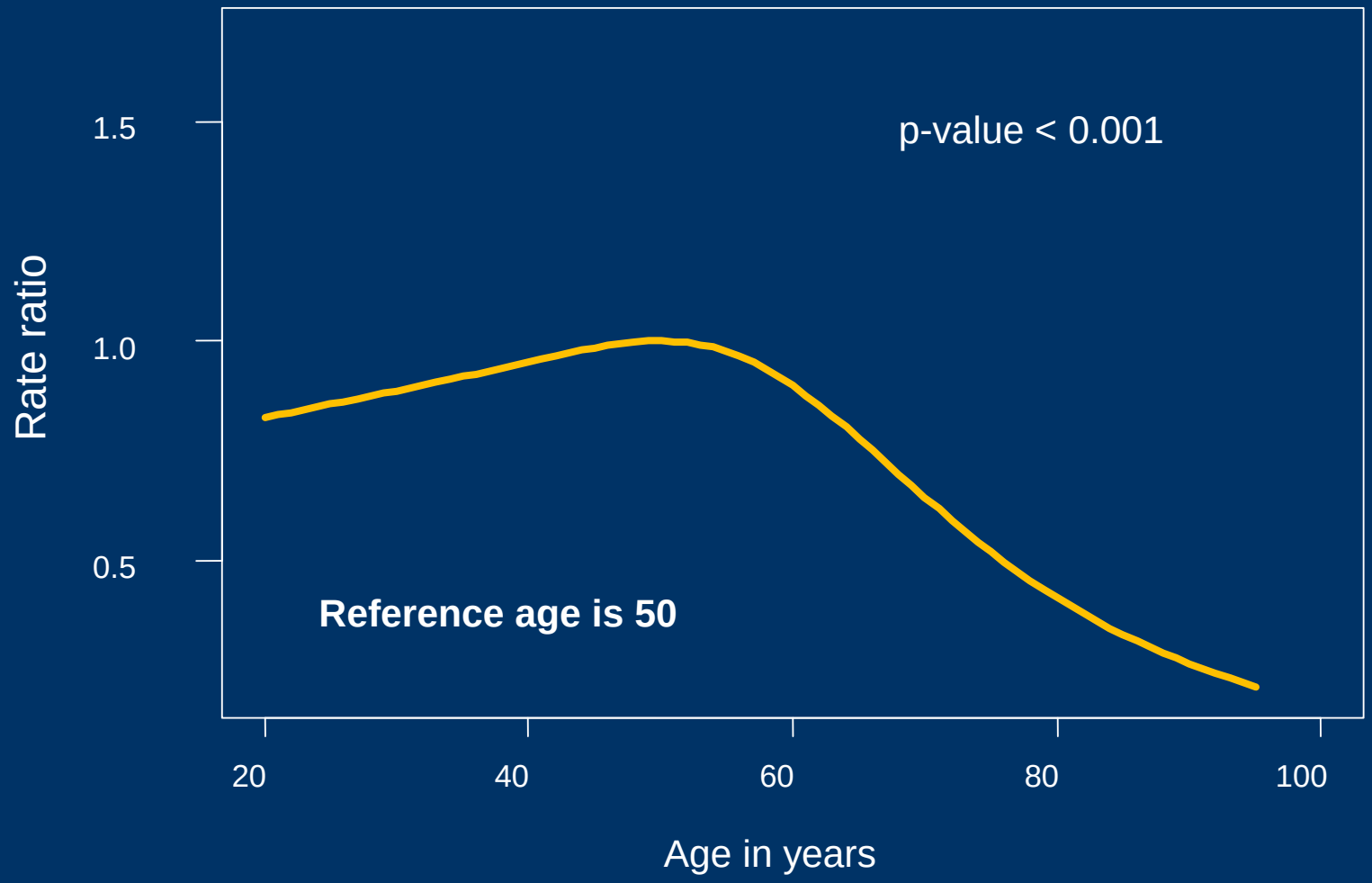
	Multivessel n = 251 (38%)	Culprit-only n = 413 (62%)	P-Value
SAQ AF score (baseline)	89.6 ± 17.1	89.2 ± 16.8	0.77
SAQ AF score (1 year)	94.8 ± 14.2	92.8 ± 17.4	0.20
Mean changes in SAQ AF	5.2 ± 22.4	3.2 ± 20.8	0.34
SAQ QoL score (baseline)	62.3 ± 20.9	68.5 ± 22.9	< 0.001
SAQ QoL score (1 year)	85.0 ± 18.3	81.5 ± 20.7	0.07
Mean changes in SAQ QoL	22.3 ± 24.9	12.7 ± 26.5	< 0.001

Independent Correlates of MV Revascularization

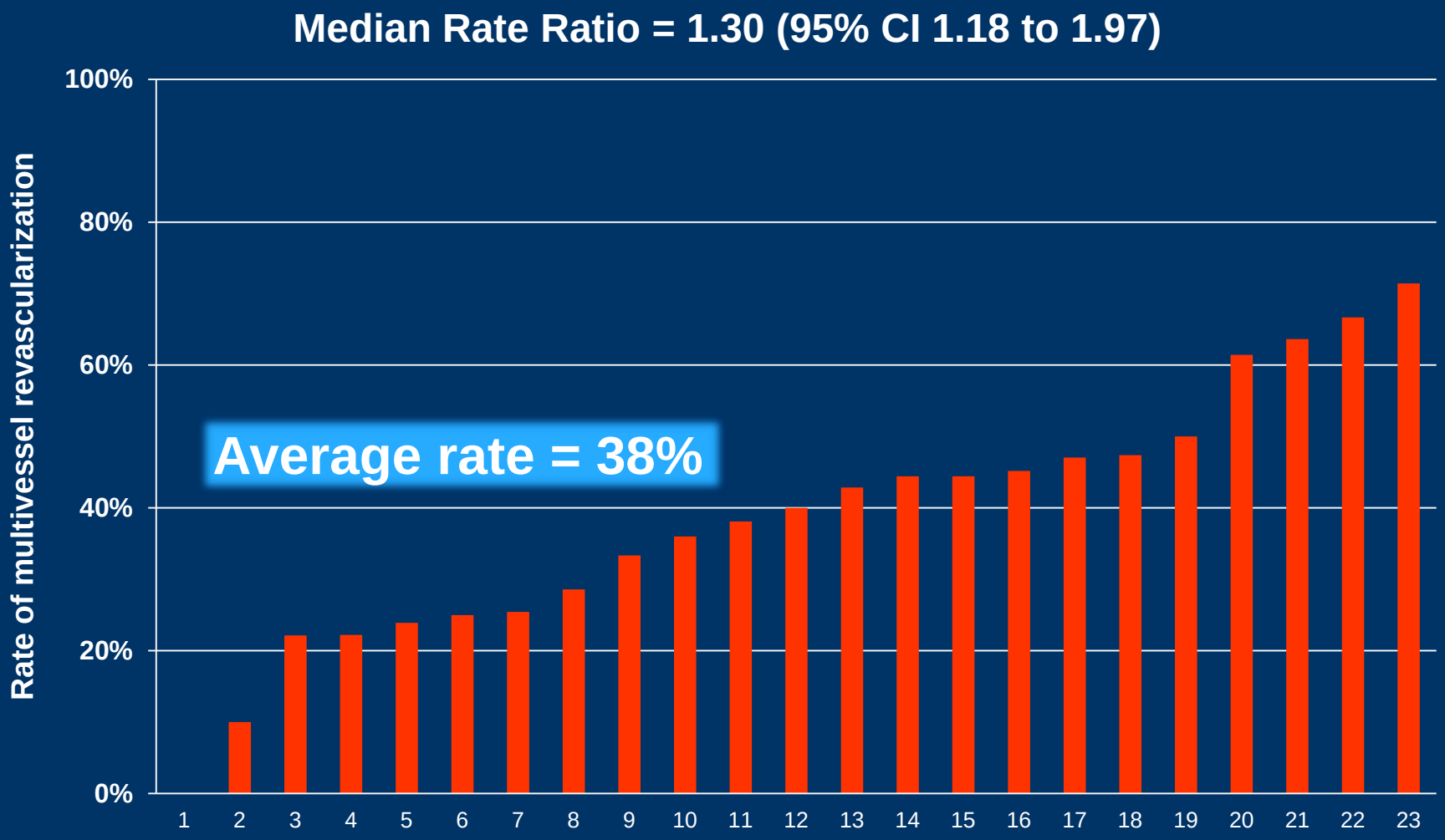


Age	
- 40 vs. 50	0.95 (0.78, 1.16)
- 60 vs. 50	0.90 (0.83, 0.97)
- 70 vs. 50	0.64 (0.54, 0.77)
- 80 vs. 50	0.41 (0.27, 0.64)
Female	1.12 (0.93, 1.35)
Caucasian	1.08 (0.88, 1.34)
Avoid care due to costs	1.04 (0.84, 1.29)
Disease vessels (per 1 increment)	1.31 (1.17, 1.46)
Non-LAD culprit vessel	1.02 (0.77, 1.37)
History of CHF	1.33 (0.79, 2.23)
In-hospital heart failure	1.44 (0.95, 2.19)
History of atrial fibrillation	0.63 (0.29, 1.35)
History of diabetes mellitus	0.91 (0.67, 1.25)
LV systolic dysfunction (moderate or severe)	0.90 (0.65, 1.26)
Initial creatinine (per 5 units increment)	0.78 (0.39, 1.54)
Initial hemoglobin (per 5 units incement)	1.08 (0.82, 1.42)
SF-12 PCS (per 5 units incement)	0.98 (0.95, 1.02)
Angina at baseline	0.90 (0.77, 1.05)
Hospital site (median rate ratio)	1.30 (1.18, 1.97)

Age and Likelihood of MV Revascularization

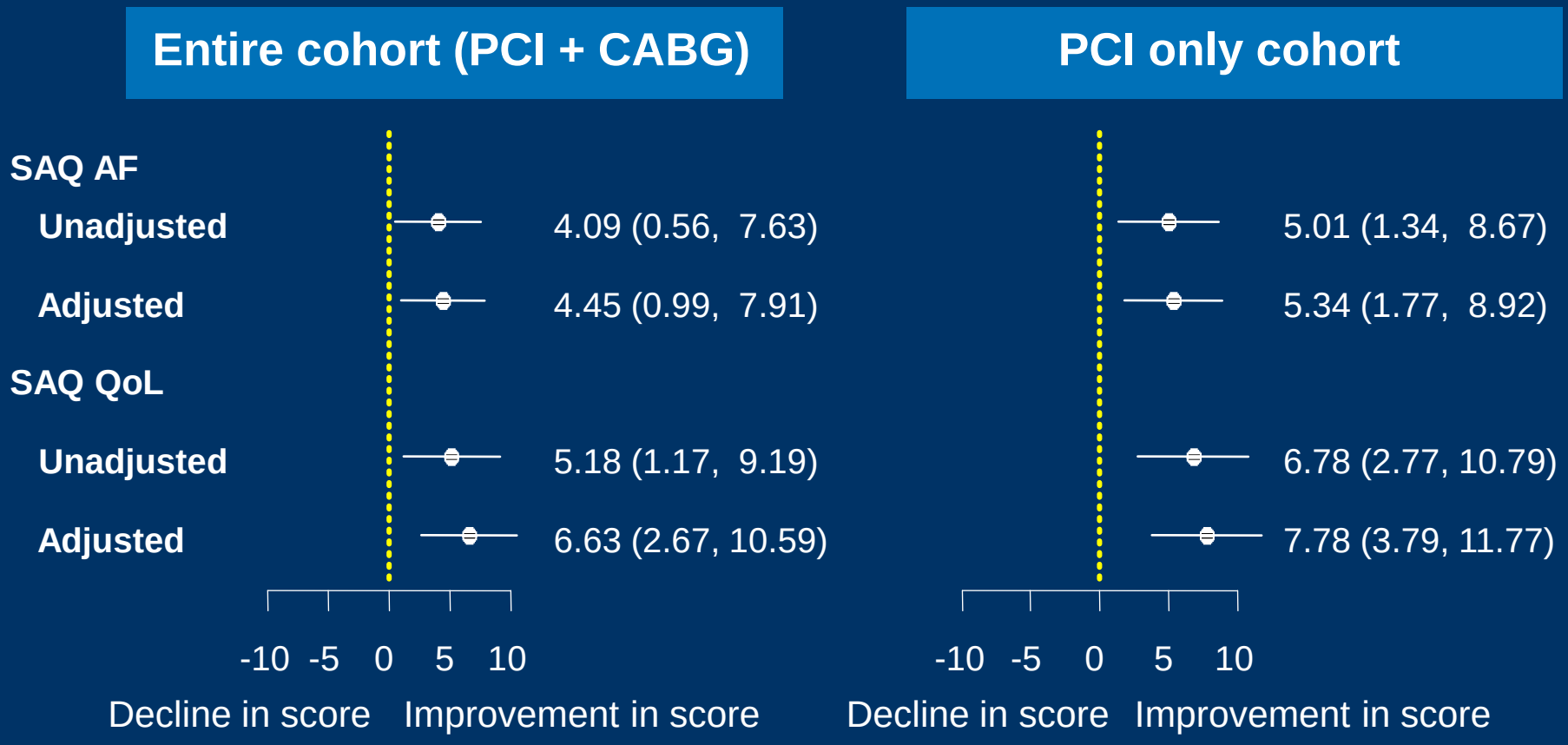


Hospital Variation of MV Revascularization



Health status outcomes

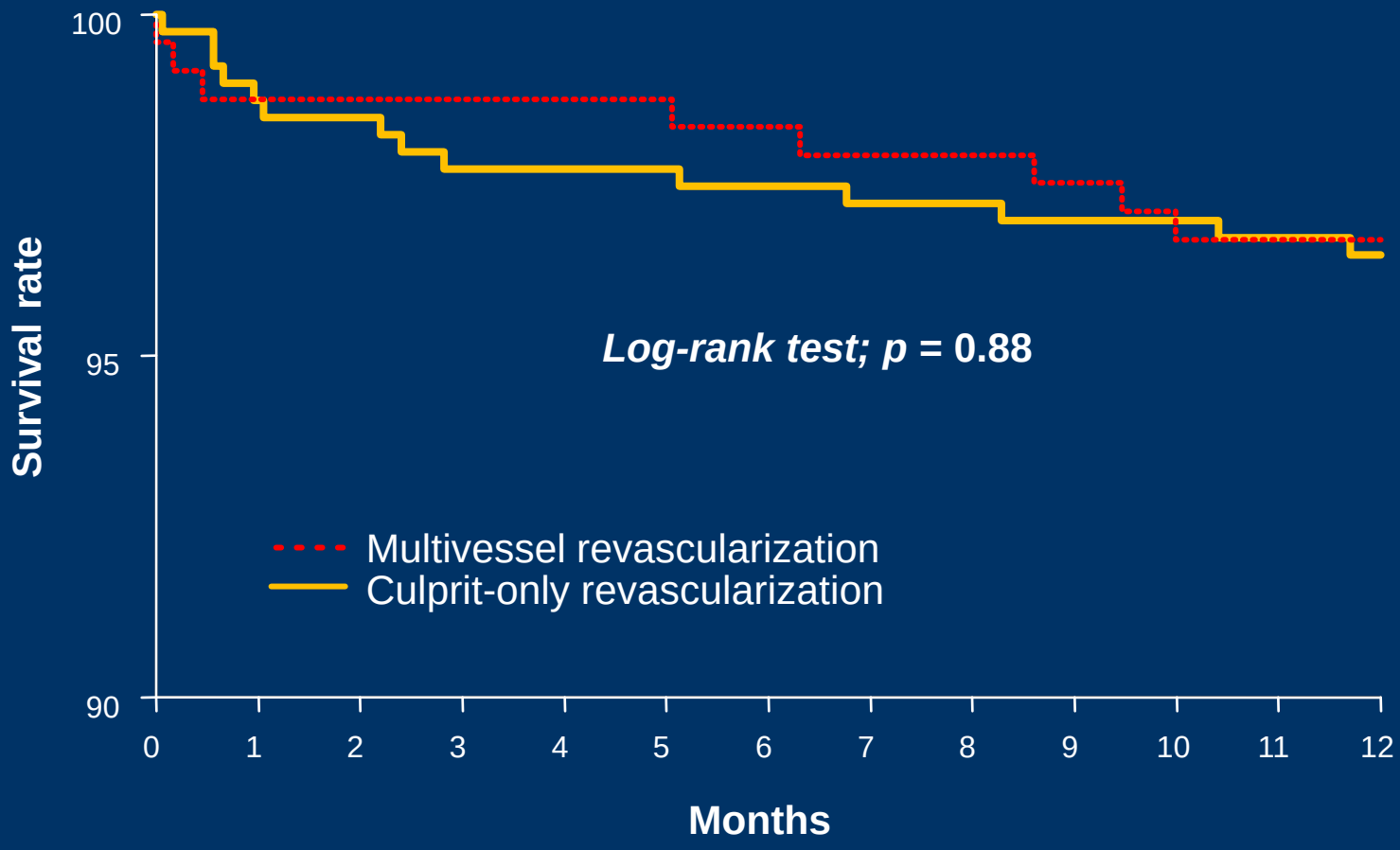
Multivessel vs. culprit-only revascularization



Clinical Outcomes at 1 year

	Multivessel n = 251	Culprit-only n = 413	P-Value
Mortality	8 (3.6%)	14 (3.4%)	0.88
Recurrent MI	7 (3.5%)	4 (1.4%)	0.12
Repeat revascularization	17 (7.5%)	32 (9.1%)	0.50
Severe angina	10 (4.4%)	22 (6.3%)	0.34

K-M Curves of 1-year Mortality



Study Limitations

- Potential for unmeasured confounding or selection bias
- No query to the clinicians as to why complete or culprit-only revascularization was performed
- Missing SAQ data in 1/3 of patients at 1 year
- No angiographic core laboratory assessing the severity of CAD
- Excluded in-hospital death. Cannot be extrapolated to extremely sick patients

Conclusions

- In a large, multicenter AMI registry,

Multivessel, complete revascularization in STEMI setting;

- common (n=251, 38% among 664 patients)
- varied by patient characteristics and the treating hospital
- improved both angina and QoL at 1 year

- **Future studies** of the potential benefits and harms of multivessel revascularization in STEMI patients should include both symptoms and health-related QoL outcomes so that more complete insights into the benefits of multivessel revascularization can be assessed

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Impact of Multivessel Revascularization on Health Status Outcomes in Patients With ST-Segment Elevation Myocardial Infarction and Multivessel Coronary Artery Disease

Jae-Sik Jang, MD, PhD,*†‡ John A. Spertus, MD, MPH,*† Suzanne V. Arnold, MD, MHA,*† Ali Shafiq, MD,*† Anna Grodzinsky, MD,*† Timothy J. Fendler, MD,*† Adam C. Salisbury, MD, MSc,*† Fengming Tang, MS,* Edward J. McNulty, MD,§ J. Aaron Grantham, MD,*† David J. Cohen, MD, MSc,*† Amit P. Amin, MD, MSc‖¶

ABSTRACT

BACKGROUND Up to 65% of patients with ST-segment elevation myocardial infarction (STEMI) have multivessel coronary artery disease (MVCAD). Long-term health status of STEMI patients after multivessel revascularization is unknown.

OBJECTIVES This study investigated the relationship between multivessel revascularization and health status outcomes (symptoms and quality of life [QoL]) in STEMI patients with MVCAD.

METHODS Using a U.S. myocardial infarction registry and the Seattle Angina Questionnaire (SAQ), we determined the health status of patients with STEMI and MVCAD at the time of STEMI and 1 year later. We assessed the association of multivessel revascularization during index hospitalization with 1-year health status using multivariable linear regression analysis, and also examined demographic, clinical, and angiographic factors associated with multivessel revascularization.

RESULTS Among 664 STEMI patients with MVCAD, 251 (38%) underwent multivessel revascularization. Most revascularizations were staged during the index hospitalization (64.1%), and 8.0% were staged after discharge, with 27.9% performed during primary percutaneous coronary intervention. Multivessel revascularization was associated with age and more diseased vessels. At 1 year, multivessel revascularization was independently associated with improved symptoms (4.5 points higher SAQ angina frequency score; 95% confidence interval [CI]: 1.0 to 7.9) and QoL (6.6 points higher SAQ QoL score; 95% CI: 2.7 to 10.6). One-year mortality was not different between those who did and did not undergo multivessel revascularization (3.6% vs. 3.4%; log-rank test $p = 0.88$).

CONCLUSIONS Multivessel revascularization improved angina and QoL in STEMI patients with MVCAD. Patient-centered outcomes should be considered in future trials of multivessel revascularization.
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Thank you for your attention!