

**TCTAP 2024**



# **Complete Revascularization in Multi-Vessel CAD: Is Physiology Needed or Is Angiography Enough?**

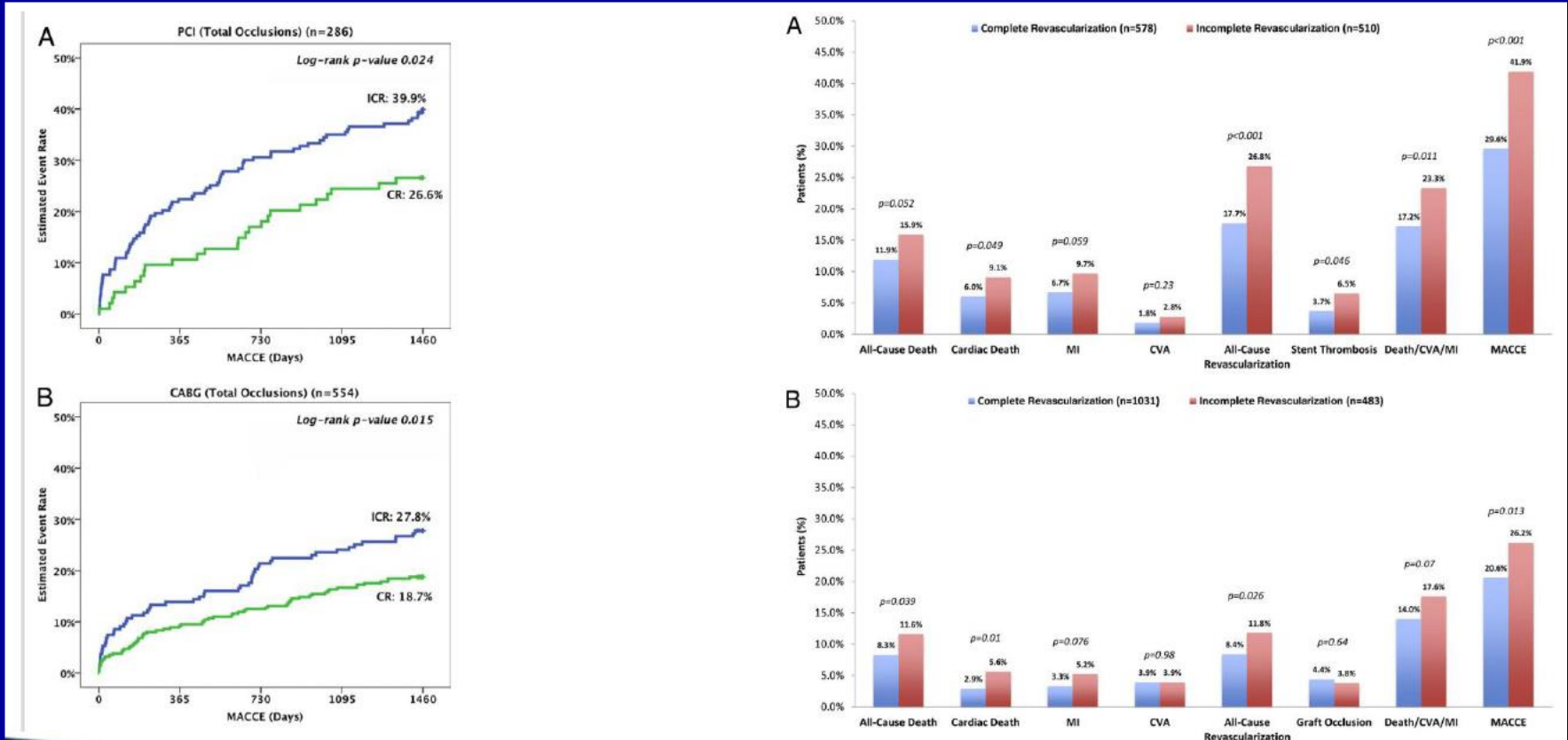
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# What Is Complete Revascularisation?

Revascularisation Type	Definition
Anatomical CR	Successful revascularisation of all coronary artery lesions or segments $\geq 1.5$ mm in diameter with $\geq 50\%$ diameter stenosis regardless of their functional significance
Anatomical ICR	Presence after revascularisation of at least one coronary artery lesion or segment $\geq 1.5$ mm in diameter with $\geq 50\%$ diameter stenosis regardless of their functional significance
Ischemic (functional) CR	Successful revascularisation of all coronary artery lesions or segments with evidence of ischemia or hemodynamic significance on either localising non-invasive or invasive tests, regardless of their anatomical severity
Ischemic (functional) ICR	Presence after revascularisation of at least one coronary artery lesion or segment with evidence of ischemia or hemodynamic significance on either localising non-invasive or invasive tests, regardless of their anatomical severity
Reasonable ICR (Anatomical but functional CR)	Successful revascularisation of all coronary artery lesions or segments $\geq 1.5$ mm in diameter with $\geq 50\%$ diameter stenosis in which non-invasive or invasive tests indicate ischemia or hemodynamic significance, without complete anatomical revascularisation

# SYNTAX: Incomplete Revascularisation Associated With Worse Outcomes in CABG and PCI



Angiographically determined ICR has a detrimental impact on long-term clinical outcomes, including mortality

# Complete Revascularisation: Physiology vs Angiography

- STEMI
- NSTEMI
- Cardiogenic Shock
- Stable Coronary artery disease

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# Primary PCI RCTs in STEMI: SVD vs MVD PCI

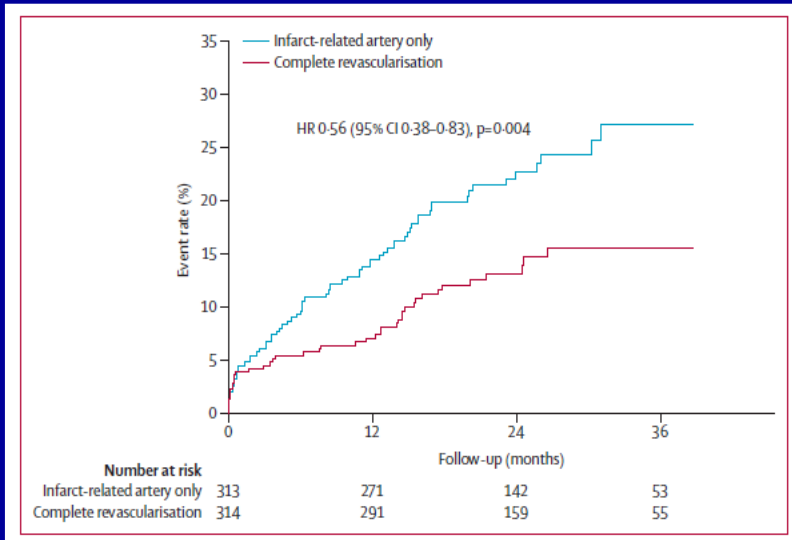
	<b>PRAMI</b> (n=465) stopped early			<b>CvLPRIT</b> (n=296)			<b>PRIMULTI</b> (n=627)		
Non-IRA lesion criteria	>50%			>70% DS or .50% DS in 2 views			>50% DS and FFR <0.80 or >90% DS		
Randomization for non-IRA lesions	Immediate MV PCI (angio-guided) during index procedure <i>vs conservative care</i>			Immediate or staged MV PCI (angio-guided) within index admission <i>vs conservative care</i>			Staged MV PCI (FFR guided) within index admission <i>vs conservative care</i>		
1° endpoint	CD, MI, RA at mean 23 mths			D, MI, HF, IDR at 1 year			D, MI IDR at mean 27 mths		
<b>Results</b>	<b>MV PCI</b>	<b>Cons</b>	<b>P</b>	<b>MV PCI</b>	<b>Cons</b>	<b>P</b>	<b>MV PCI</b>	<b>Cons</b>	<b>P</b>
1° endpoint	8.9%	22.9%	<0.001	10.0%	21.2%	0.009	13.0%	22.0%	0.004
Death or MI/Death	4.7%	11.4%	0.004	1.3%	4.1%	0.14	8.0%	6.4%	0.47
Heart Failure	-	-	-	2.7%	6.2%	0.14	-	-	-
Refractory Angina	5.1%	13.0%	0.002	-	-	-	-	-	-
Revasc	6.8%	19.7%	<0.001	4.7%	8.2%	0.20	16.6%	5.4%	<0.001

Wald DS et al NEJM 2013; Gershlick A et al JACC 2015

Engstrom T et al Lancet 2015

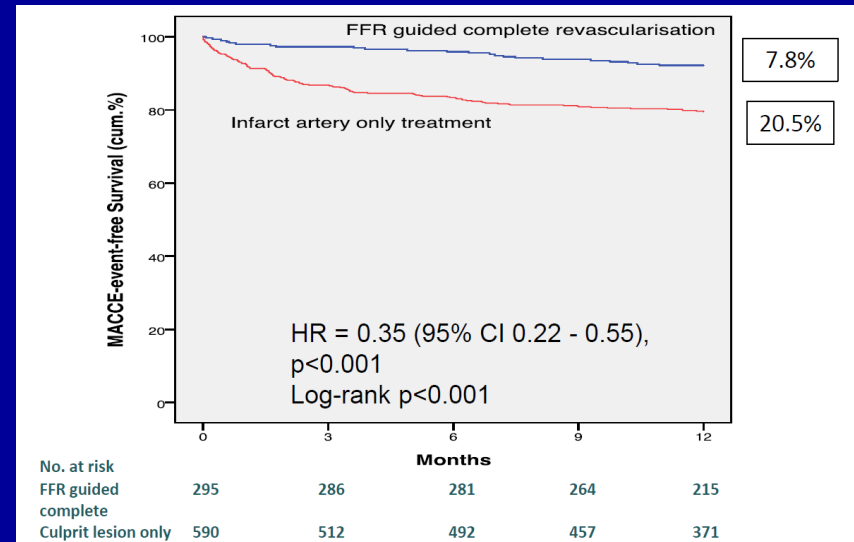
# Positive FFR Trials In Guiding PCI of Non-Culprit Lesions

## DANAMI 3-PRIMULTI



- Significant lesion:  $\geq 50\%$  with  $FFR \leq 0.80$  on iv adenosine OR  $\geq 90\%$  stenosis
- Superiority of complete revas driven by 69% reduction in repeat revasc (40% urgent)
- No sig difference in occurrence of cardiac-related deaths

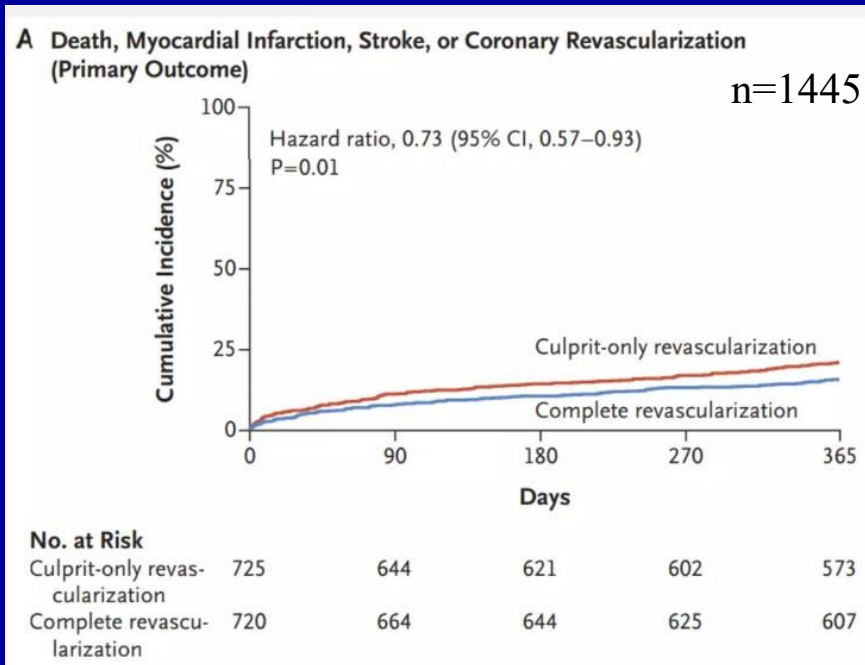
## COMPARE ACUTE Trial



- Reduction in MACCE driven by reduction in need for revasc
- 50% of angiographically sig lesions had  $FFR > 0.80$ . Deferring treatment in these lesions is safe and efficient

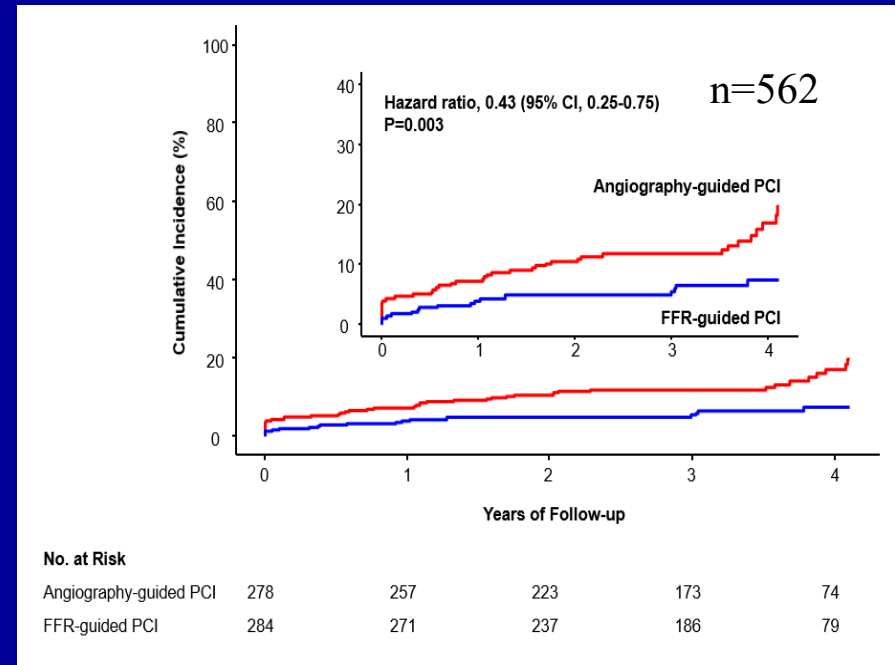
# Positive FFR Trials In Guiding PCI of Non-Culprit Lesions

## FIRE



- Age > 75 yrs, median age 80,
- 35% STEMI
- FFR vs Angiography PCI
- Primary outcome: Composite of death, MI, stroke, or ischemia-driven revascularization at 1 year
- 51% lesions evaluated by FFR deferred

## FRAME AMI



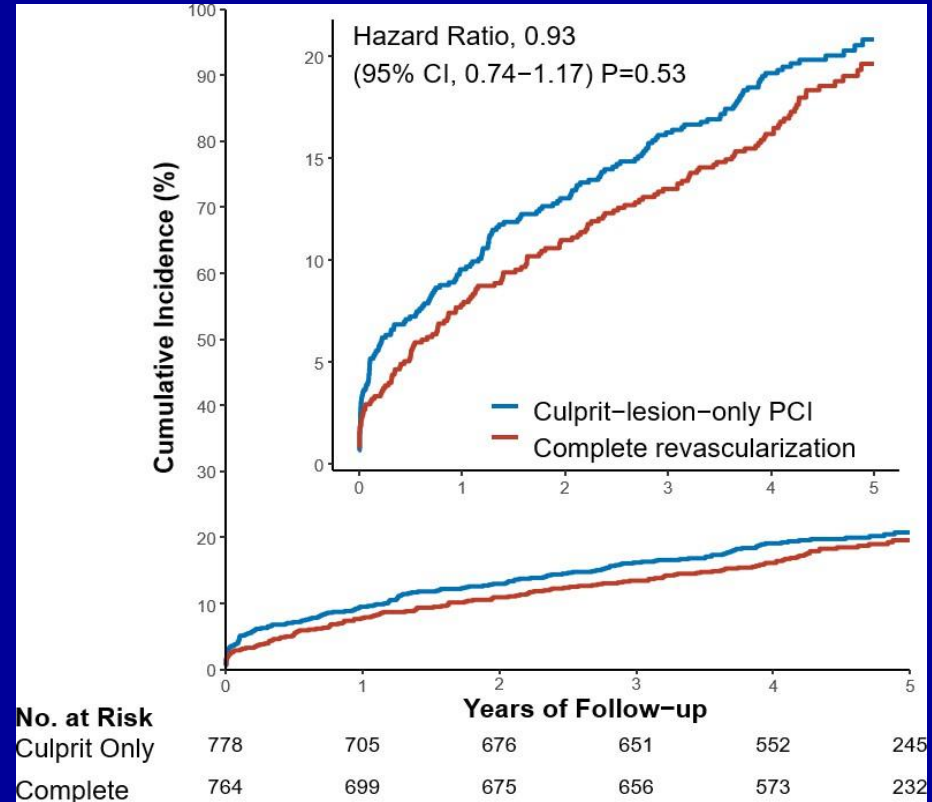
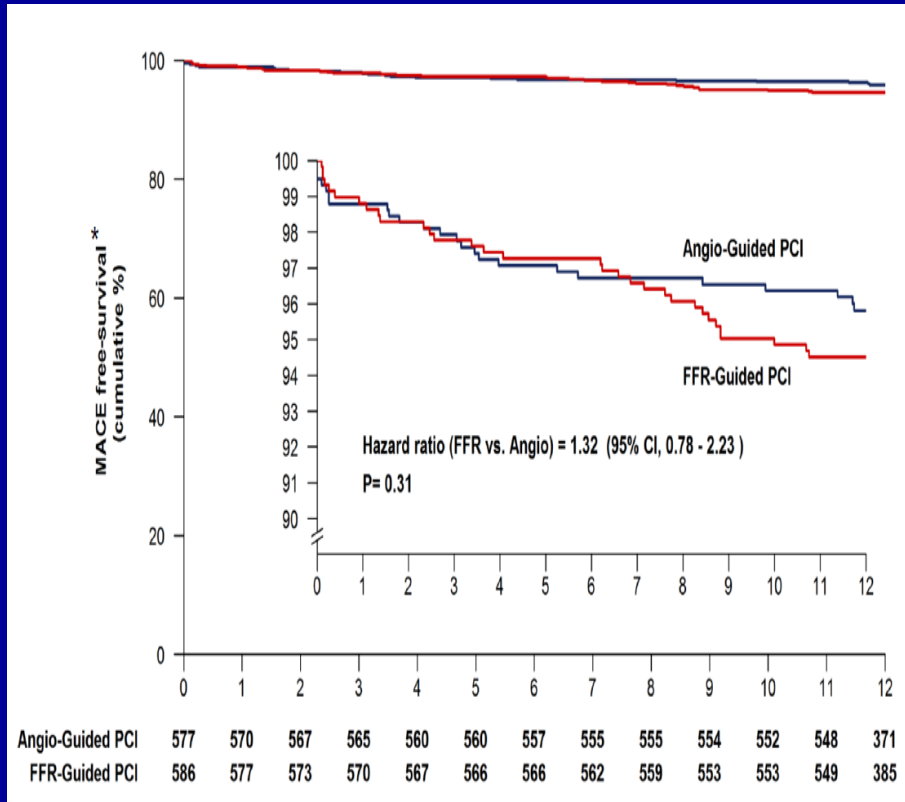
- Korea 14 Centres (2016-2020)
- 47% STEMI
- FFR vs Angiography PCI
- Primary outcome: A composite of death, MI, or repeat revascularization
- FU 3.5 yrs, slow enrolment
- 36% of lesions evaluated by FFR deferred



# Negative FFR Trials In Guiding PCI of Non-Culprit Lesions

## FLOWER-AMI Primary Outcomes: MACE Free Survival

## FULL REVASC Primary Endpoint: Death, MI or Unplanned Revascularisation



- FFR-guided strategy did not reduce composite risk at 1 year

- FFR-guided strategy did not result in lower risk of composite events at 4.8 yrs

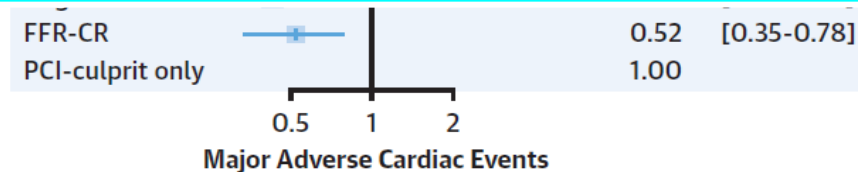
E Puymirat et al N Engl J Med 2021; 385: 297-308

F Böhm ACC 2024, NEJM DOI: 10.1056/NEJMoa2314149

# FFR- vs Angiography-Guided Revascularization for Non-Culprit Stenosis in STEMI and MV CAD: A Network Meta-Analysis

11 trials with 8,195 patients

- FFR predict flow severity and subsequent ischemia driven revascularisation (FAME1)
- Angiographic selection selects complexity and vulnerability (PROSPECT, VIVA, COMPLETE-50% non culprit had TCFA morphology)

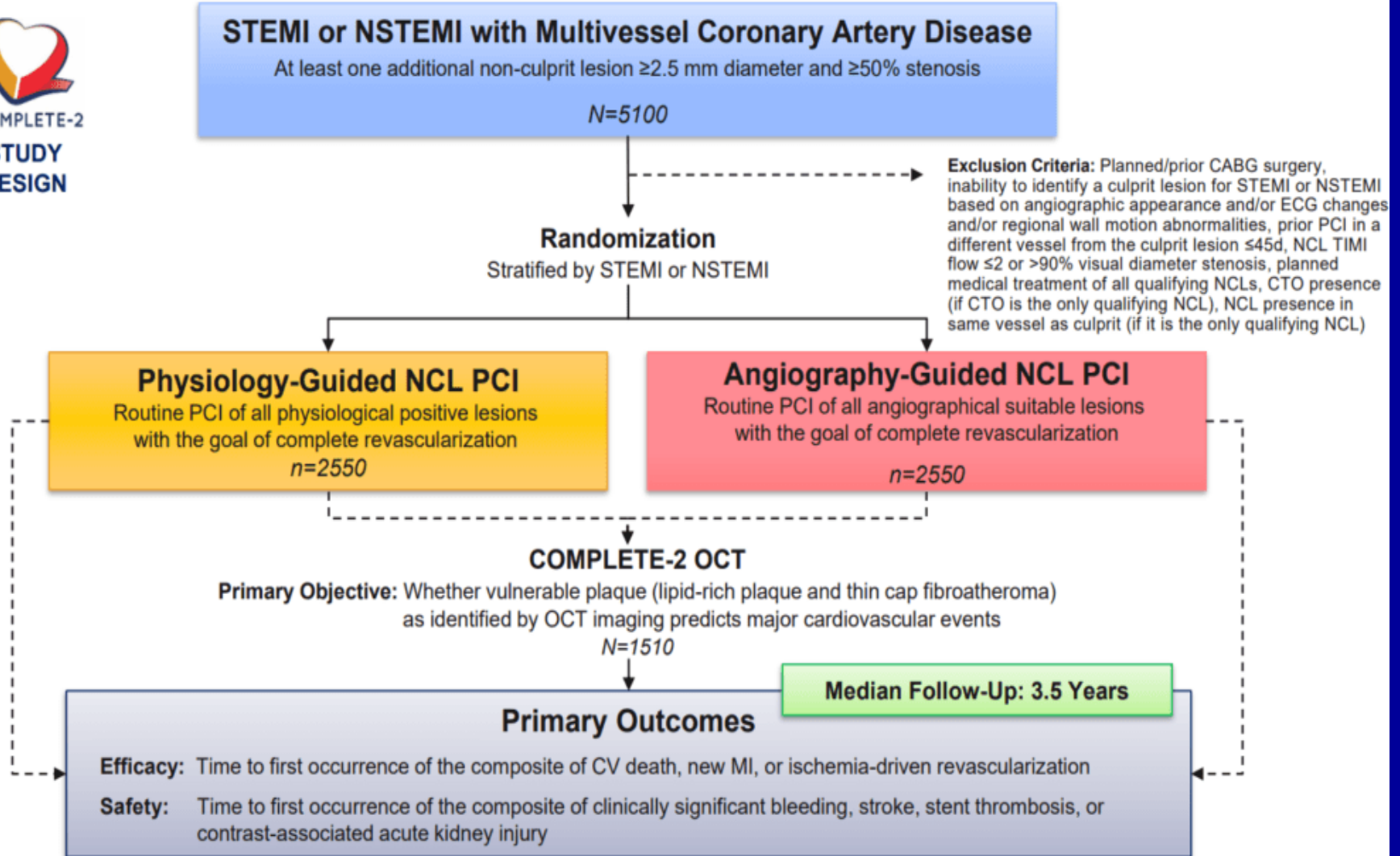


- CR, with angiographic or FFR guidance for nonculprit stenosis, was associated with lower incidence of adverse events of culprit-only revascularization.
- FFR-guided CR was not superior to angiography-guided CR in reducing the incidence of adverse events.

# COMPLETE-2: *The Final Answer?*



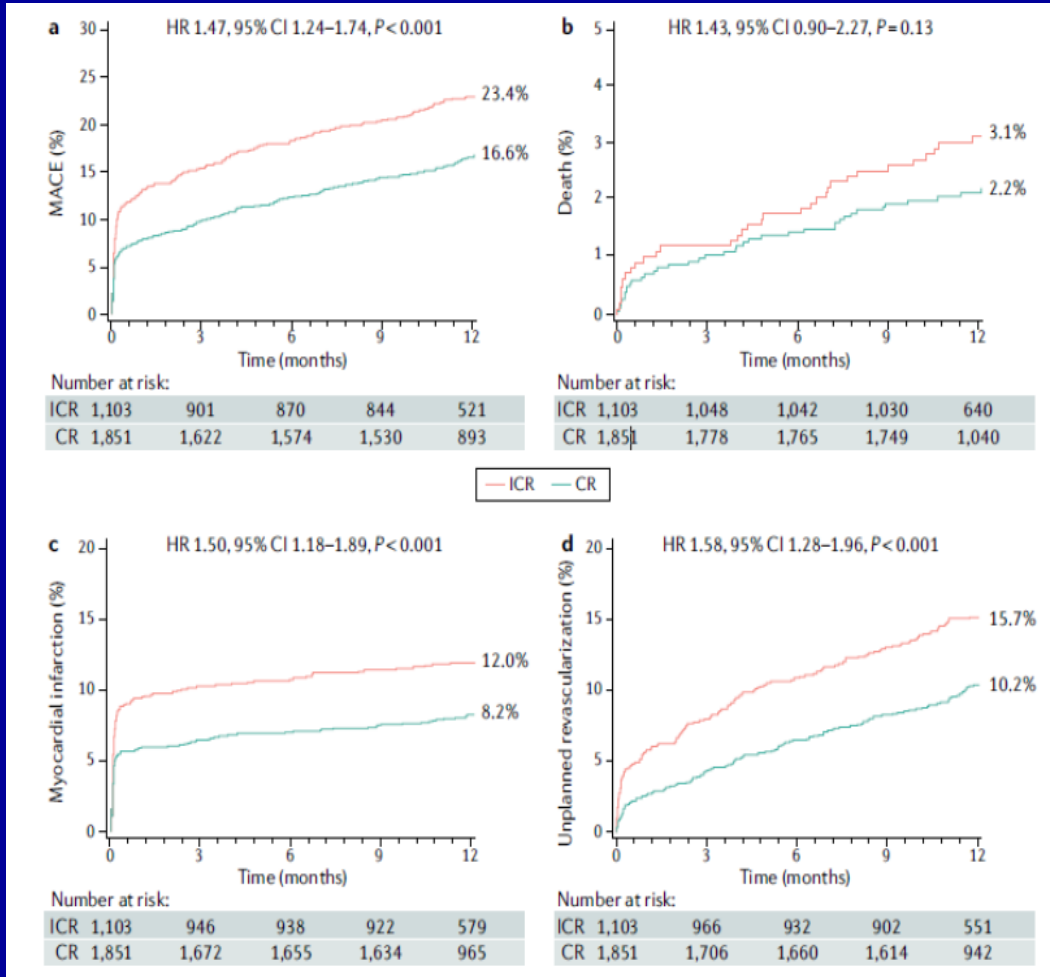
COMPLETE-2  
STUDY  
DESIGN



# Complete Revascularisation: Physiology vs Angiography

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# ACUITY: Impact of Incomplete Coronary Revascularization (ICR) After PCI In NSTEMI (n=2954)



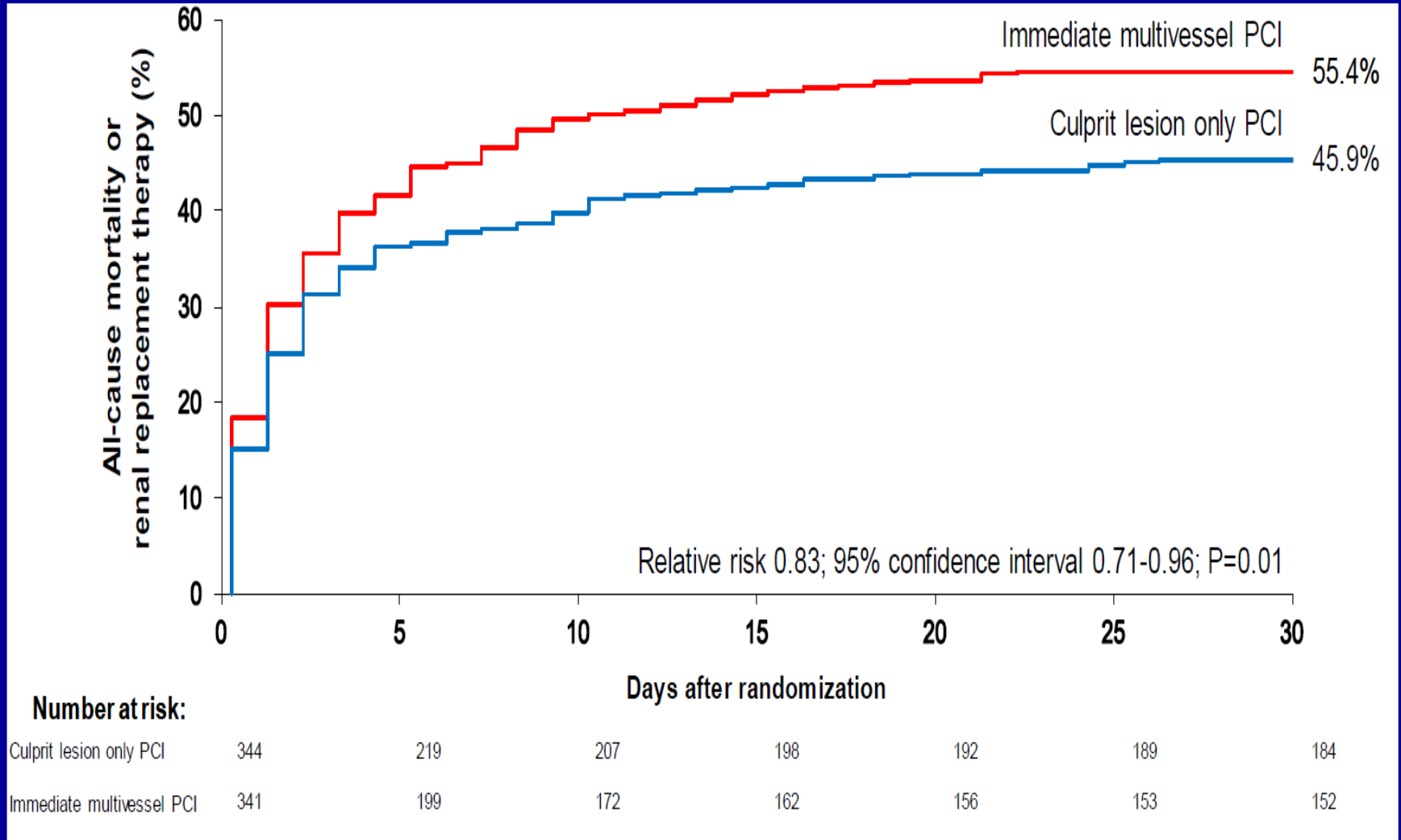
- ICR present in 17% to 75% of NSTEMI patients after PCI (based on angiography  $\geq 50\%$  DS)
- ICR was strongly associated with 1-year myocardial infarction, ischemia-driven unplanned revascularization, and major adverse cardiac events.

Limited data of CR in NSTEMI  
Mostly observational

# Complete Revascularisation: Physiology vs Angiography

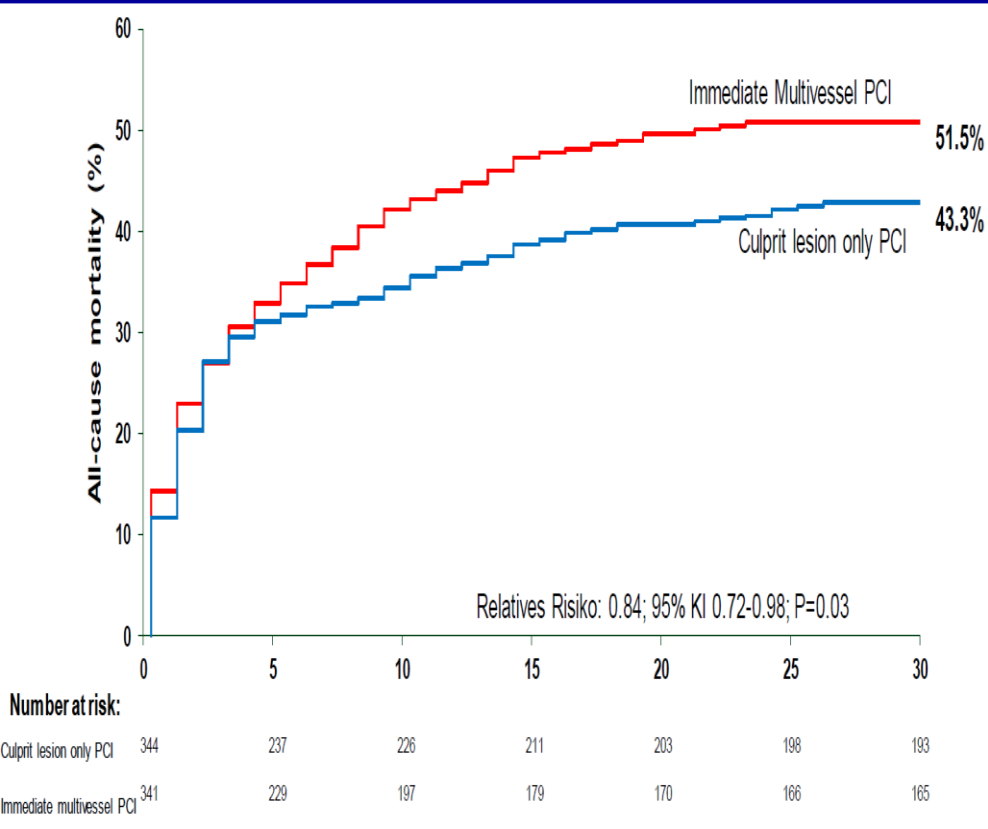
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# CULPRIT SHOCK Primary Endpoint: All Cause Mortality & Renal Replacement Therapy at 30 Day

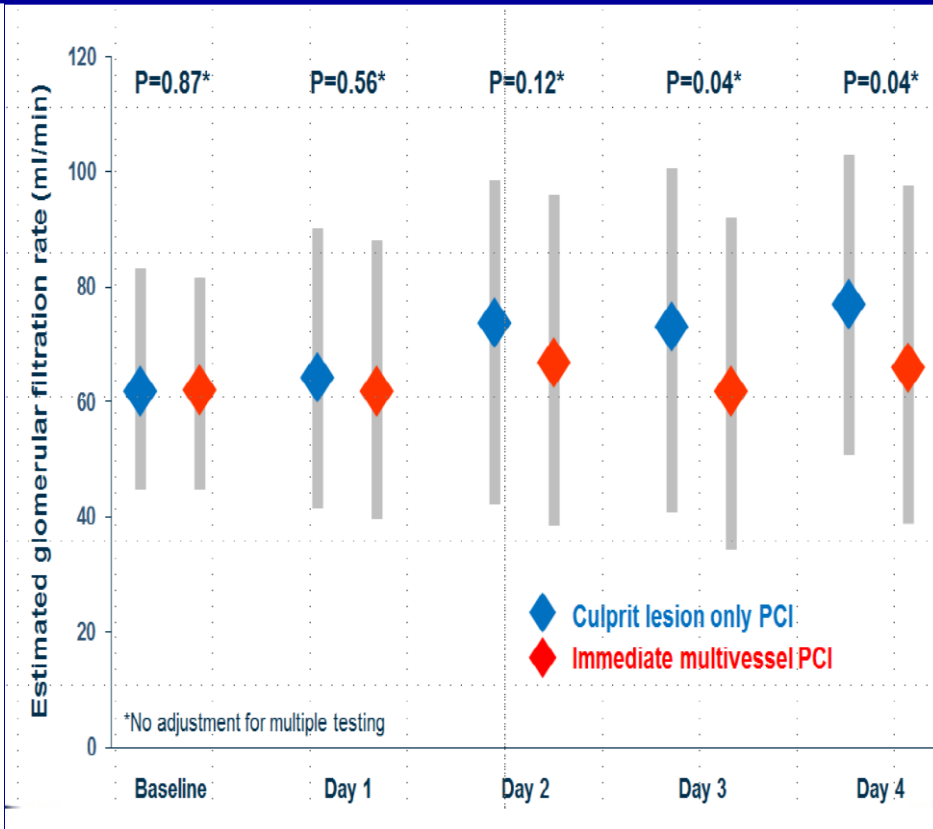


# CULPRIT SHOCK

## 30-Day Total Mortality



## eGFR



- Increased risk of death and need for renal replacement therapy with immediate non-culprit artery PCI. Delayed complete revasc considered.
- ? Hemodynamic support makes a difference



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# *The* NEW ENGLAND JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

JANUARY 15, 2009

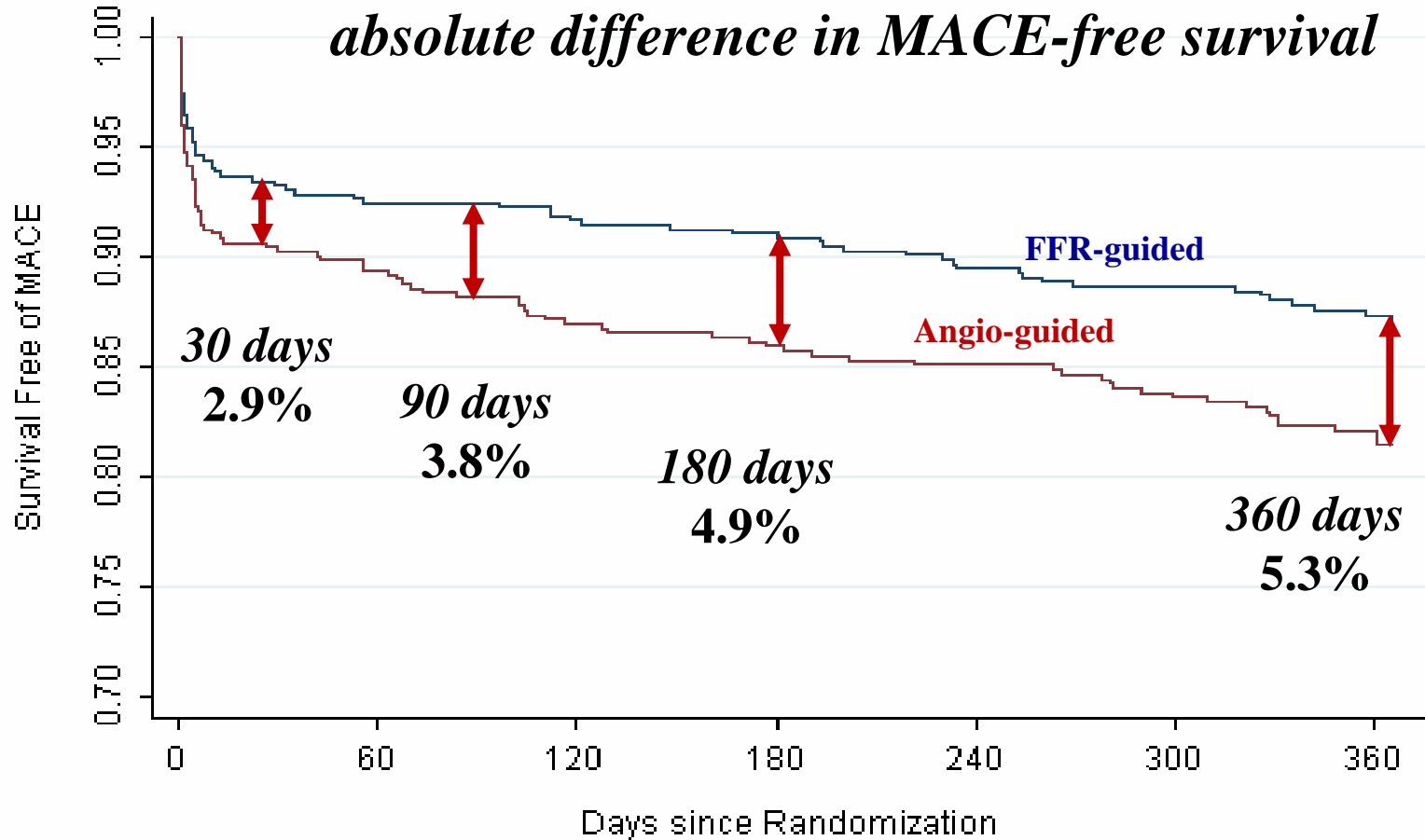
VOL. 360 NO. 3

## Fractional Flow Reserve versus Angiography for Guiding Percutaneous Coronary Intervention

Pim A.L. Tonino, M.D., Bernard De Bruyne, M.D., Ph.D., Nico H.J. Pijls, M.D., Ph.D.,  
Uwe Siebert, M.D., M.P.H., Sc.D., Fumiaki Ikeno, M.D., Marcel van 't Veer, M.Sc., Volker Klauss, M.D., Ph.D.,  
Ganesh Manoharan, M.D., Thomas Engstrøm, M.D., Ph.D., Keith G. Oldroyd, M.D., Peter N. Ver Lee, M.D.,  
Philip A. MacCarthy, M.D., Ph.D., and William F. Fearon, M.D., for the FAME Study Investigators\*

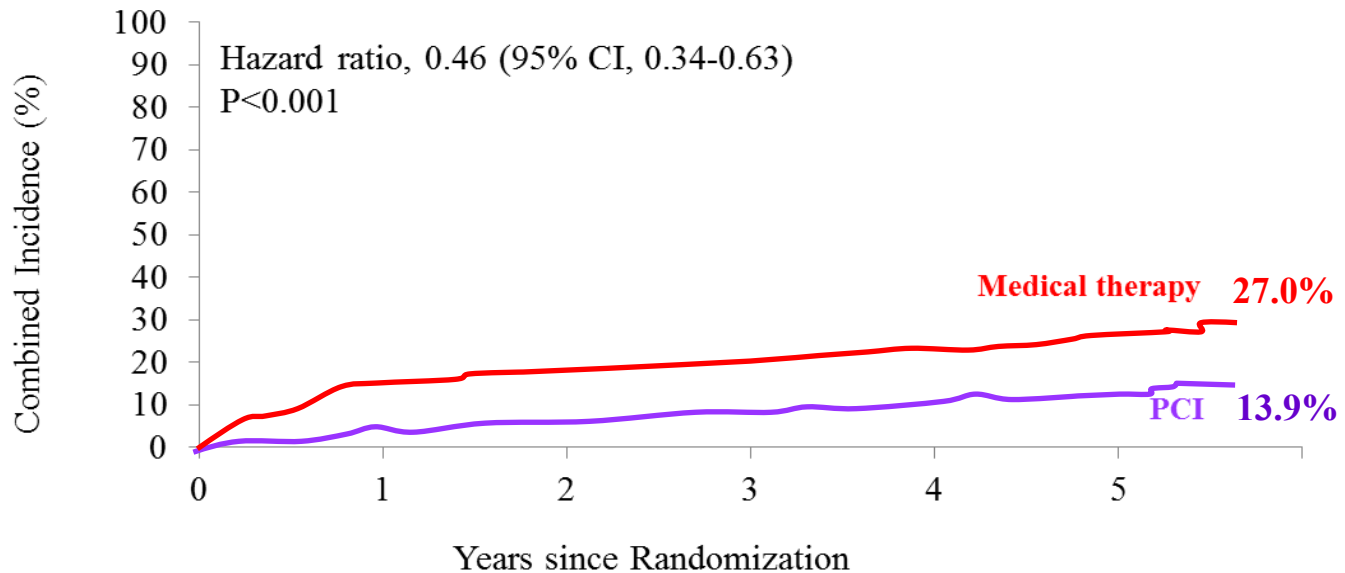
- Patients with stenosis  $\geq 50\%$  in  $\geq 2$  major epicardial coronary arteries
- 1005 pts randomised to angiography-guided PCI (stent all lesions  $\geq 50\%$  stenosis) & FFR-guided PCI (stent all with FFR  $< 0.80$ )

# FAME Study: Event-free Survival



# FAME 2 Trial– 5 Year Follow Up

Primary endpoint: Composite of death, MI, or urgent revascularization



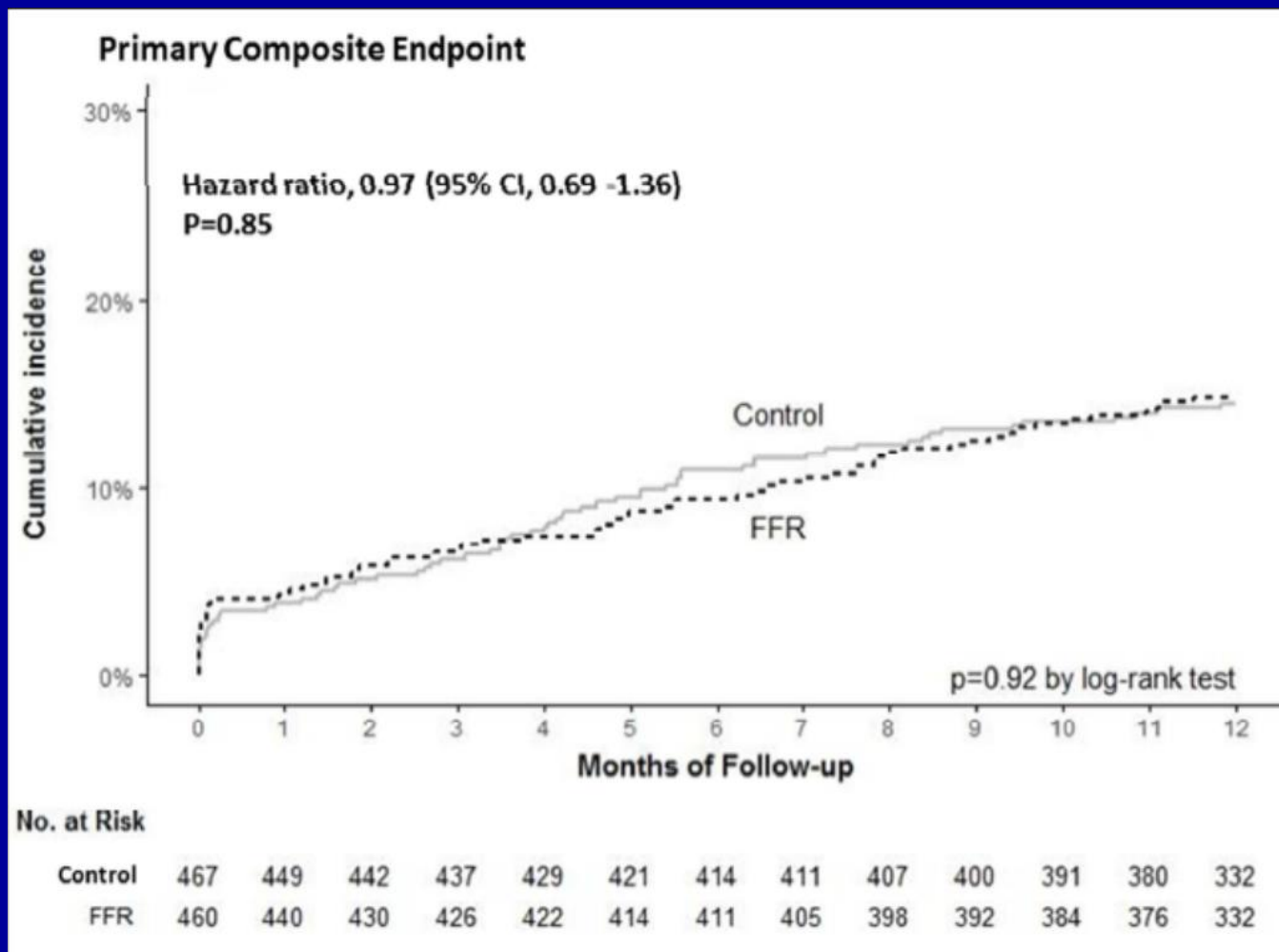
## No. of Risk

Medical therapy	441	360	349	337	271	258
PCI	447	416	403	391	334	321

- Absolute difference in events persist up to 5 years. Confirm the long-term safety of FFR-guided PCI in pts with multivessel disease

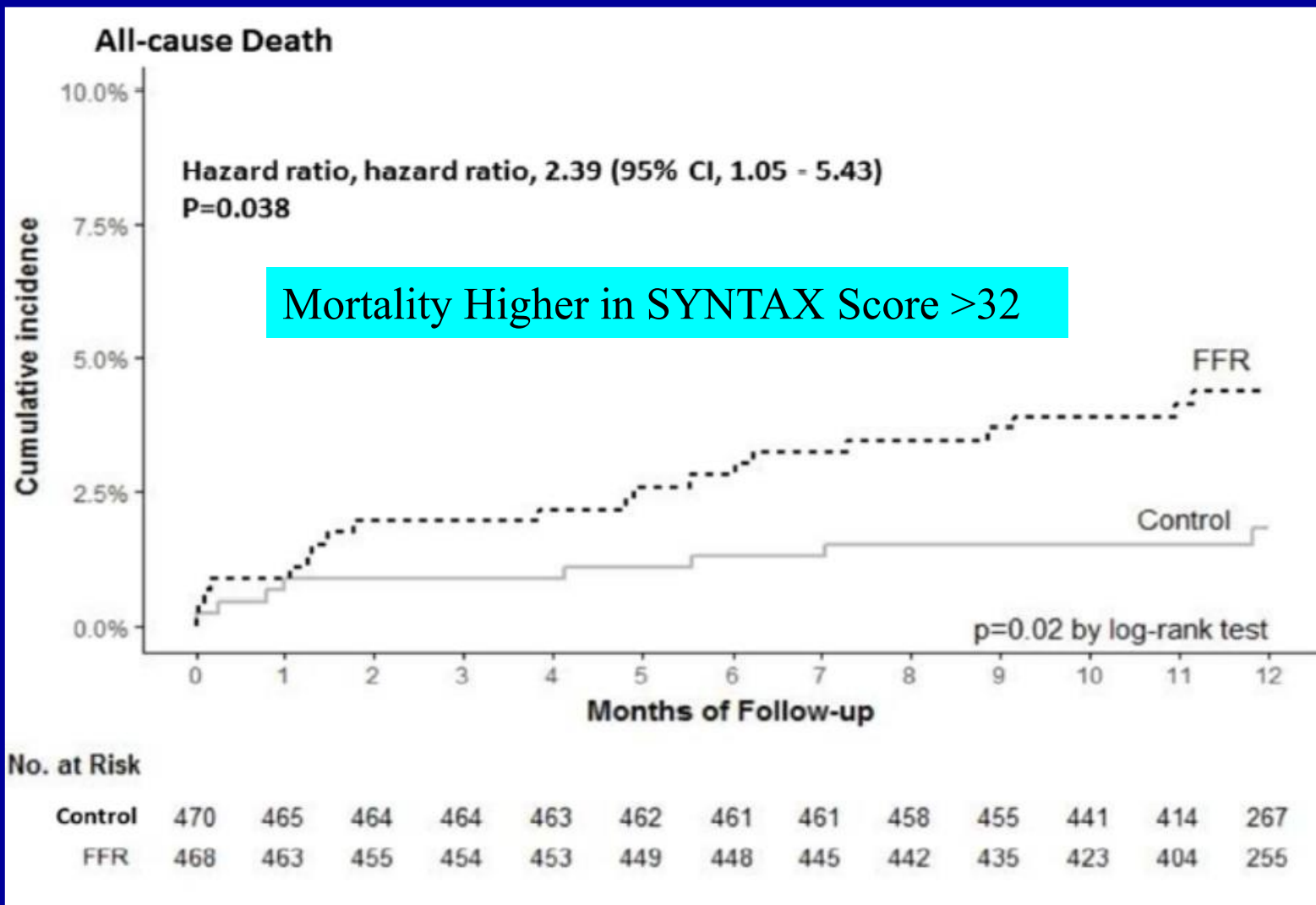
# FUTURE: Angio vs FFR-Guided PCI in Multivessel Stable CAD (>50% stenosis including LAD)

Primary Endpt: Death, MI, Revasc, Stroke at 1 Year



G Rioufol et al J Am Coll Cardiol 2021;78:1875-1885

# FUTURE: Trial Stopped at n=938 by DSMB For Higher All-Cause Mortality



# 2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes

## The Task Force for the diagnosis and management of chronic coronary syndromes of the European Society of Cardiology (ESC)

Recommendations for asymptomatic patients	Class <sup>a</sup>	Level <sup>b</sup>
A periodic visit to a cardiovascular healthcare professional is recommended to reassess any potential change in the risk status of patients, entailing clinical evaluation of lifestyle-modification measures, adherence to targets of cardiovascular risk factors, and the development of comorbidities that may affect treatments and outcomes.	I	C
In patients with mild or no symptoms receiving medical treatment in whom non-invasive risk stratification indicates a high risk, and for whom revascularization is considered for improvement of prognosis, invasive coronary angiography (with FFR when necessary) is recommended.	I	C
Coronary CTA is not recommended as a routine follow-up test for patients with established CAD.	III	C
Invasive coronary angiography is not recommended solely for risk stratification.	III	C

# Conclusions

- Complete anatomic revascularization improves clinical outcomes long term
- FFR-based strategy decreases the rate of revascularization
- Treatment decision based on FFR have not shown any improvement in clinical outcomes of patients compared to angiography-guided strategy, which is still standard of care, for both ACS and stable CAD patients
- Future randomised trials (eg COMPLETE-2) needed to address the role of physiologic assessment