IVUS-Guided PCI: ADAPT-DES and More…

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship	Company
• Grant/Research Support	• Boston Scientific Corporation
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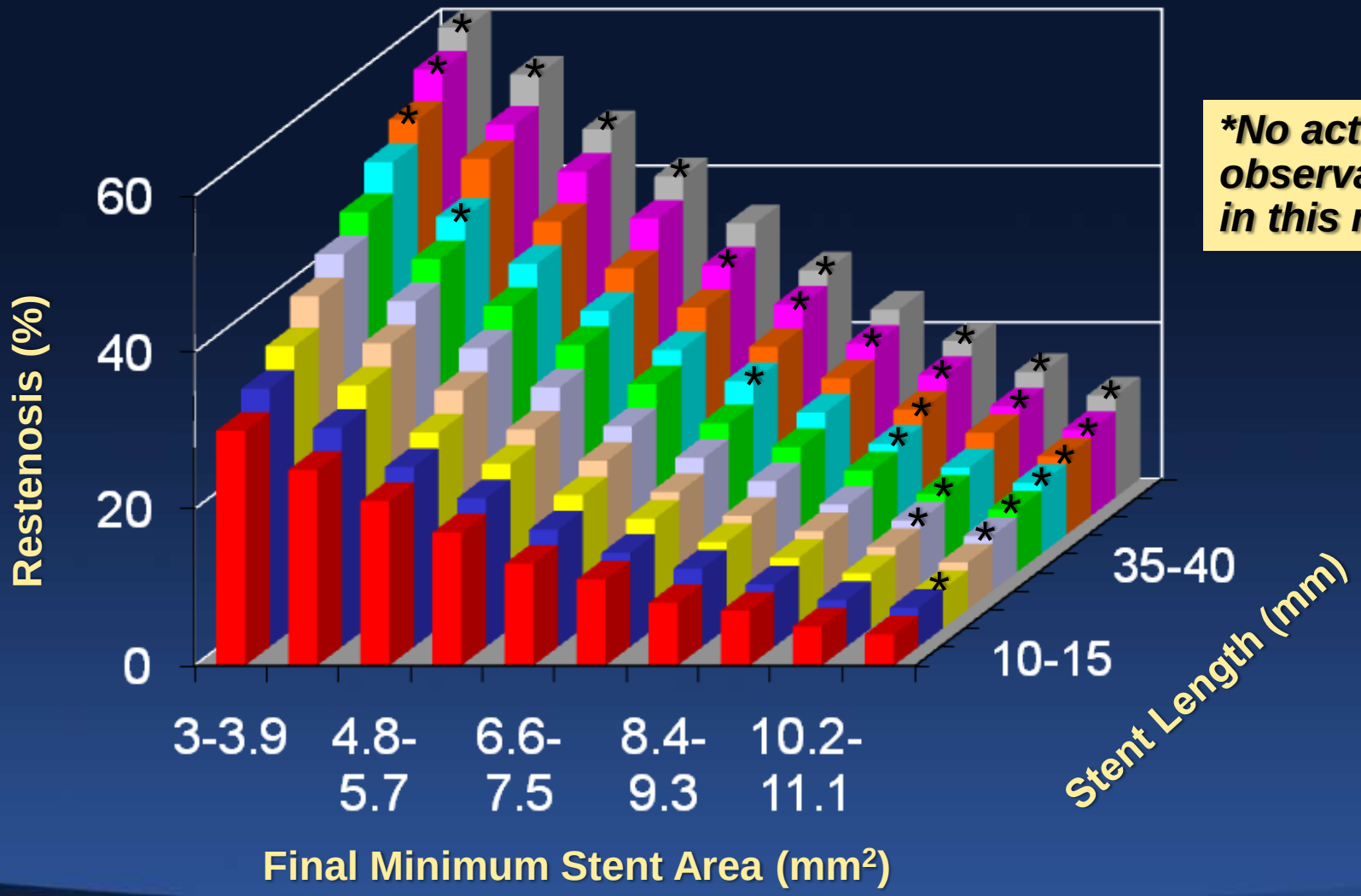
• Speaker Fee	• Volcano Corporation, St Jude Medical

Impact of lesion length and final minimum stent area (MSA) on restenosis



de Feyter et al. Circulation 1999;100:1777-83

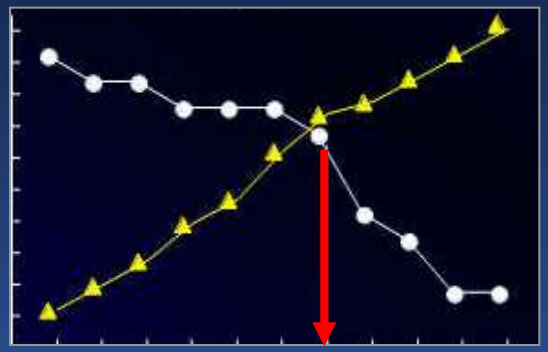
Underexpansion Predicts DES Restenosis

	Population	DES	Endpoint	MSA Cut-off
SIRIUS [1]	72	SES	8 mo, MLA<4.0mm^2	**5.0mm^2**
Hong [2]	550	SES	6 mo, Angio-ISR	**5.5mm^2**
TAXUS-Meta [3]	1098	PES	9 mo, Angio-ISR	**5.7mm^2**

[1]J Am Coll Cardiol 2004;43:1959-63 [2] Eur Heart J 2006;27:1305-10 [3] JACC Interv 2009;2:1269-75

BMS

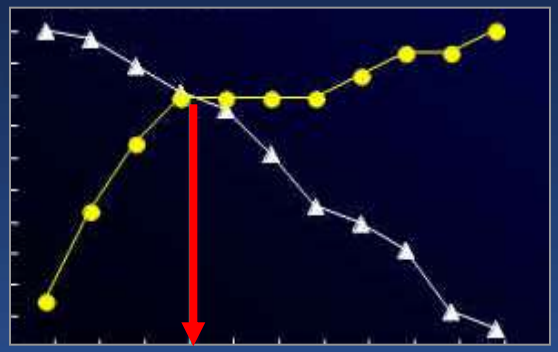
100%



MSA 6.5mm^2
Predictive value 56%

SES

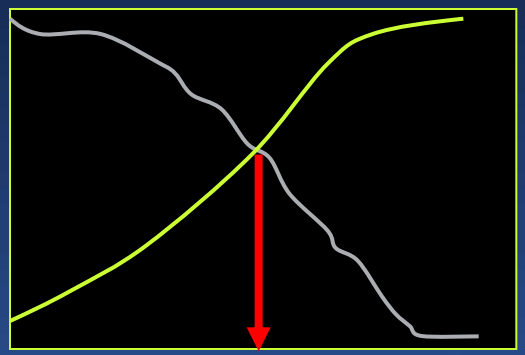
100%



MSA 5.0mm^2
Predictive value 90%

PES

100%



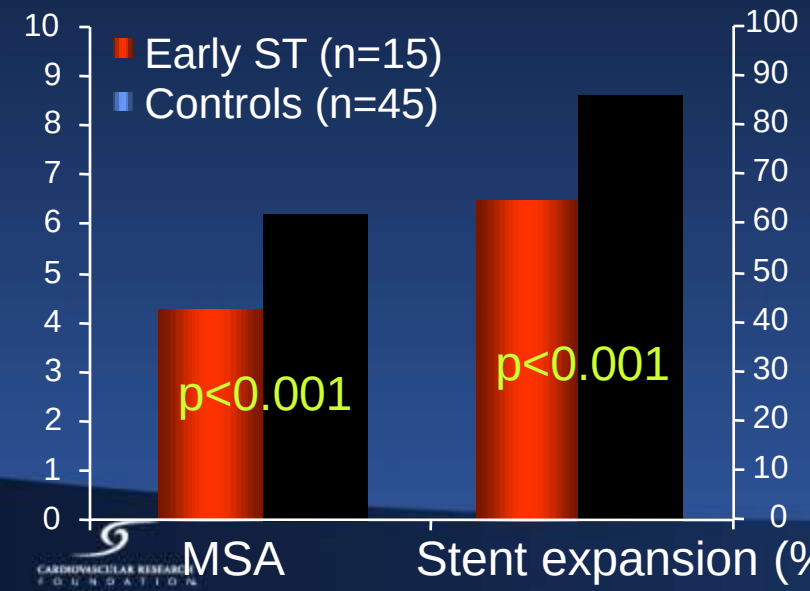
MSA 5.7mm^2

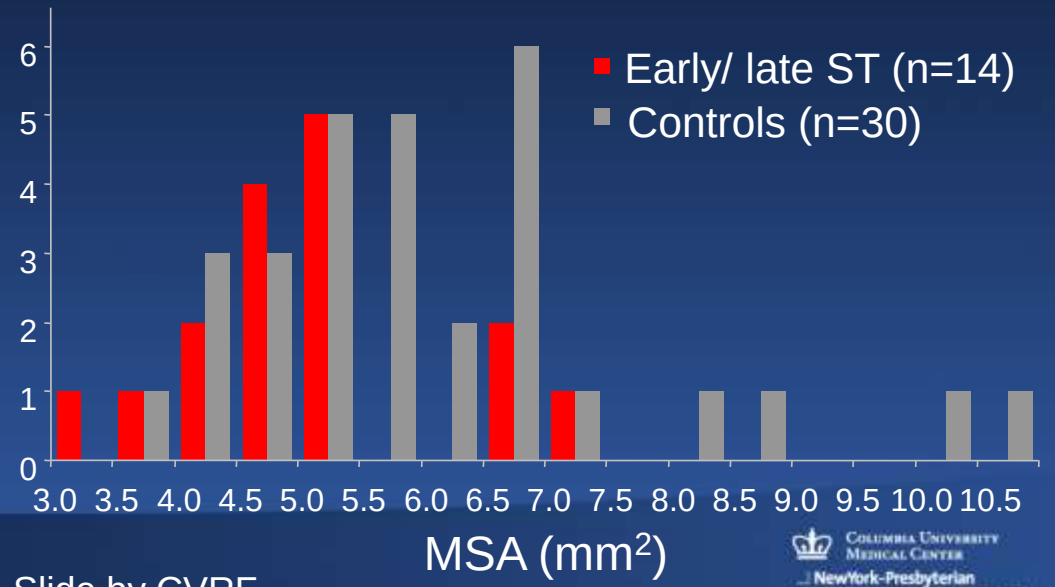
Slide by CVRF

Underexpansion Predicts DES Thrombosis

	Population	DES	Endpoint	Rate of Underexpansion
Fujii [1]	15 ST vs. 45 controls	SES	ST <1 month	<5.0mm^2 in **80%** vs. 29%
Okabe [2]	13 ST vs. 27 controls	DES	ST <1 year	<5.0mm^2 in **79%** vs. 40%
Liu [3]	20 ST vs. 50 controls	DES	ST <1 year	<5.0mm^2 in **85%** vs. 26%

[1] J Am Coll Cardiol 2005;45:995-8 [2] Am J Cardiol 2007;100:615-20 [3] JACC interv 2009;2:428-34





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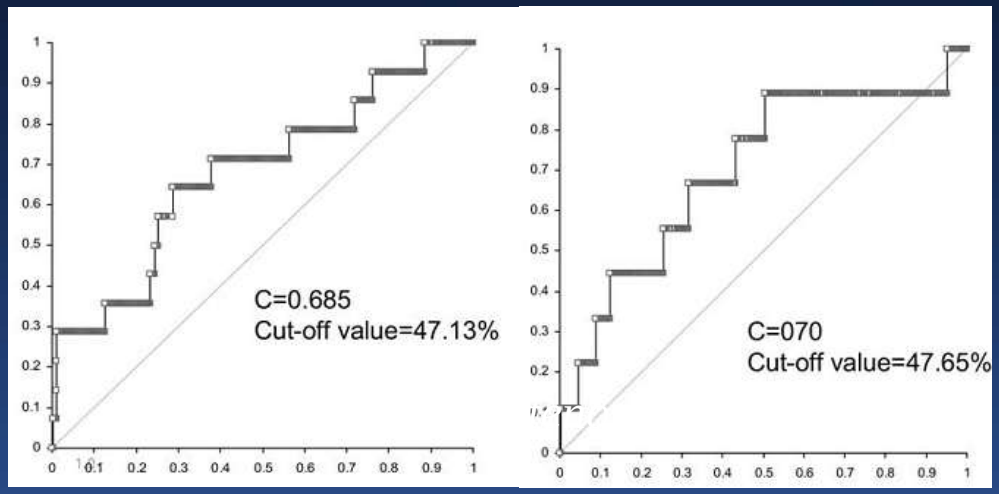
Residual Plaque Predicts DES Restenosis

	Population	DES	F/U time	Predictor
SIRIUS[1]	6 edge restenosis vs. 162 controls	SES	8 mo	**Ref segment PB** 60% vs. 41% (p<0.01)
TAXUS[2]	276 edge stenosis	PES	9 mo	**Ref segment PB 47%**

	Edge restenosis		p
	Yes	**No**	
Ref MLA, mm^2	4.7±2.3	6.4±2.3	0.05
Ref EEM, mm^2	10.7±3.8	14.0±4.8	0.16
Max PB, %	61 ±9	41±12	0.03
Edge dissec	0	2 (1%)	1.00



Plaque Burden 47%≅50%

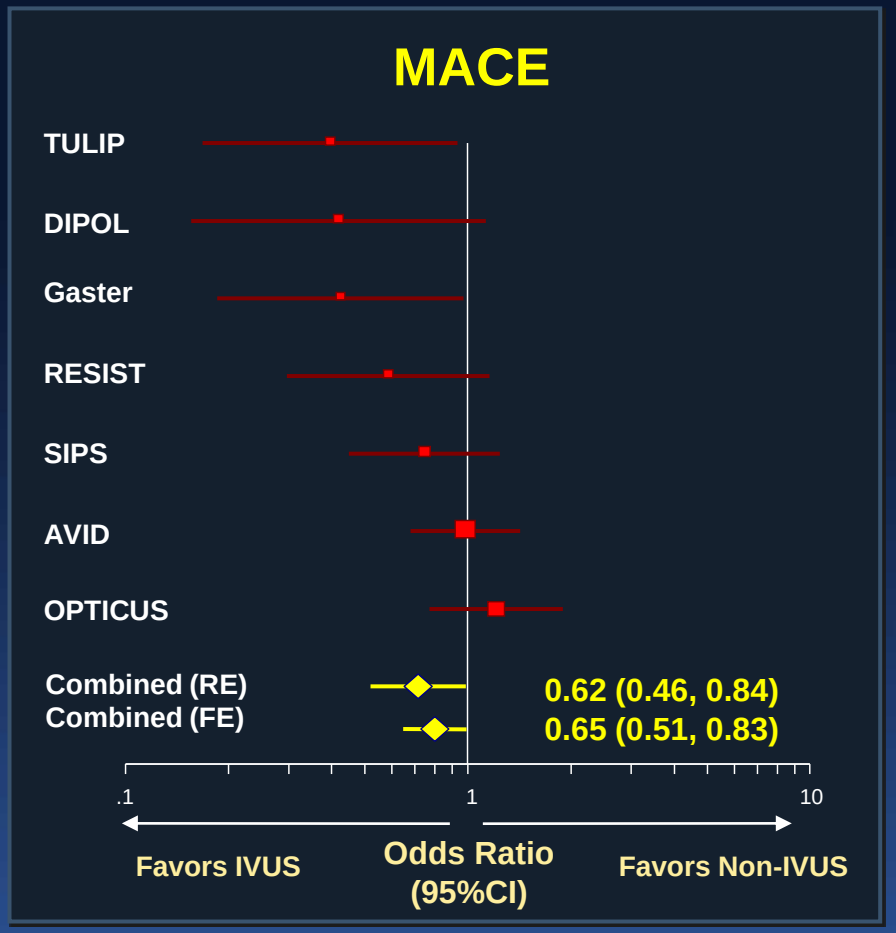
[1]Am J Cardiol 2005;96:1251-3
[2]Liu et al. Am J Cardiol 2009;103:501-6

Slide by CVRF

Meta-analysis of 7 RCTs of IVUS vs Angio Guided BMS implantation (n=2,193 pts)

IVUS guidance was associated with significantly larger post-PCI MLD (Δ0.12 mm (0.06, 0.18), p<0.0001), and lower rates of:

- Angiographic restenosis (22.2% vs. 28.9%; OR 0.64, p=0.02)
- Repeat revascularization (12.6% vs. 18.4%; OR 0.66, p=0.004)
- Overall MACE (19.1% vs. 23.1%; OR 0.69, p=0.03)
- But no significant effect on MI (p=0.51) or mortality (p=0.18)



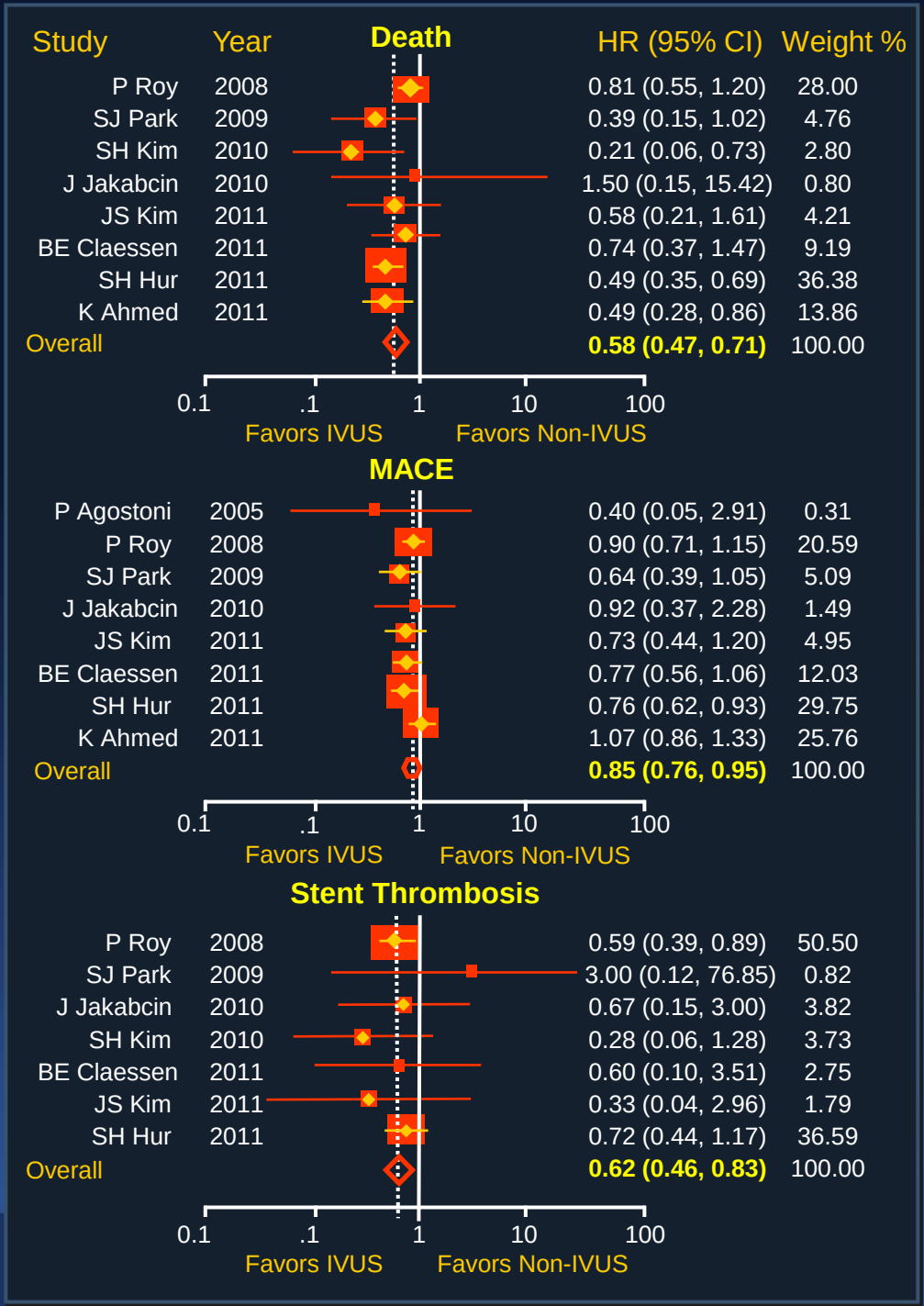
Parise et al. Am J Cardiol. 2011;107:374-82

Meta-Analysis of 8 DES Studies (n=17,570)

Compared with angiographic guidance, IVUS-guided DES implantation was associated with reduced rates of:

- Death
  HR 0.58 (0.47-0.71), p<0.001
- MACE
  HR 0.85 (0.76-0.95), p=0.005
- Stent thrombosis
  HR 0.62 (0.46-0.83), p=0.002

Note: TLR HR 0.90 (0.73. 1.11) all studies; 0.63 (0.46, 1.14) propensity adjusted studies



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A Passion for Innovation

Zhang Y et al.
EuroInt 2012;8:855-65

ADAPT-DES Study Design

Assessment of Dual AntiPlatelet Therapy with Drug-Eluting Stents

Up to 11,000 pts prospectively enrolled

No clinical or anatomic exclusion criteria

11 sites in US and Germany

↓

PCI with ≥1 non-investigational DES

Successful and uncomplicated

(IVUS/VH substudy; Up to 3000 pts enrolled)

↓

Assess platelet function after adequate DAPT loading and GPI washout: Accumetrics VerifyNow Aspirin, VerifyNow P2Y12, and VerifyNow IIb/IIIa assays (results blinded)

↓

Clinical FU at 30 days, 1 year, and 2 years

Angio core lab assessment all STs w/1:2 matching controls

ADAPT-DES - Current Cohort -

Assessment of Dual AntiPlatelet Therapy with Drug-Eluting Stents

8582 pts prospectively enrolled

No clinical or anatomic exclusion criteria

11 sites in US and Germany

↓

PCI with ≥1 non-investigational DES

Successful and uncomplicated

↙ ↘

IVUS Use: 3361 pts | **No IVUS: 5221 pts**

↓ ↓

Clinical FU at 30 days, 1 year, 2 years

Patient Characteristics

	IVUS n = 3361	No IVUS n = 5221	P Value
Age (yrs)	62.9±10.8	64.1±10.9	<0.0001
Male	73.4%	74.5%	0.23
Diabetes	31.3%	33.2%	0.066
Hypertension	78.2%	80.5%	0.0084
Hyperlipidemia	68.3%	78.2%	<0.0001
Current smoking	25.4%	20.8%	<0.0001
Prior MI	24.6%	25.6%	0.30
Prior CABG	12.6%	20.0%	<0.0001
STEMI presentation	12.5%	7.5%	<0.0001

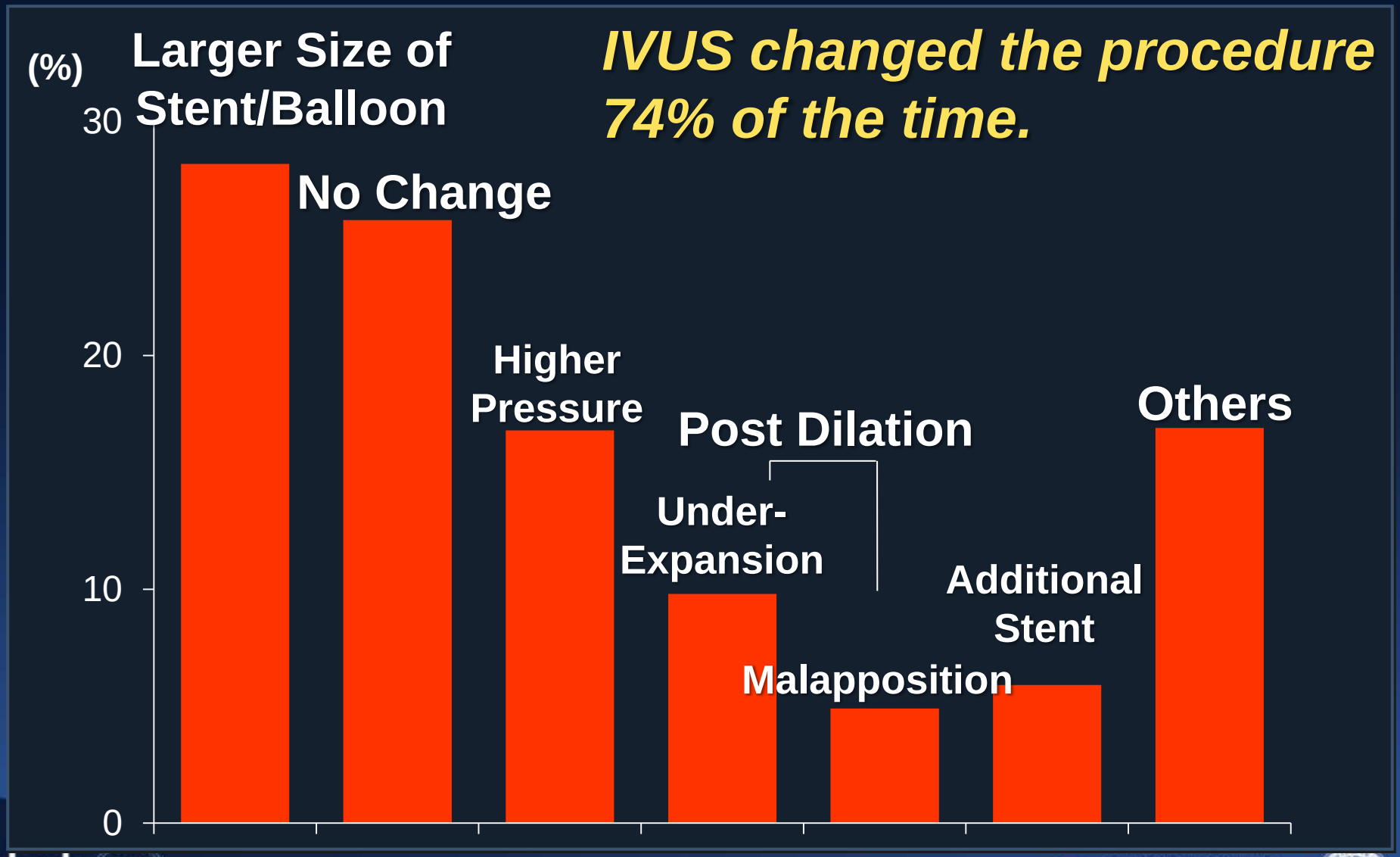
Platelet Function and Medication

	IVUS n = 3361	No IVUS n = 5221	P Value
P2Y12 PRU	191±96	186±98	0.030
- PRU >208	44.5%	41.6%	0.008
Aspirin ARU	418±54	420±56	0.14
- ARU ≥550	5.1%	6.0%	0.077
Thienopyridine at 1 yr	81.9%	71.6%	<0.0001
Thienopyridine at 2 yrs	46.1%	51.1%	<0.0001
Aspirin at 1 yr	87.2%	87.1%	0.84
Aspirin at 2 yrs	80.8%	80.3%	0.59

Lesion and Procedural Characteristics

	IVUS n = 3361	No IVUS n = 5221	P Value
# of lesions treated	1.48±0.75	1.52±0.81	0.024
Bifurcation lesion	14.2%	16.2%	0.012
In-stent restenosis lesion	11.6%	9.6%	0.003
Bypass graft lesion	2.9%	6.3%	<0.0001
# of DES implanted	1.71±0.96	1.69±1.03	0.31
Total stent length (mm)	33.6±21.9	31.8±22.6	0.0002
Max device diameter (mm)	3.44±0.56	3.14±0.50	<0.0001
Max balloon pressure (atm)	16.9±3.7	16.7±3.5	0.070

How IVUS changed the procedure?



Clinical Outcome at 2 Years

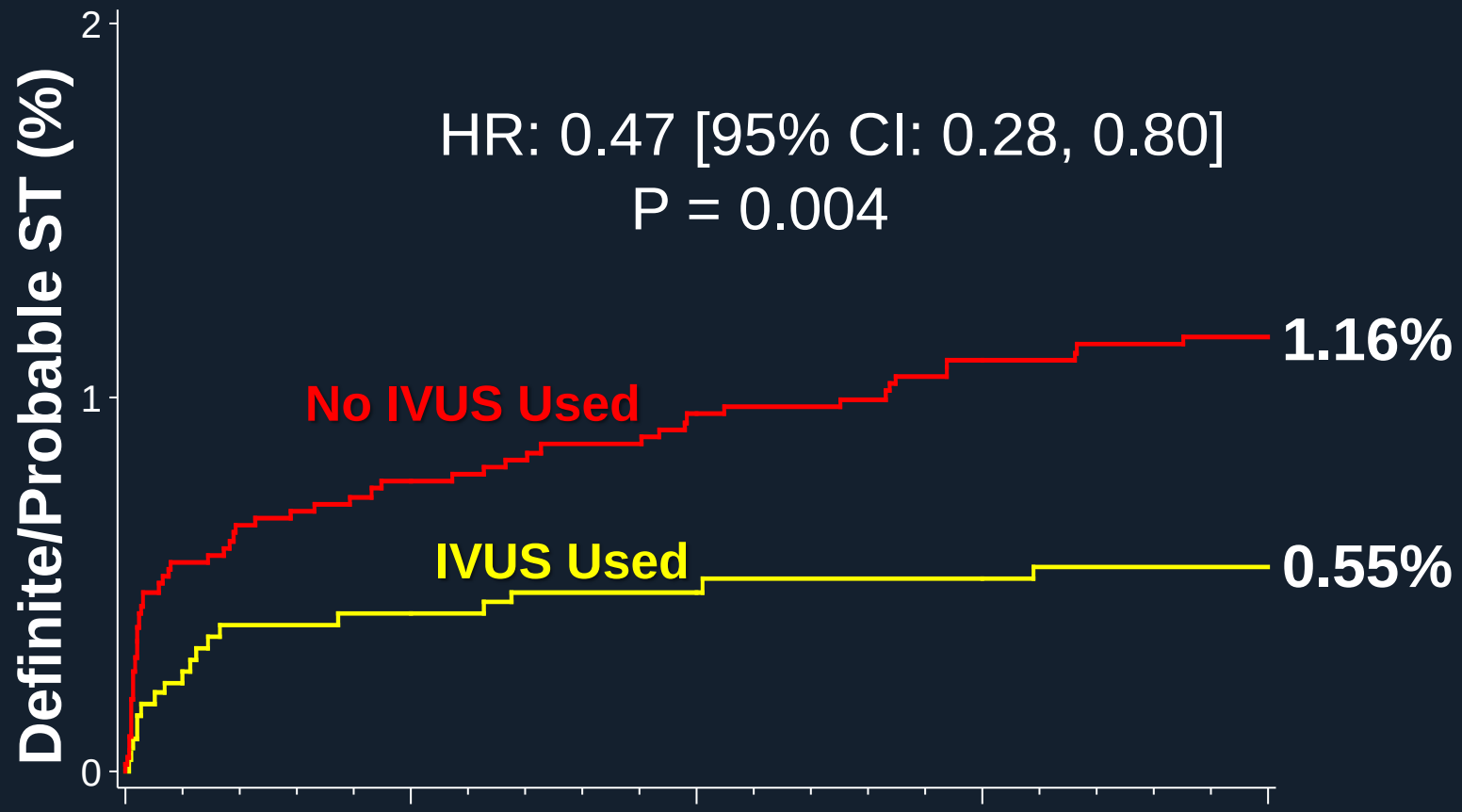
	IVUS n = 3361	No IVUS n = 5221	P Value
Definite/probable ST	0.55% (18)	1.16% (59)	0.004
All death	3.32% (106)	4.23% (210)	0.034
Cardiac death	1.71% (54)	2.42% (119)	0.028
All MI	3.47% (112)	5.59% (279)	<0.0001
- Peri-procedural MI	1.31% (44)	1.62% (84)	0.26
- ST related MI	0.52% (17)	0.92% (46)	0.045
- Non ST related MI	1.66% (52)	3.11% (151)	<0.0001
- Q wave MI	0.34% (11)	0.85% (42)	0.006
- Non Q wave MI	3.13% (101)	4.85% (242)	0.0001
Clinically driven TLR*	4.79% (161)	6.01% (314)	0.02
Clinically driven TVR*	8.30% (279)	9.77% (510)	0.02

* Site reported

Stent Thrombosis (Target Lesion) at 2 Years

	IVUS Use n = 3361	No IVUS n = 5221	P Value
Definite ST	0.46% (15)	0.85% (43)	0.036
Definite/probable ST	0.55% (18)	1.16% (59)	0.004
- Acute (<1 day)	0.00% (0)	0.04% (2)	0.26
- Subacute (1-30 day)	0.24% (8)	0.52% (27)	0.047
- Late (>30 day to 1 yr)	0.24% (8)	0.40% (20)	0.24
- Very late (1 yr to 2 yrs)	0.06% (2)	0.21% (10)	0.11

Relationship Between IVUS Use and Definite/Probable Stent Thrombosis Within 2 Years



Number at risk:					
IVUS Used	3361	3260	3182	3065	1791
IVUS Not Used	5221	5019	4886	4713	2279

Multivariable Cox PHR Models of 2-Year Definite/Probable Stent Thrombosis

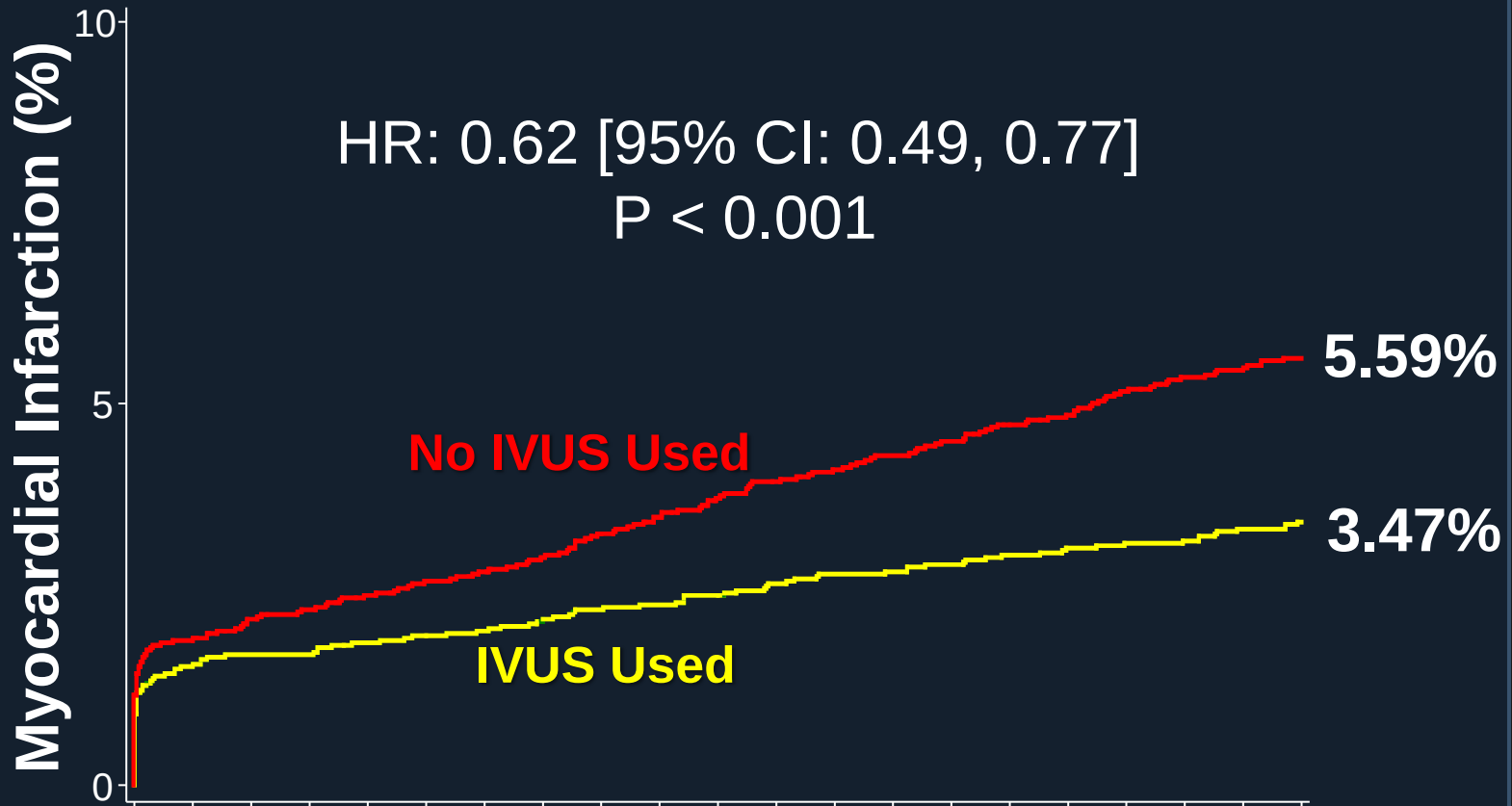
Number events=92, Total at risk=8582

	HR [95% CI]	P value
IVUS use	0.41 [0.23, 0.76]	0.005
Maximum device diameter (mm)	0.58 [0.35, 0.96]	0.04
Premature DAPT discontinuation*	5.97 [3.43, 10.39]	<0.0001
STEMI presentation	3.08 [1.73, 5.51]	0.0001
PRU >208	2.19 [1.35, 3.54]	0.001
Diabetes	1.75 [1.09, 2.78]	0.02
Total stent length (mm)	1.01 [1.00, 1.02]	0.02

Other non-significant covariates entered to the model: ARU ≥550

* Defined as permanent discontinuation at 6 months

Relationship Between IVUS Use and MI Within 2 Years



Number at risk:					
IVUS Used	3361	3209	3120	2991	1739
IVUS Not Used	5221	4916	4744	4541	2179

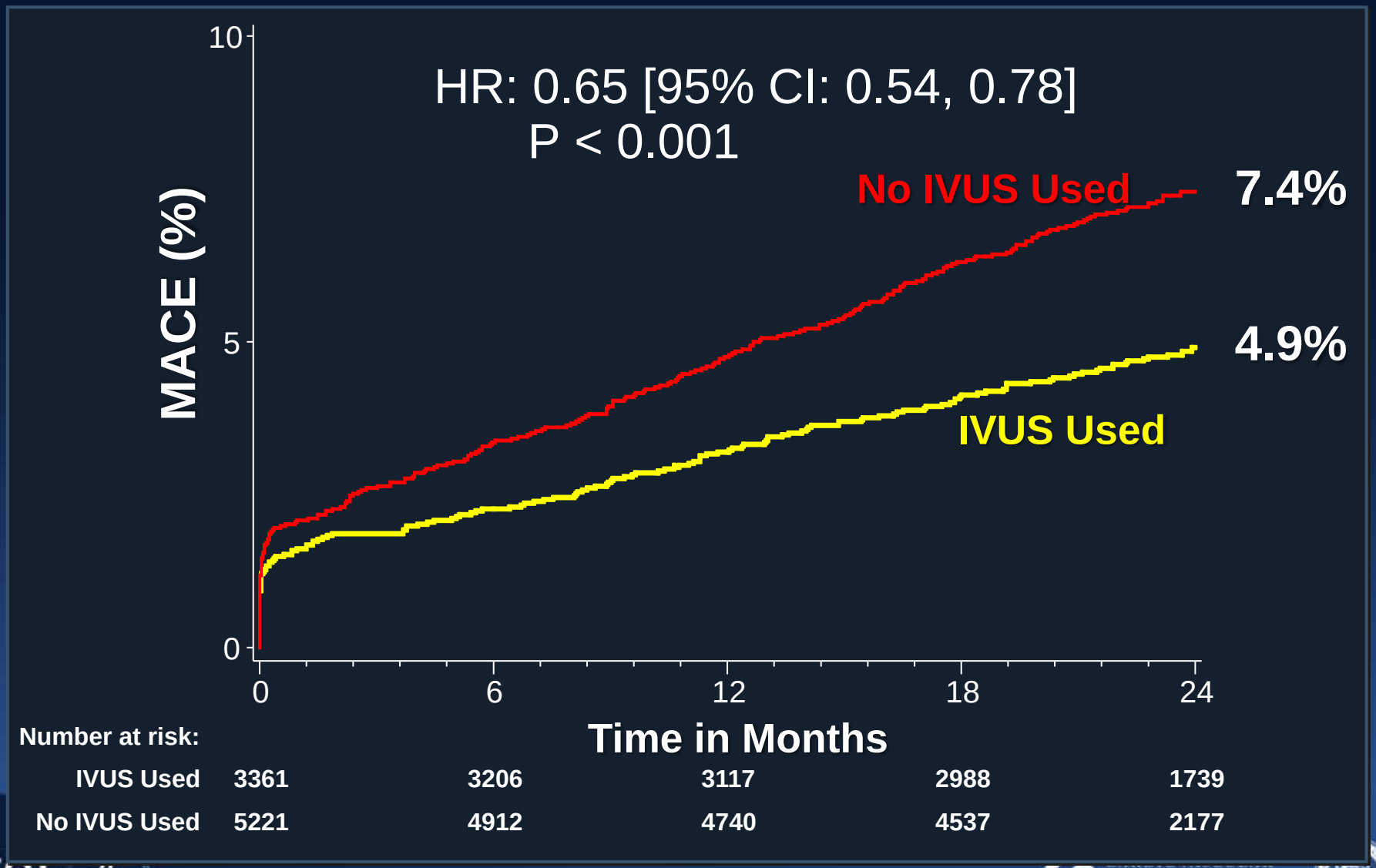
Multivariable Cox PHR Models of 2-Year MI

Number events=391, Total at risk=8582

	HR [95% CI]	P value
IVUS use	0.65 [0.51, 0.83]	0.0006
Renal Insufficiency*	1.57 [1.20, 2.05]	0.001
Three vessel CAD	1.68 [1.37, 2.07]	<0.0001
Diabetes	1.49 [1.21, 1.83]	0.0002
Acute coronary syndrome	1.44 [1.17, 1.76]	0.0005
Prior MI	1.36 [1.10, 1.68]	0.005

Other non-significant covariates entered to the model: Male, hemoglobin (g/dL)
*defined as CrCl <60 mL/min

Relationship Between IVUS Use and MACE (Definite/Probable ST, Cardiac Death, MI) Within 2Yrs



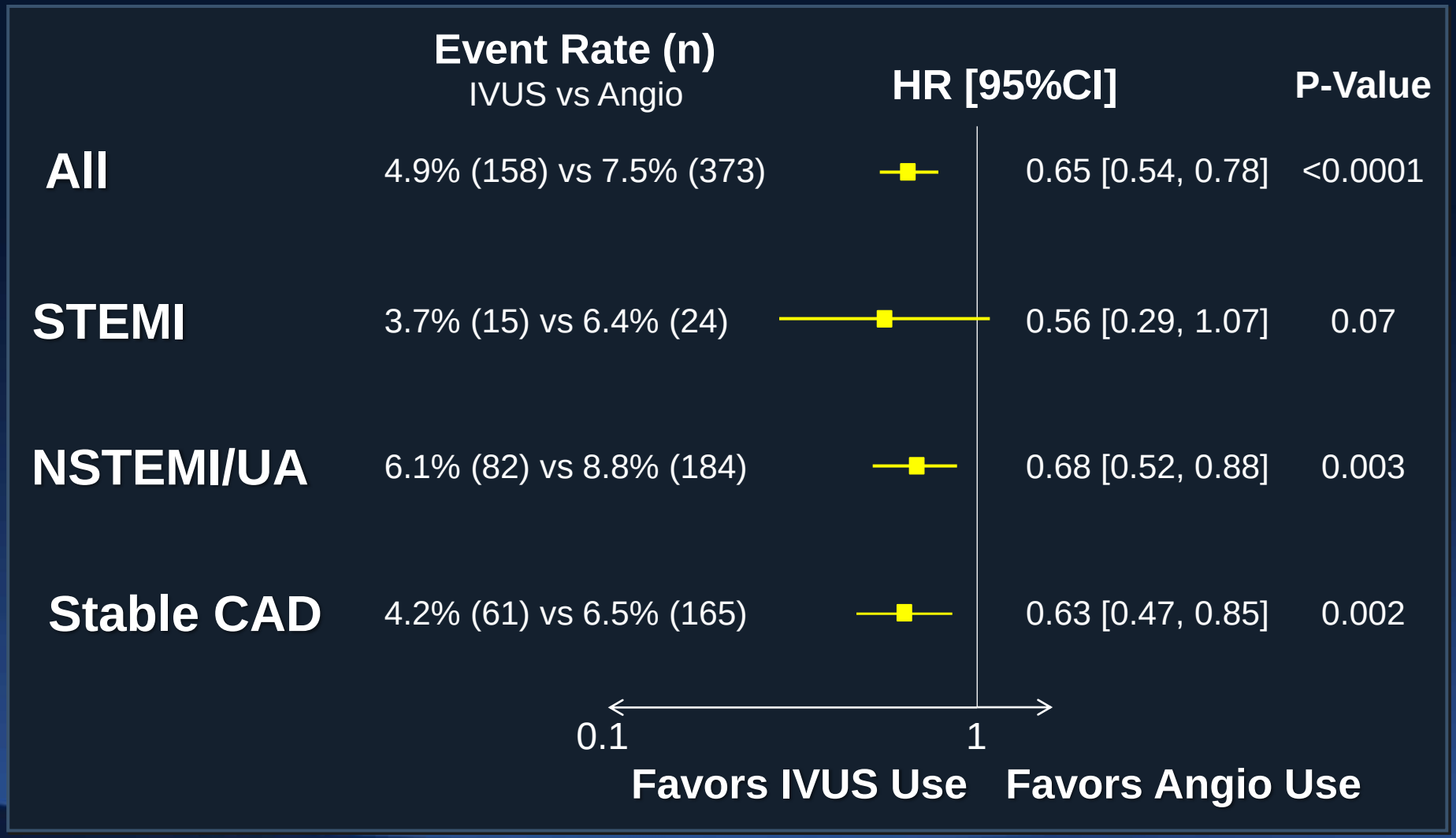
Multivariable Cox PHR Models of 2-Year MACE (Definite/Probable ST, Cardiac Death, MI)

Number events=531, Total at risk=8582

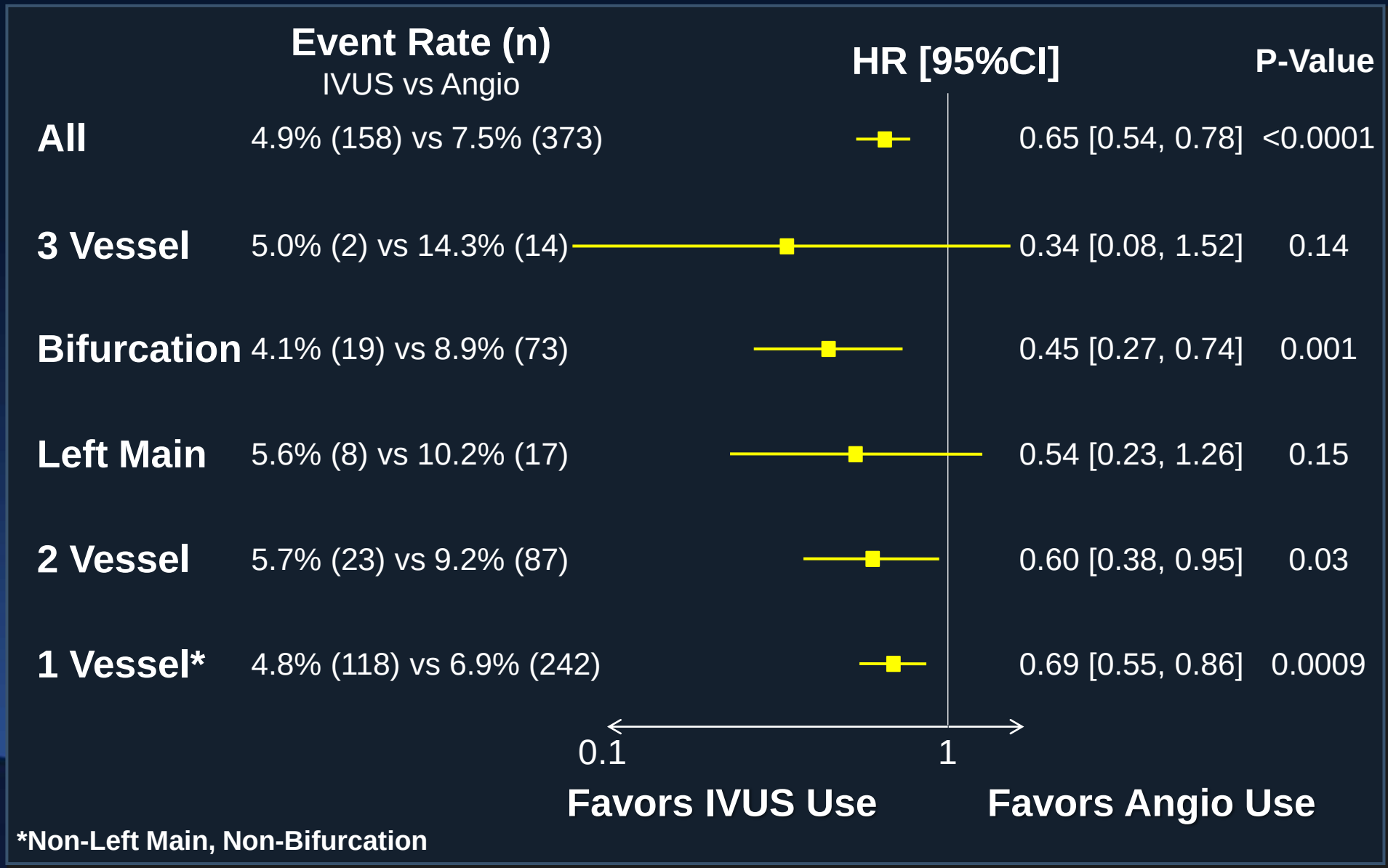
	HR [95% CI]	P value
IVUS use	0.72 [0.59, 0.89]	0.0025
Renal Insufficiency*	1.65 [1.32, 2.07]	<0.0001
Diabetes	1.52 [1.28, 1.82]	<0.0001
Three vessel CAD	1.50 [1.25, 1.79]	<0.0001
Prior MI	1.45 [1.21, 1.74]	<0.0001
Acute coronary syndrome	1.39 [1.17, 1.66]	0.0002
Hemoglobin (g/dl)	0.88 [0.83, 0.94]	<0.0001

Other non-significant covariates entered to the model: Male

Association of IVUS Use with MACE (Definite/Probable ST, Cardiac Death, MI) in Relation to Index Presentation



Association of IVUS Use with MACE (Definite/Probable ST, Cardiac Death, MI) in Relation to Lesion Complexity



*Non-Left Main, Non-Bifurcation

ADAPT-DES: Conclusions and Implications

- IVUS use was associated with longer stent length and larger stent size without increasing peri-procedural MI or the number of stents utilized.
- These data, drawn from the largest prospective registry of IVUS use to date, suggest that IVUS guidance during DES PCI may result in less stent thrombosis (beginning at the time of implantation) as well as fewer myocardial infarctions and target lesion revascularizations.
- The positive association between IVUS use and outcomes was observed to continue out to 2 years of follow-up.