

Impact of Functional Angioplasty in Our Real Practice

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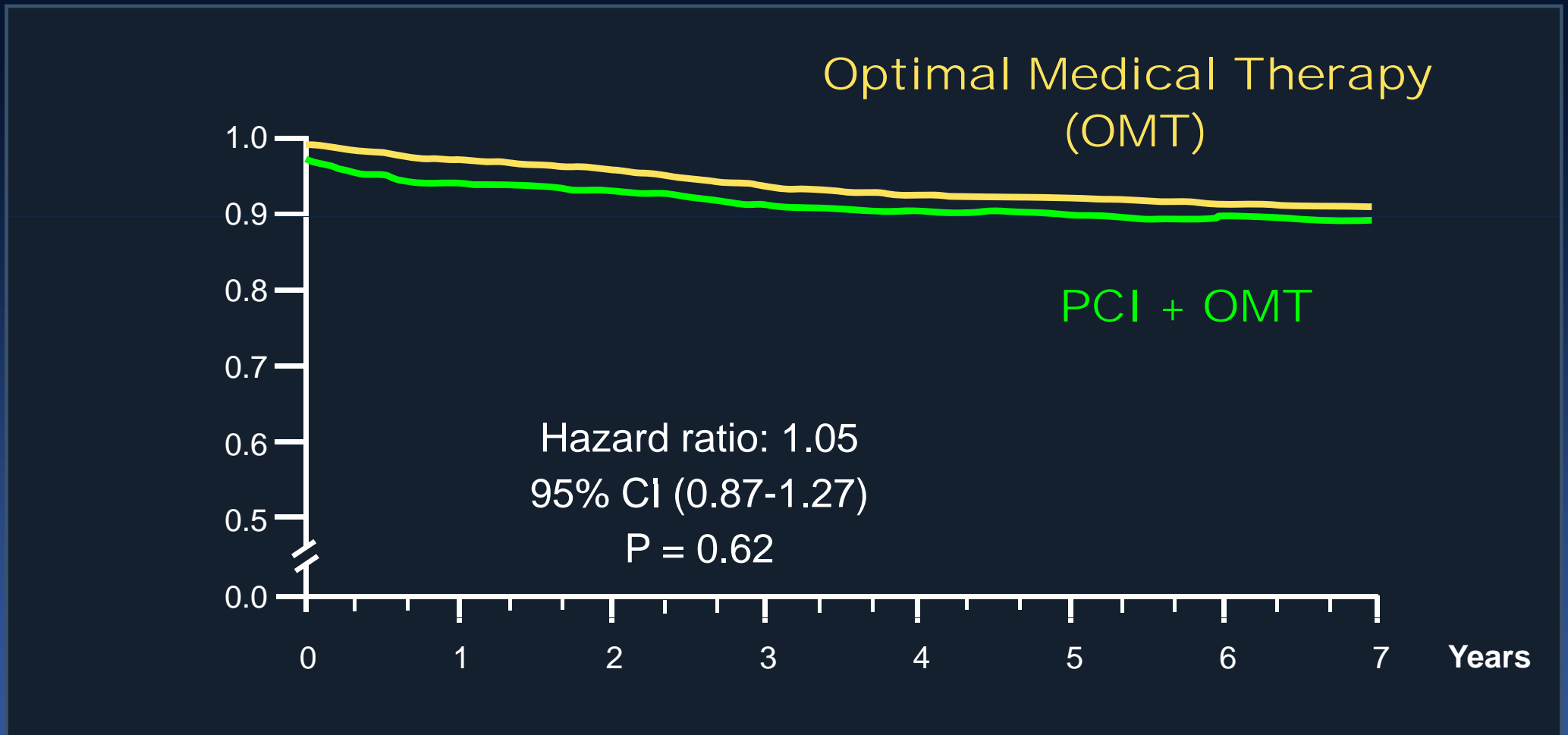
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What is the Concept of Functional Angioplasty ?

Optimal Medical Treatment,
Reasonable Incomplete Revascularization.
FFR Guided PCI is Better,
Integrated Use of FFR and IVUS.

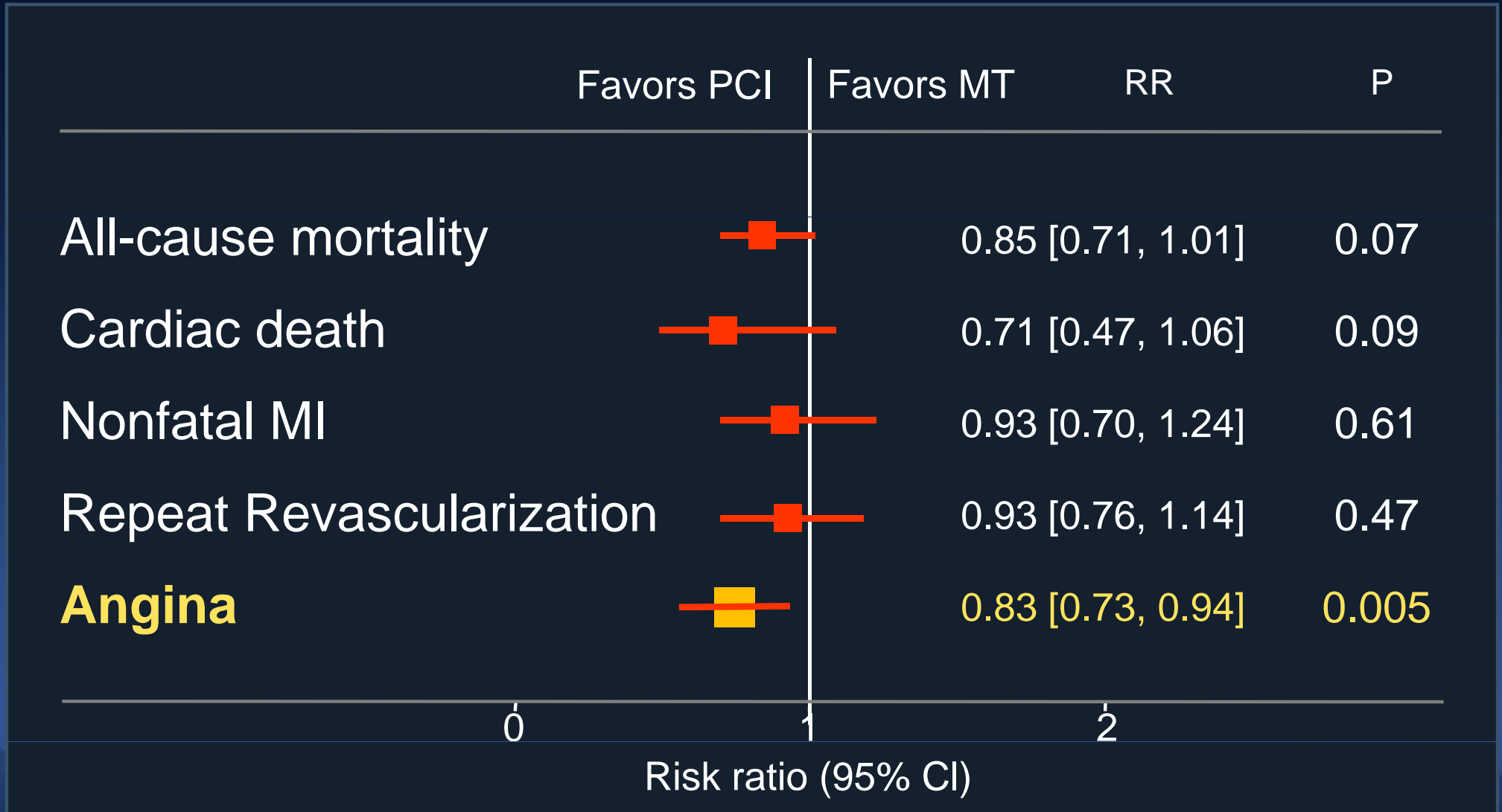
Benefit of Stents Over Medications in Stable Disease

Survival Free From Death and MI (COURAGE, n=2,287)



Benefit of Stents Over Medications in Stable Disease

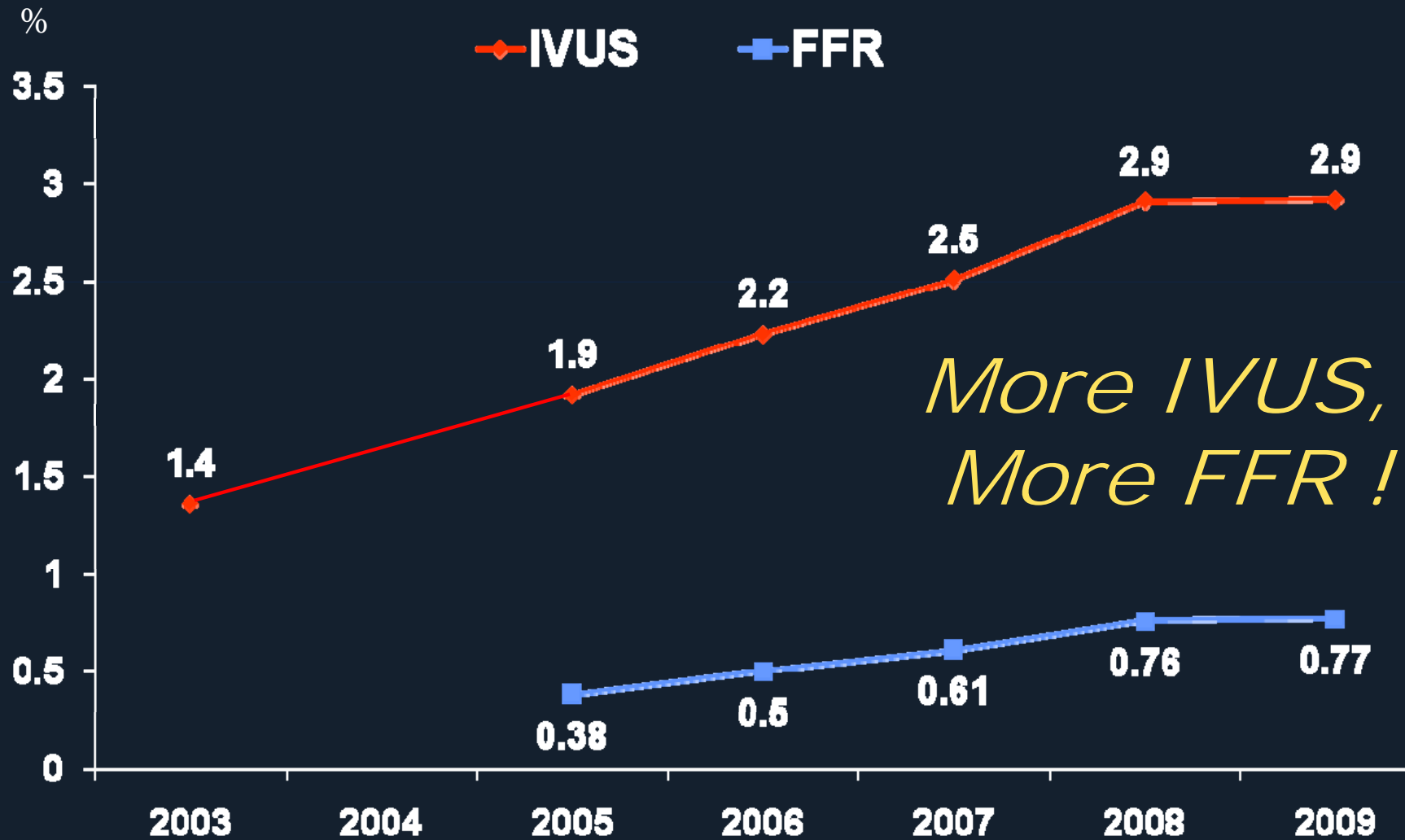
12 RCTs, 7182 participants



Optimal Medical Treatment With Reasonable Incomplete Revascularization

Optimal Medical Treatment is Usually Enough in Many Clinical Setting of Stable Angina.

Our Practice Is Changing Now !



Impact of FFR for Multi-Vessel Disease

“Totally Different World”
“Different Concept and
Different Clinical Outcomes” !

Meta-Analysis **FFR vs. CAG Guided PCI**

**A total of 9,301 patients
(1 randomized trial and 4 observational studies)**

Park SJ, Ahn JM, Unpublished Data, 2013

FFR vs. Angio-Guided PCI

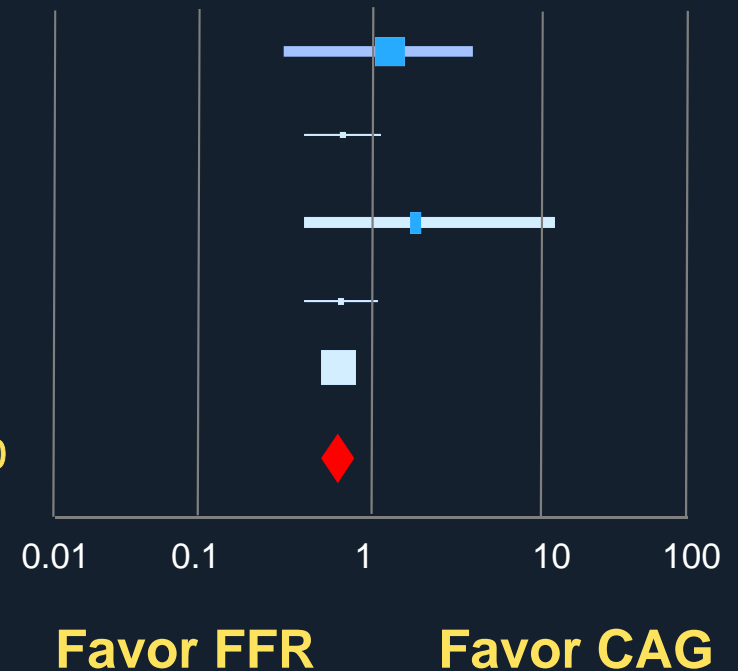
(Meta-analysis n=9,301)

Death

		Odds Ratio	Lower Limit	Upper Limit	Z-Value	P-Value
Wongpraparut	2005	1.25	0.24	6.59	0.26	0.80
Pijls	2010	0.68	0.33	1.38	-1.08	0.28
Angkananard	2011	2.09	0.36	12.16	0.82	0.41
Puymirat	2012	0.61	0.30	1.20	-1.44	0.15
Lerman	2013	0.56	0.48	0.66	-7.22	0.00
Random pooled estimate		0.58	0.50	0.67	- 724	<0.00 1

I²=0

Odds ratio and 95% CI

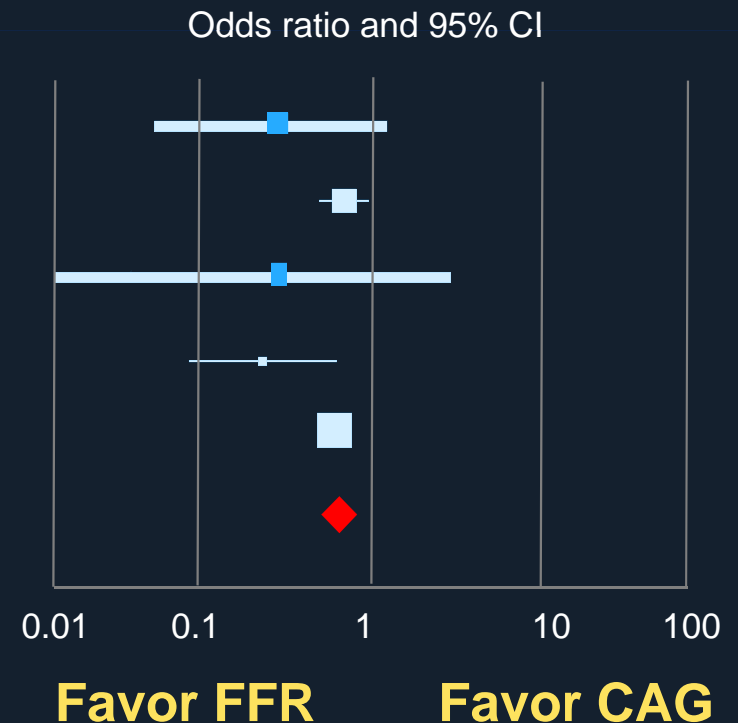


FFR vs. Angio-Guided PCI

(Meta-analysis n=9,301)

Myocardial Infarction

		Odds Ratio	Lower Limit	Upper Limit	Z-Value	P-Value
Wongpraparut	2005	0.21	0.02	1.75	-1.45	0.15
Pijls	2010	0.59	0.37	0.94	-2.20	0.03
Angkananard	2011	0.20	0.01	4.19	-1.04	0.30
Puymirat	2012	0.13	0.03	0.53	-2.88	0.00
Lerman	2013	0.49	0.39	0.62	-6.04	0.00
Random pooled estimate		0.47	0.34	0.65	-4.55	<0.001

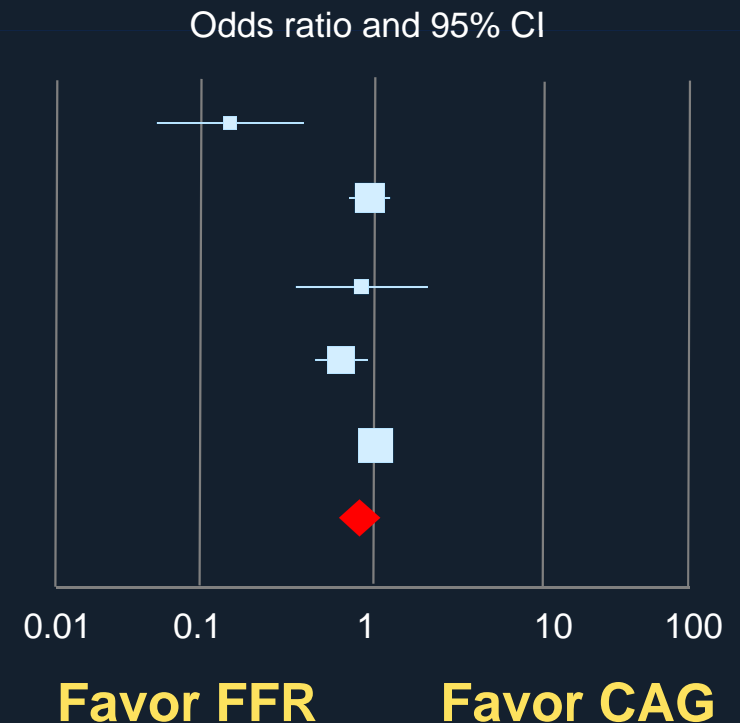


FFR vs. Angio-Guided PCI

(Meta-analysis n=9,301)

Repeat Revascularization

		Odds Ratio	Lower Limit	Upper Limit	Z-Value	P-Value
Wongpraparut	2005	0.18	0.05	0.68	-2.51	0.15
Pijls	2010	0.82	0.55	1.20	-1.04	0.03
Angkananard	2011	0.73	0.22	2.49	-0.50	0.30
Puymirat	2012	0.51	0.31	0.83	-2.70	0.00
Lerman	2013	0.96	0.84	1.10	-0.64	0.00
Random pooled estimate		0.70	0.48	1.02	-1.88	0.06

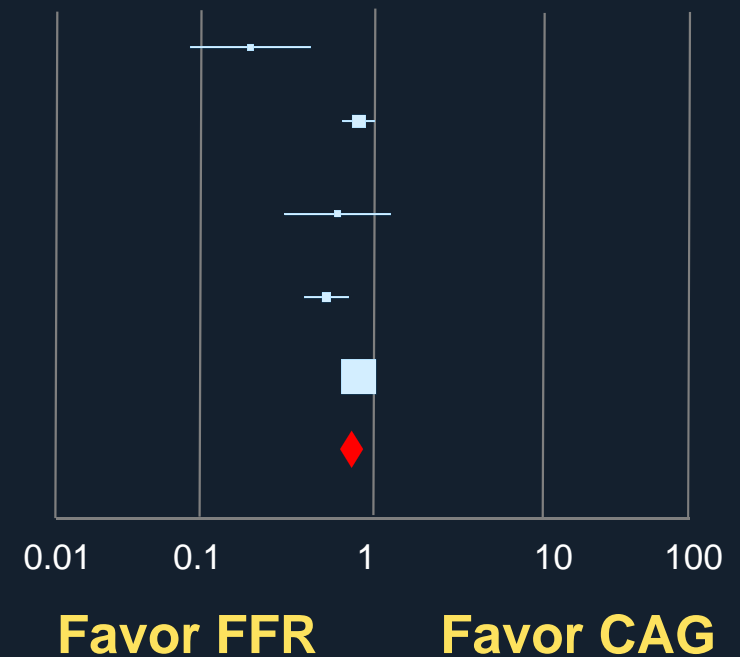


FFR vs. Angio-Guided PCI

(Meta-analysis n=9,301)

MACE (Death, MI or Repeat Revascularization)

		Odds Ratio	Lower Limit	Upper Limit	Z-Value	P-Value
Wongpraparut	2005	0.24	0.08	0.72	-2.52	0.01
Pijls	2010	0.76	0.55	1.03	-1.78	0.08
Angkananard	2011	0.51	0.19	1.39	-1.31	0.19
Puymirat	2012	0.42	0.27	0.64	-4.00	0.00
Lerman	2013	0.75	0.66	0.86	-4.29	0.00
Random pooled estimate		0.71	0.64	0.80	-5.88	<0.001



FFR vs. Angio-Guided PCI

(Meta-analysis n=9,301)

Relative

**FFR Guided PCI Has
Better Clinical Outcomes !**

MACE

↓ 29%

<0.001

Impact of FFR Guided PCI In AMC Practice.

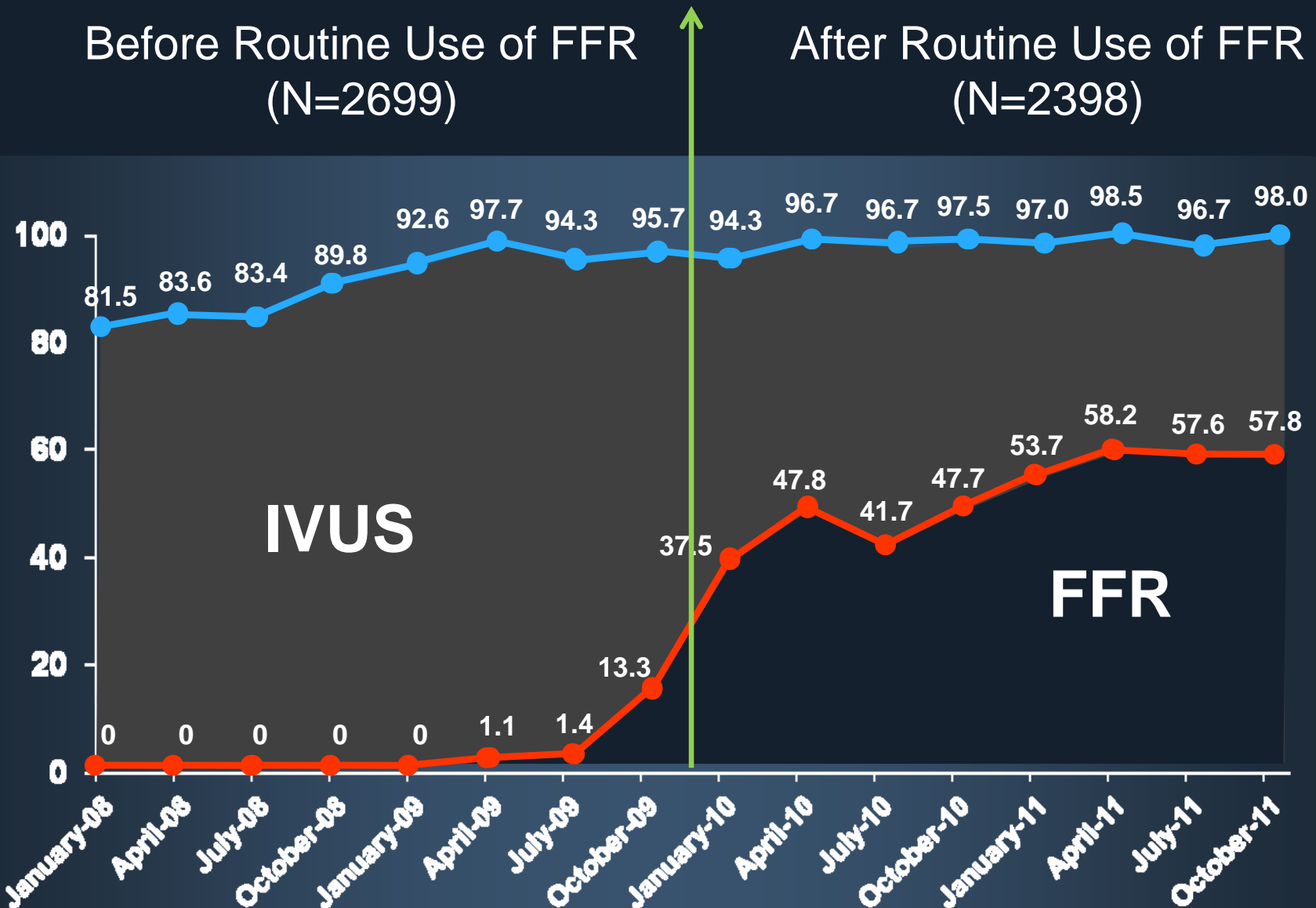
Park SJ, Ahn JM. AMC Registry Data Analysis

Study Population

Between January 2008 and December 2011, a total of 5097 patients were enrolled. Since January 2010, the investigators have routinely used FFR in assessing the functional severity of intermediate coronary stenosis (visual estimated DS between 50% and 80%).

Integrated Use of FFR and IVUS

(AMC data, n=5097)



Baseline Clinical Characteristics

Unadjusted Group

Propensity Matched Group

	Unadjusted Group			Propensity Matched Group		
	Before Routine FFR (N=2699)	After Routine FFR (N=2398)	P	Before Routine FFR (N=2178)	After Routine FFR (N=2178)	P
Age, year	62.0±9.9	62.6±10.3	0.04	62.4±9.8	62.3±10.3	0.87
Male sex	1982 (70.5)	1685 (74.2)	0.003	1585 (72.8)	1574 (72.3)	0.73
Hypertension	1615 (59.8)	1483 (61.8)	0.15	1328 (61.0)	1333 (61.2)	0.90
DM	834 (30.9)	794 (33.1)	0.09	705 (32.4)	705 (32.4)	>0.99
Current smoker	803 (29.8)	681 (28.4)	0.29	634 (29.1)	632 (29.0)	0.97
Hyperlipidemia	1535 (56.9)	1600 (66.7)	<0.001	1388 (63.7)	1396 (64.1)	0.77
Previous CABG	113 (4.2)	44 (1.8)	<0.001	51 (2.3)	44 (2.0)	0.40
Previous MI	154 (5.7)	112 (4.7)	0.10	106 (4.9)	108 (5.0)	0.95
Previous PCI	473 (17.5)	411 (17.1)	0.72	369 (16.9)	363 (16.7)	0.84

Baseline Clinical Characteristics

Unadjusted Group

Propensity Matched Group

	Unadjusted Group			Propensity Matched Group		
	Before Routine FFR (N=2699)	After Routine FFR (N=2398)	P	Before Routine FFR (N=2178)	After Routine FFR (N=2178)	P
Previous CHF	20 (0.7)	26 (1.1)	0.20	19 (0.9)	22 (1.0)	0.76
Previous stroke	153 (5.7)	149 (6.2)	0.41	131 (6.0)	126 (5.8)	0.79
Peripheral vascular Dz	46 (1.7)	59 (2.5)	0.06	46 (1.9)	44 (2.0)	0.91
Chronic renal failure	67 (2.5)	82 (3.4)	0.05	57 (2.6)	59 (2.7)	0.92
COPD	36 (1.3)	57 (2.4)	0.005	36 (1.7)	30 (1.4)	0.53
LVEF, %	58.7 ± 7.9	59.2 ± 9.1	0.09	58.7 ± 7.9	59.2 ± 9.1	0.37
Clinical presentation			0.18			0.10
Stable angina	1687 (62.5)	1552 (64.7)		1394 (64.0)	1411 (64.8)	
Unstable angina	750 (27.8)	642 (26.8)		582 (26.7)	584 (26.8)	
AMI	262 (9.7)	204 (8.5)		202 (9.3)	183 (8.4)	

Baseline Angiographic Characteristics

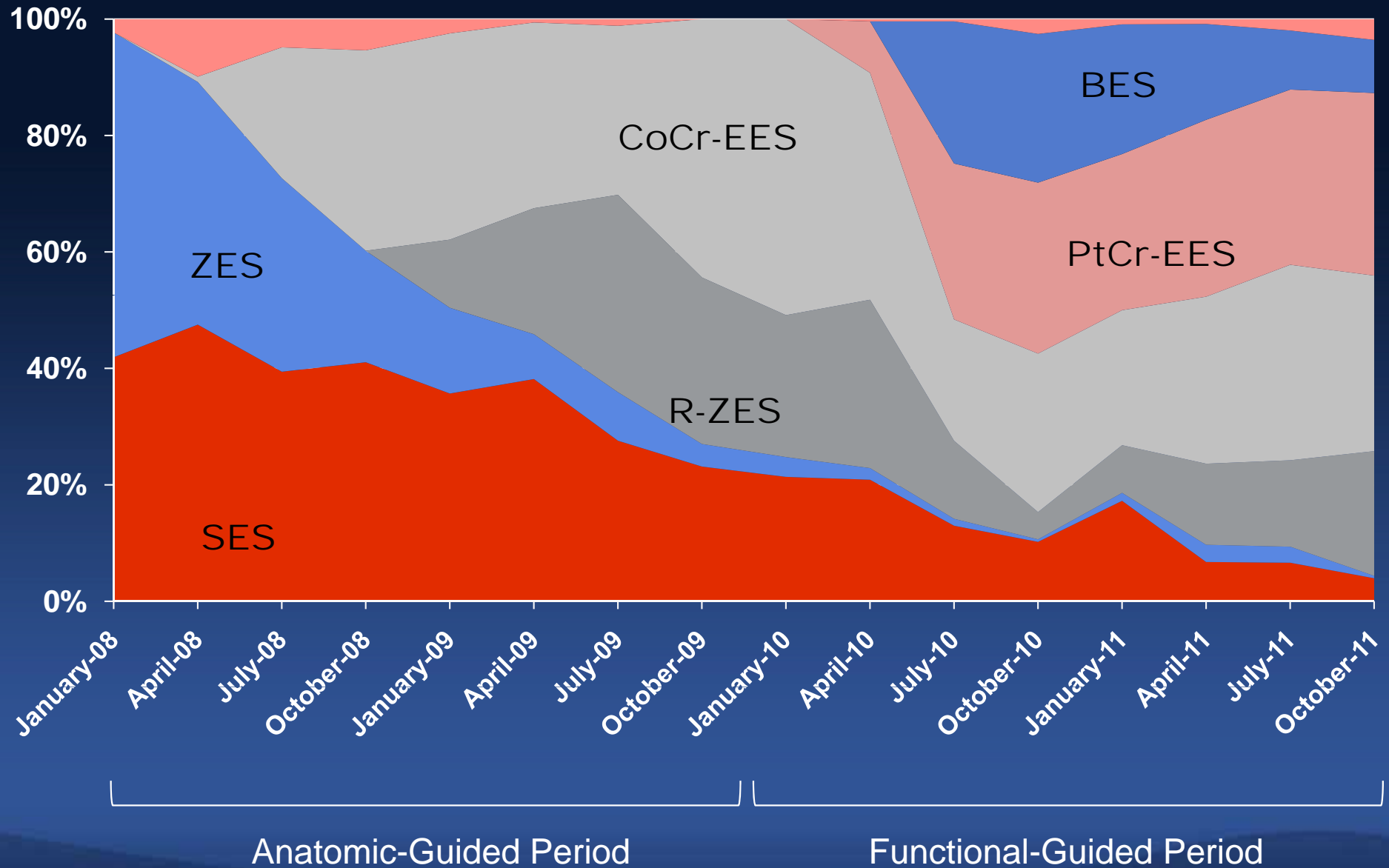
	Unadjusted Group			Propensity Matched Group		
	Before Routine FFR (N=2699)	After Routine FFR (N=2398)	P	Before Routine FFR (N=2178)	After Routine FFR (N=2178)	P
Extent			0.21			0.38
1VD	1216 (45.1)	1138 (47.5)		994 (45.6)	1051 (48.3)	
2VD	787 (29.2)	644 (26.9)		637 (29.2)	570 (26.2)	
3VD	377 (14.0)	346 (14.4)		313 (14.4)	306 (14.0)	
LMCA stenosis	319 (11.8)	270 (11.3)		234 (10.7)	251 (11.5)	
Bifurcation	1242 (46.0)	1048 (43.7)	0.10	1205 (55.3)	1200 (55.1)	0.90
Restenotic lesion	207 (7.7)	173 (7.2)	0.54	155 (7.1)	151 (6.9)	0.86
Long lesion (>20mm)	2215 (82.1)	1879 (78.4)	0.001	1742 (80.0)	1748 (80.3)	0.84
CTO	148 (5.5)	177 (7.4)	0.006	141 (6.5)	129 (5.9)	0.48
Calcified lesion	214 (7.9)	157 (6.5)	0.06	147 (6.7)	144 (6.6)	0.90

Procedural Characteristics

Propensity Score Matched Population

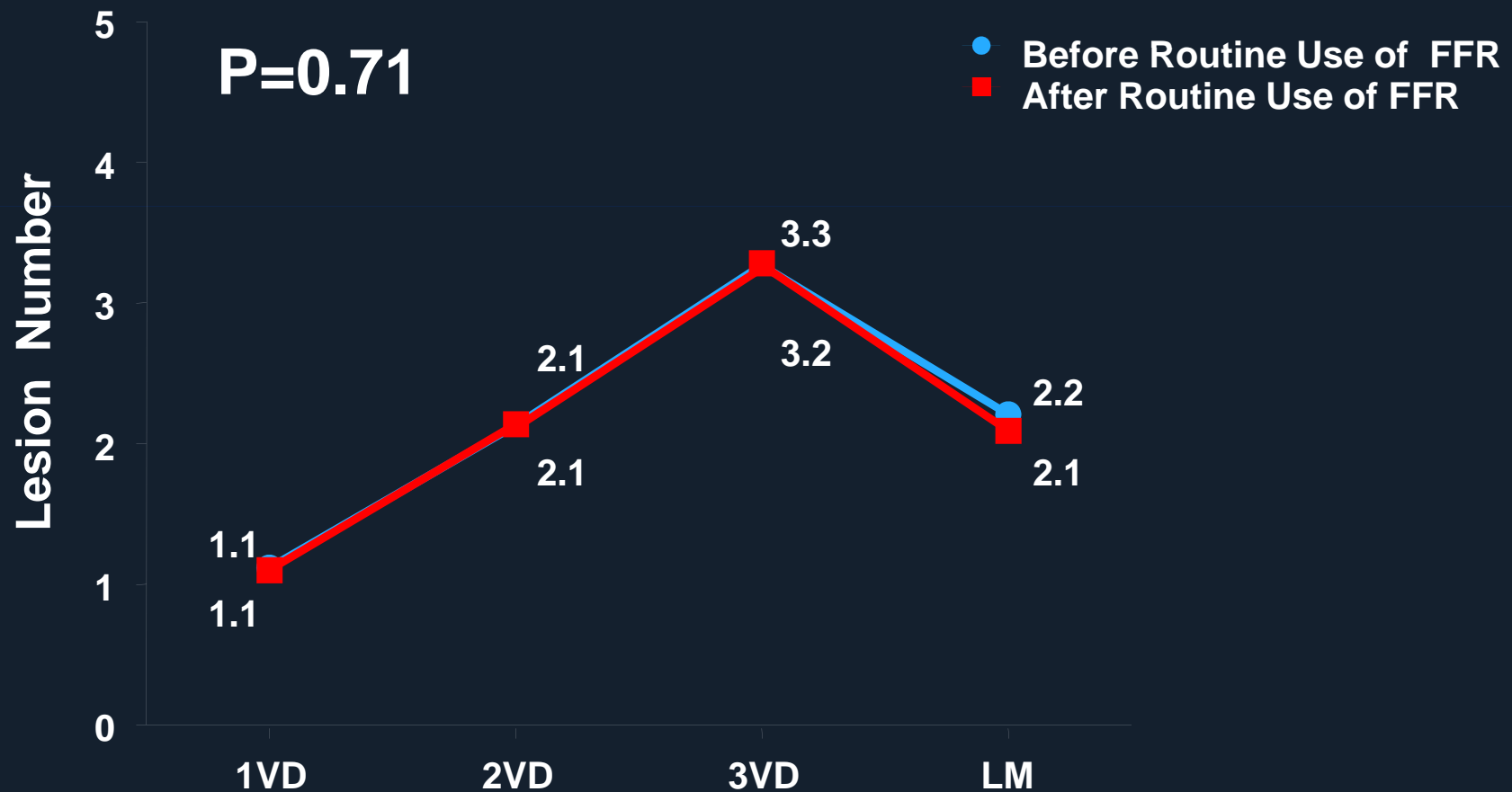
	Before Routine FFR (N=2178)	After Routine FFR (N=2178)	P value
Fractional flow reserve	47 (2.2)	1093 (50.2)	<0.001
Intravascular ultrasound	1967 (90.3)	2114 (97.1)	<0.001
No. of lesions	1.8±0.9	1.8±1.0	0.71
Average stent diameter, mm	3.3±0.3	3.3±0.4	0.31
No. of treated lesions	1.4±0.7	1.1±0.8	<0.001
No. of stents	2.1±1.3	1.5±1.2	<0.001
Total stent length, mm	53.7±36.1	40.1±34.1	<0.001
Multivessel stenting	772 (35.4)	563 (25.8)	<0.001

Type of DES

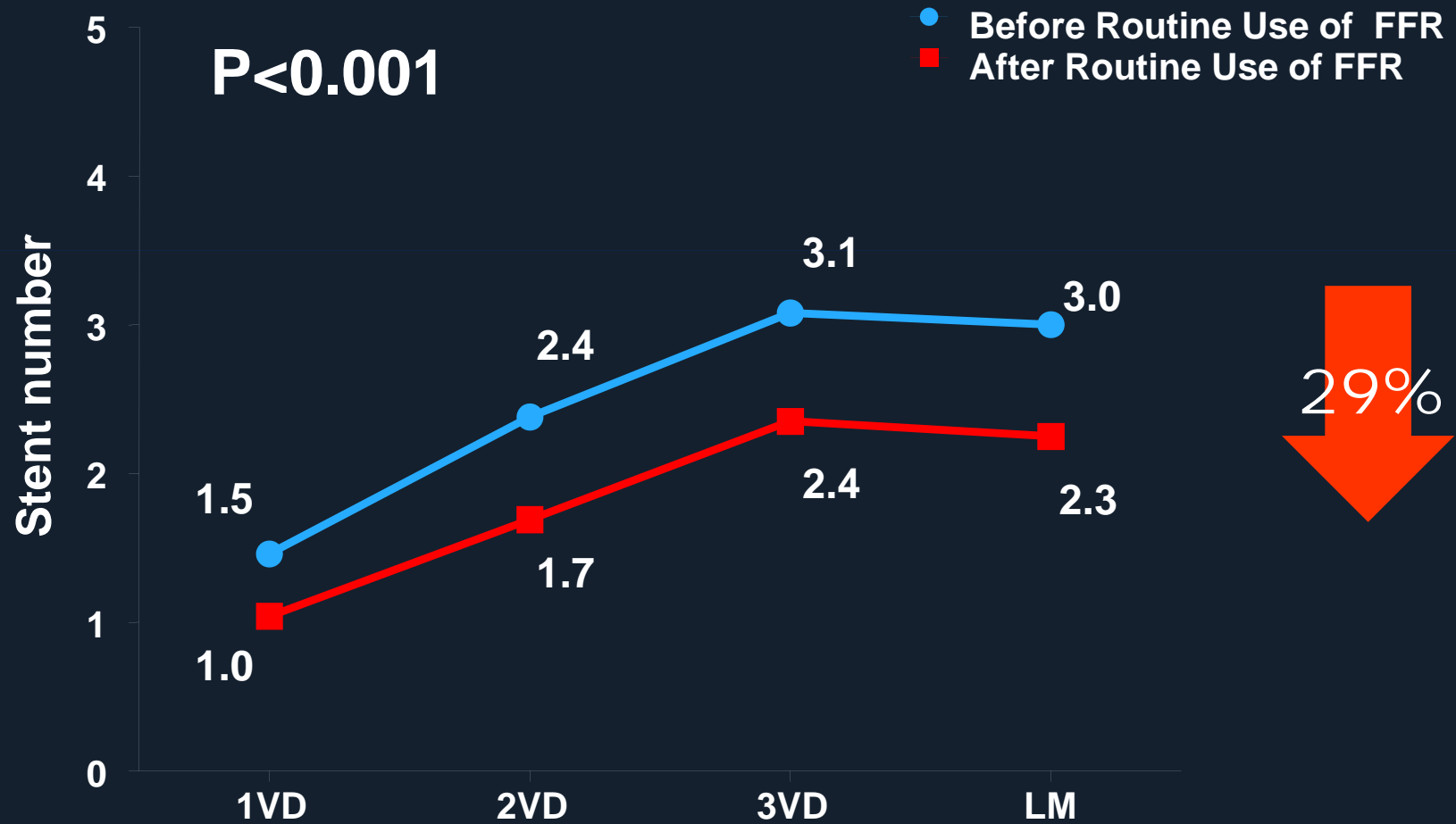


Results

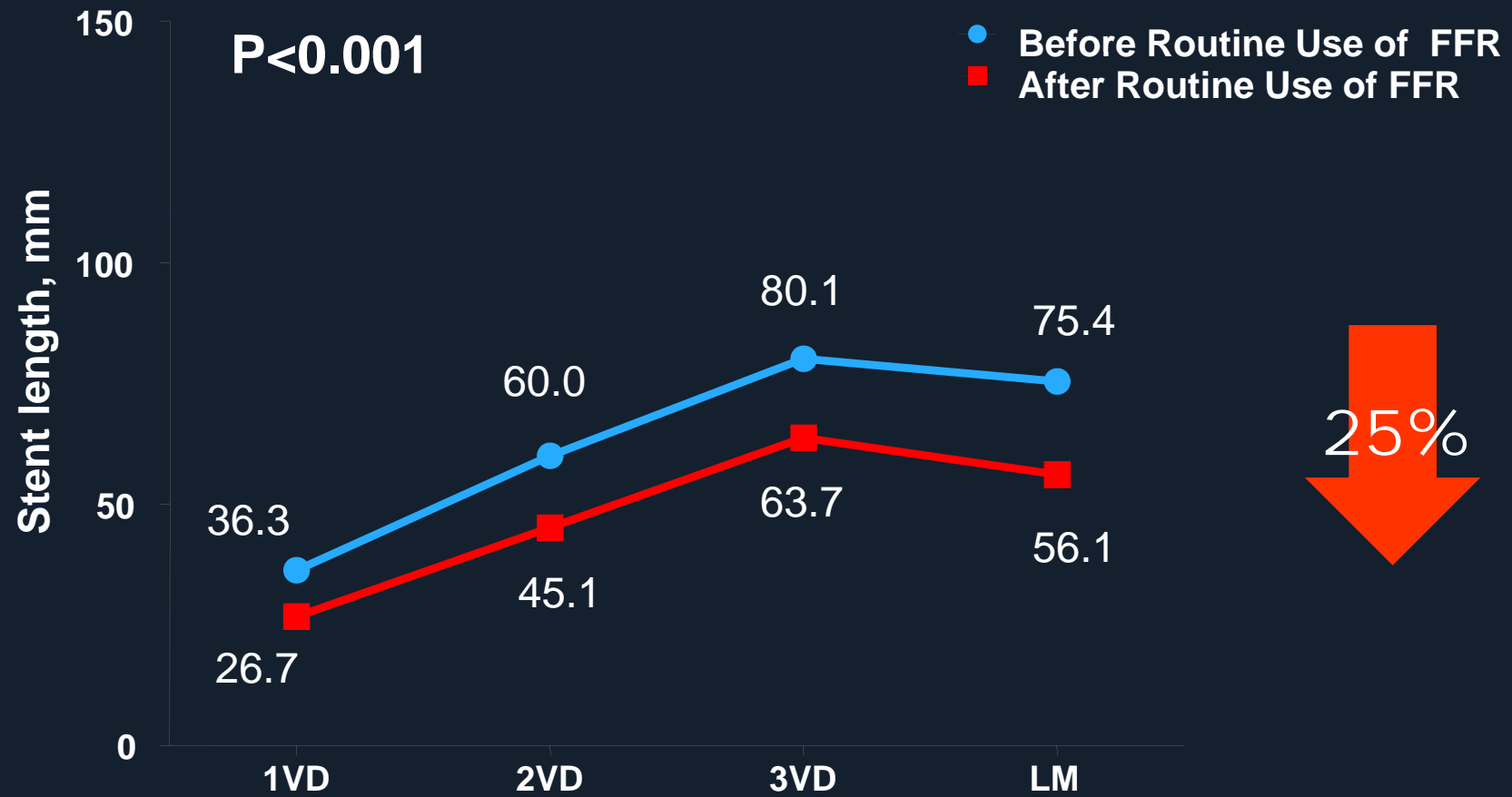
Angiographic Assessed Lesion Number



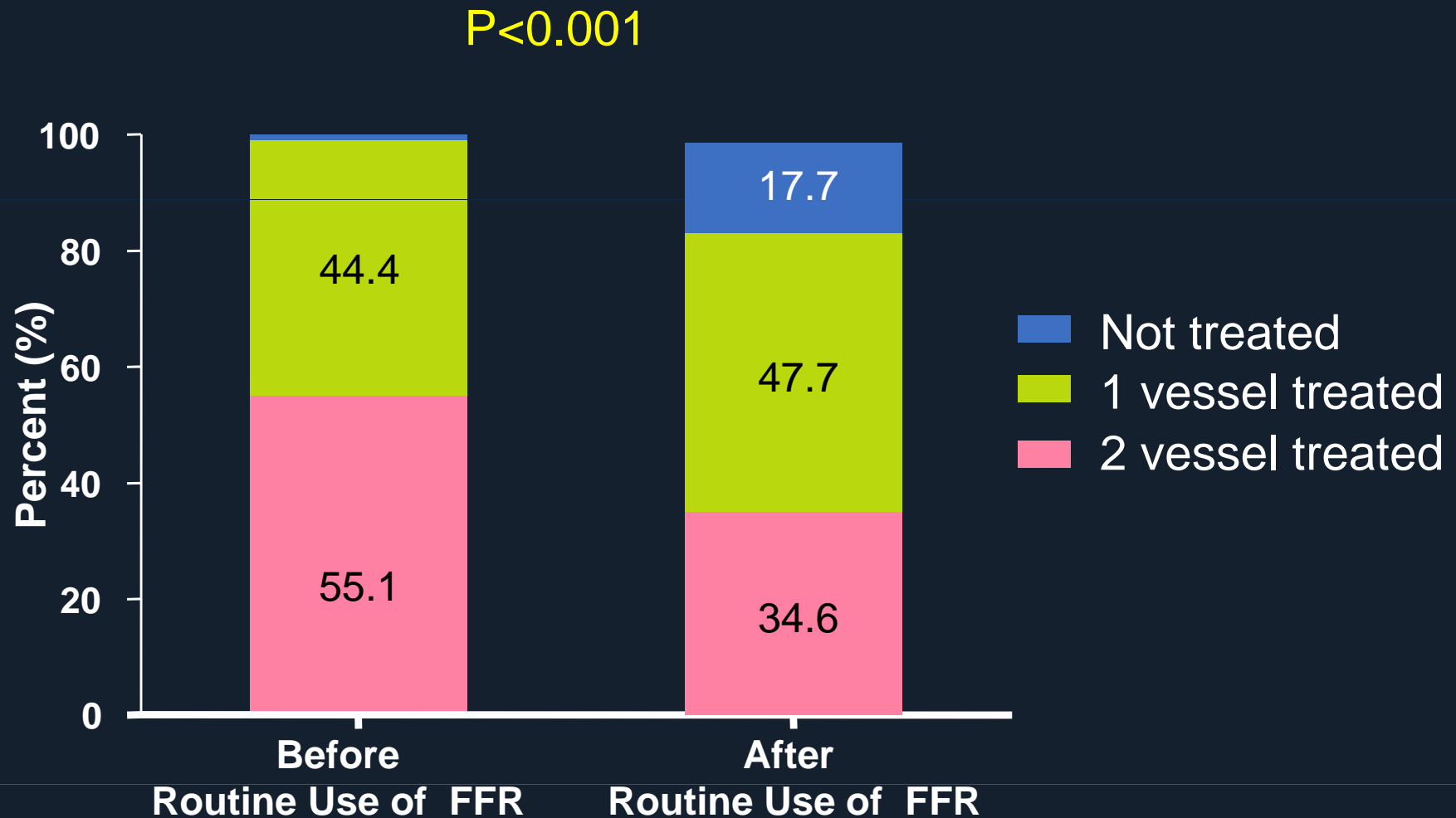
Stent Number



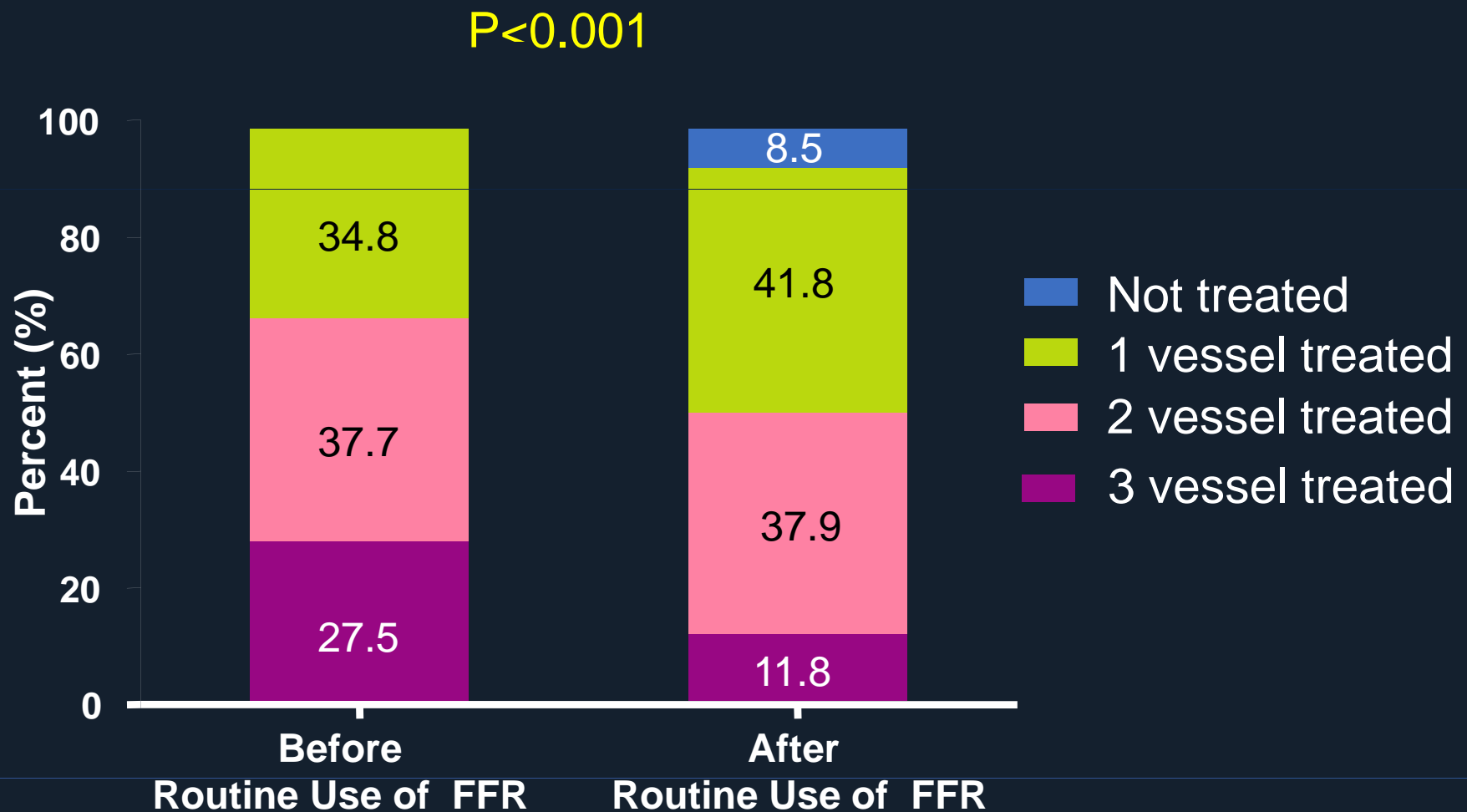
Stent Length



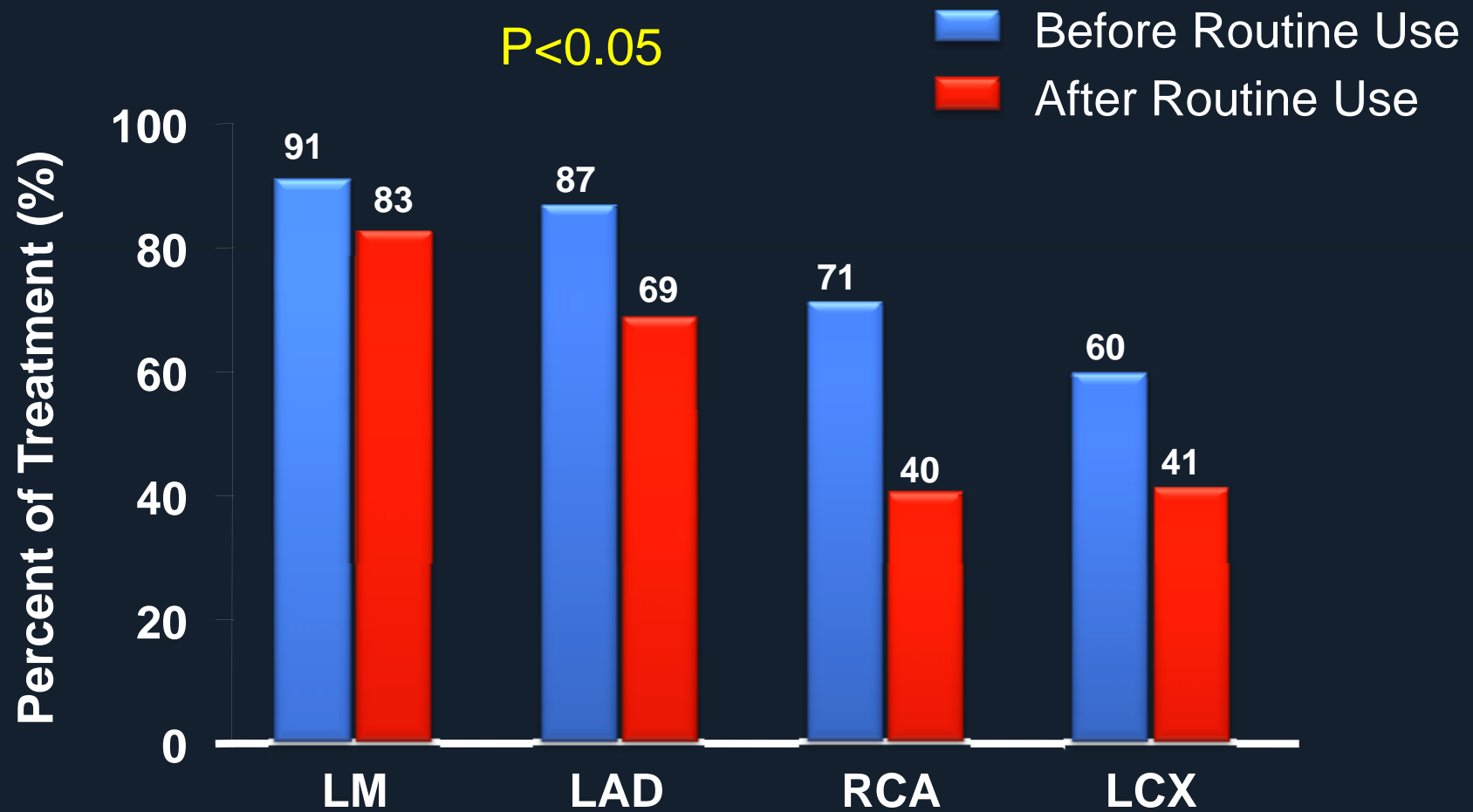
Angiographic 2 Vessel Disease



Angiographic 3 Vessel Disease

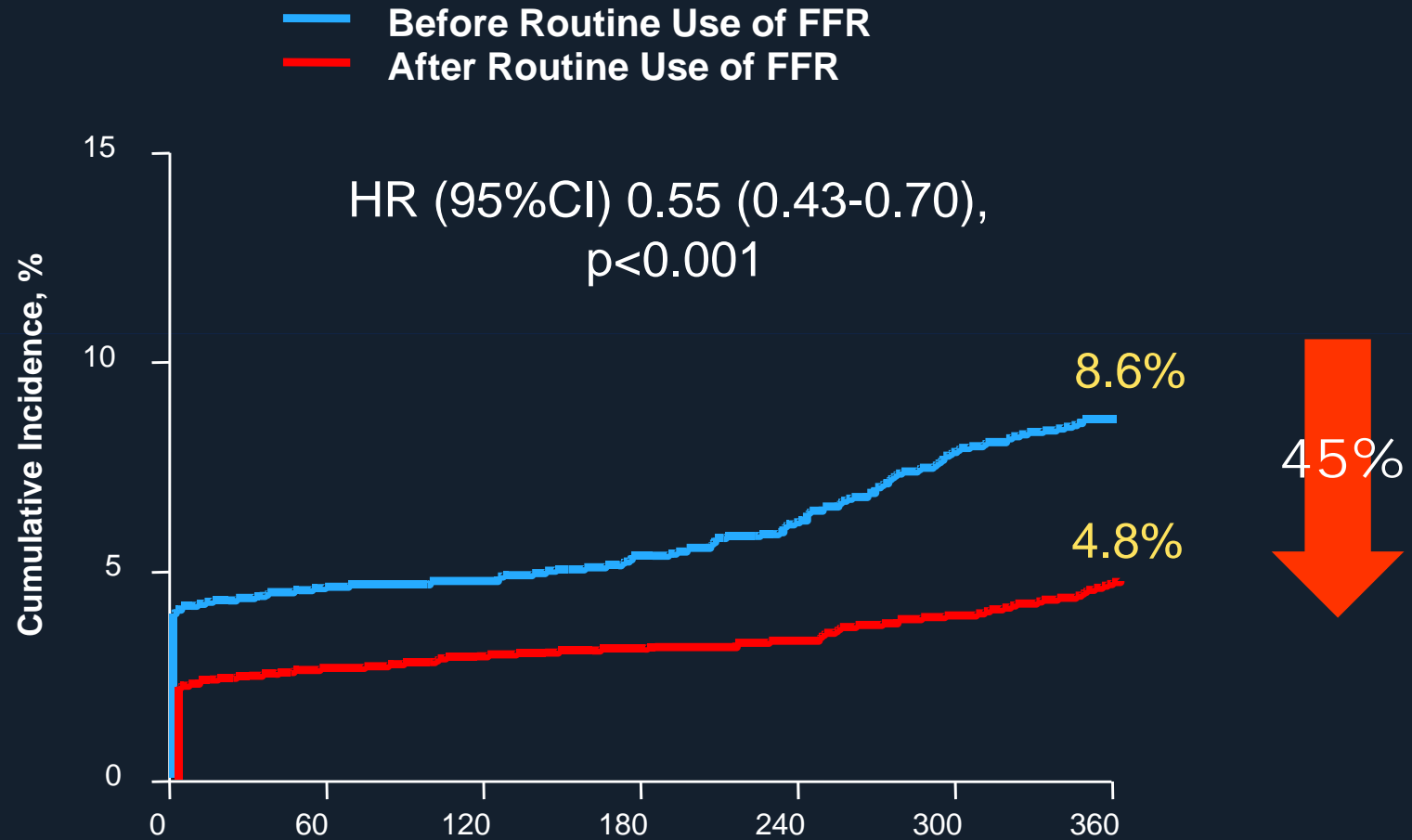


Treated Vessel Territory



Primary End Point

(Death, MI, or Repeat Revascularization)

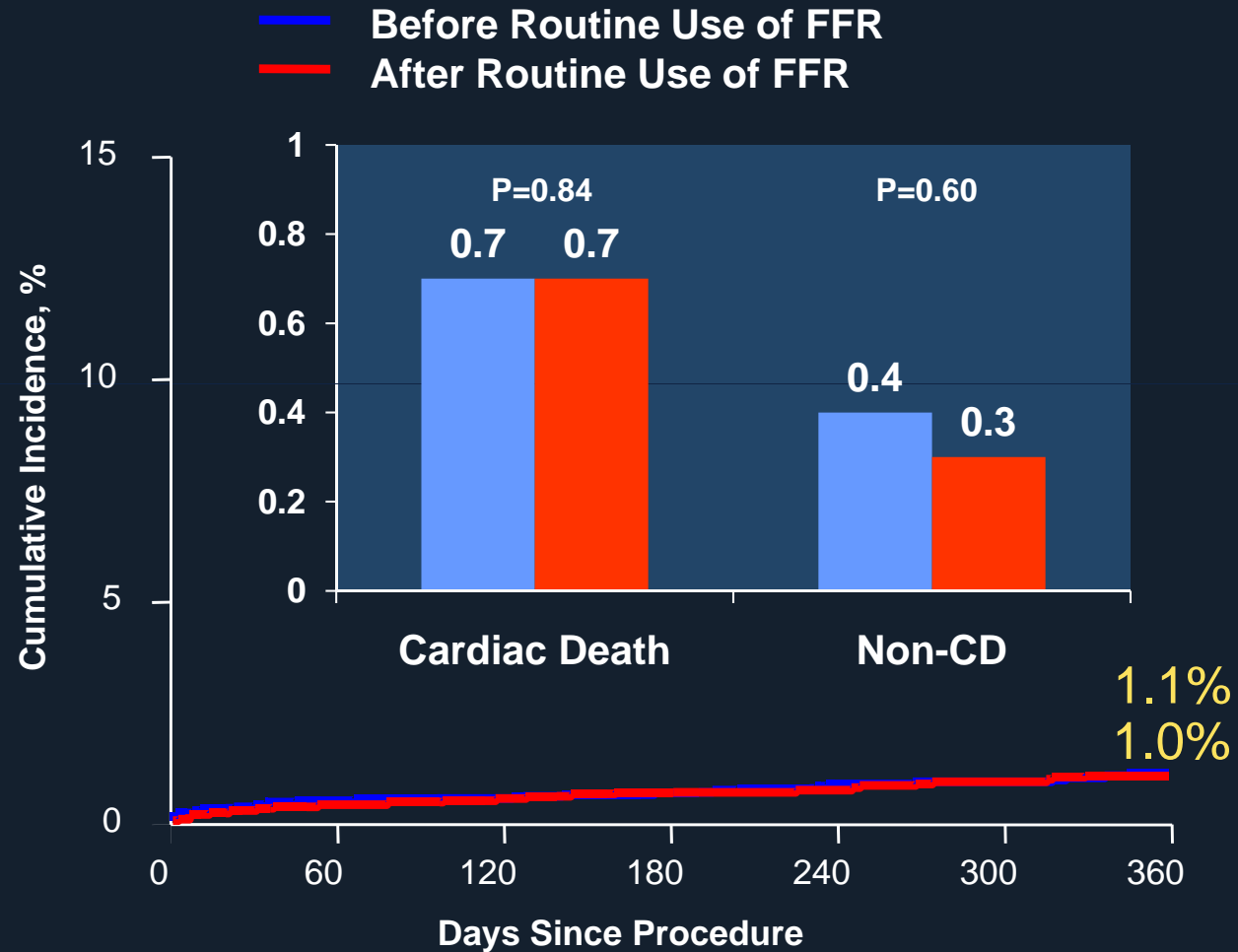


No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	2178	2066	2011	1960			
After Routine Use	2178	2092	2067	2037			

Propensity Score Matched Population

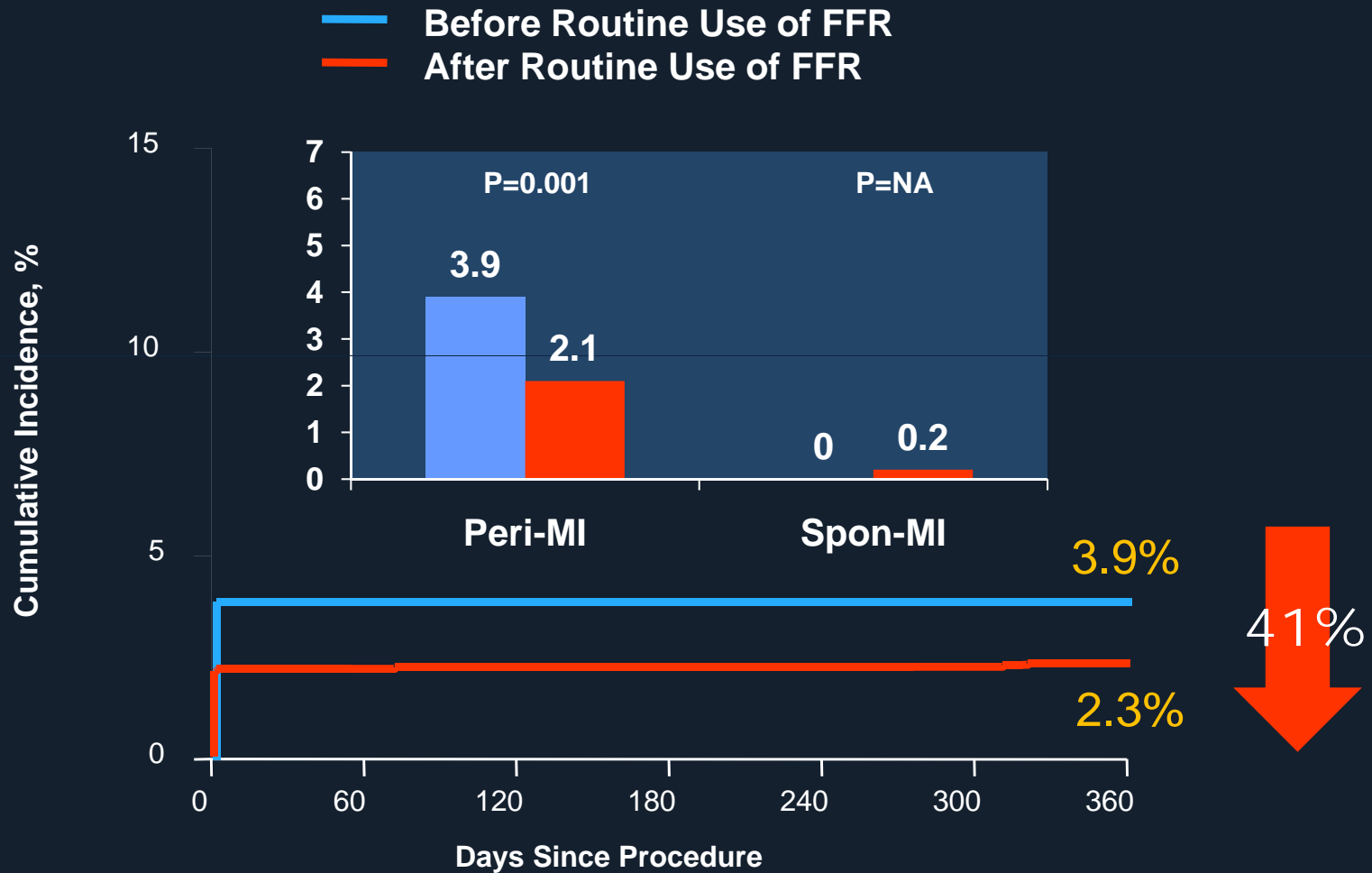
Death



No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	2178		2156		2126		2121
After Routine Use	2178		2143		2120		2113

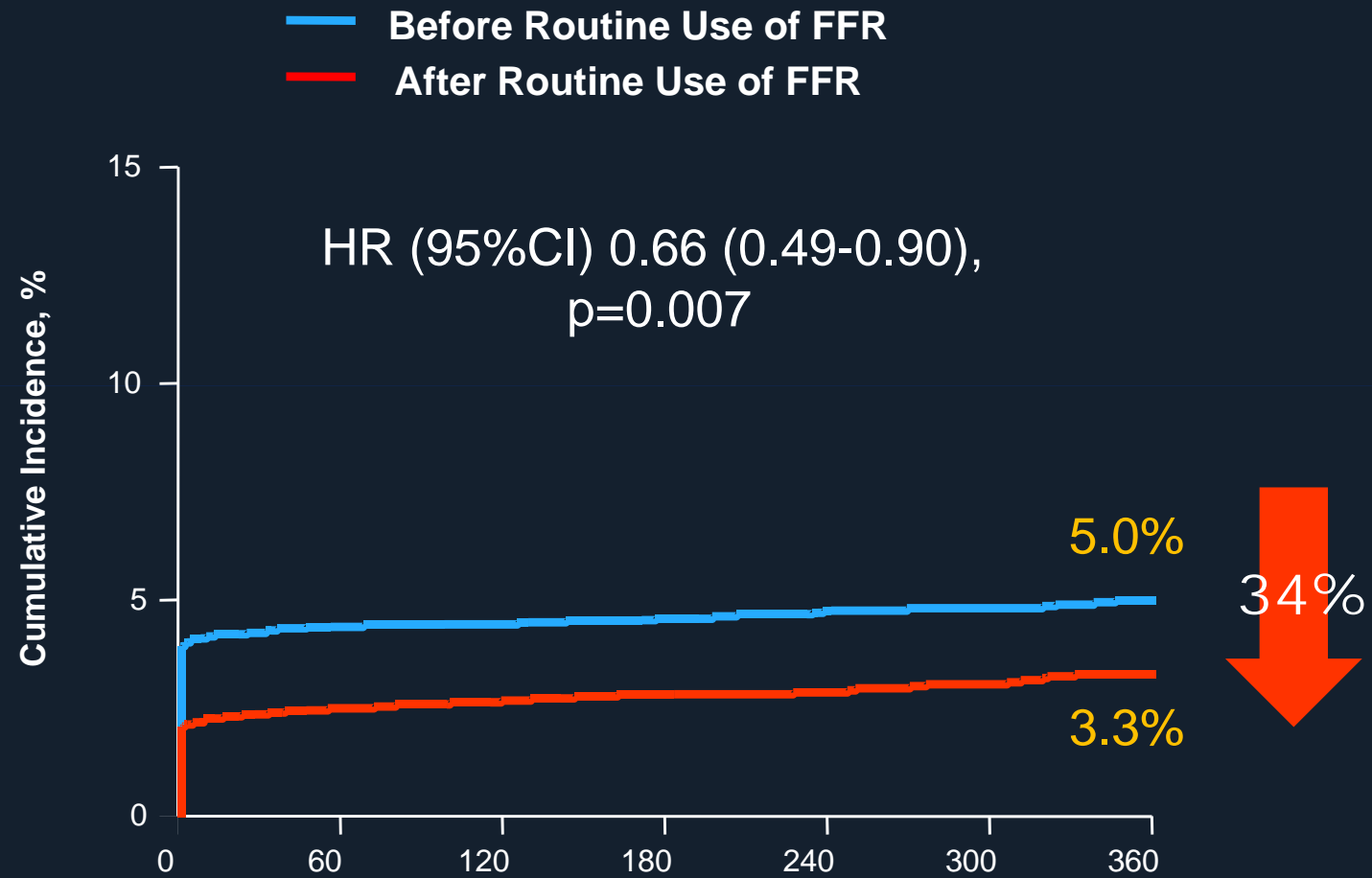
Myocardial Infarction



No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	2178	2071	2041	2036			
After Routine Use	2178	2098	2075	2066			

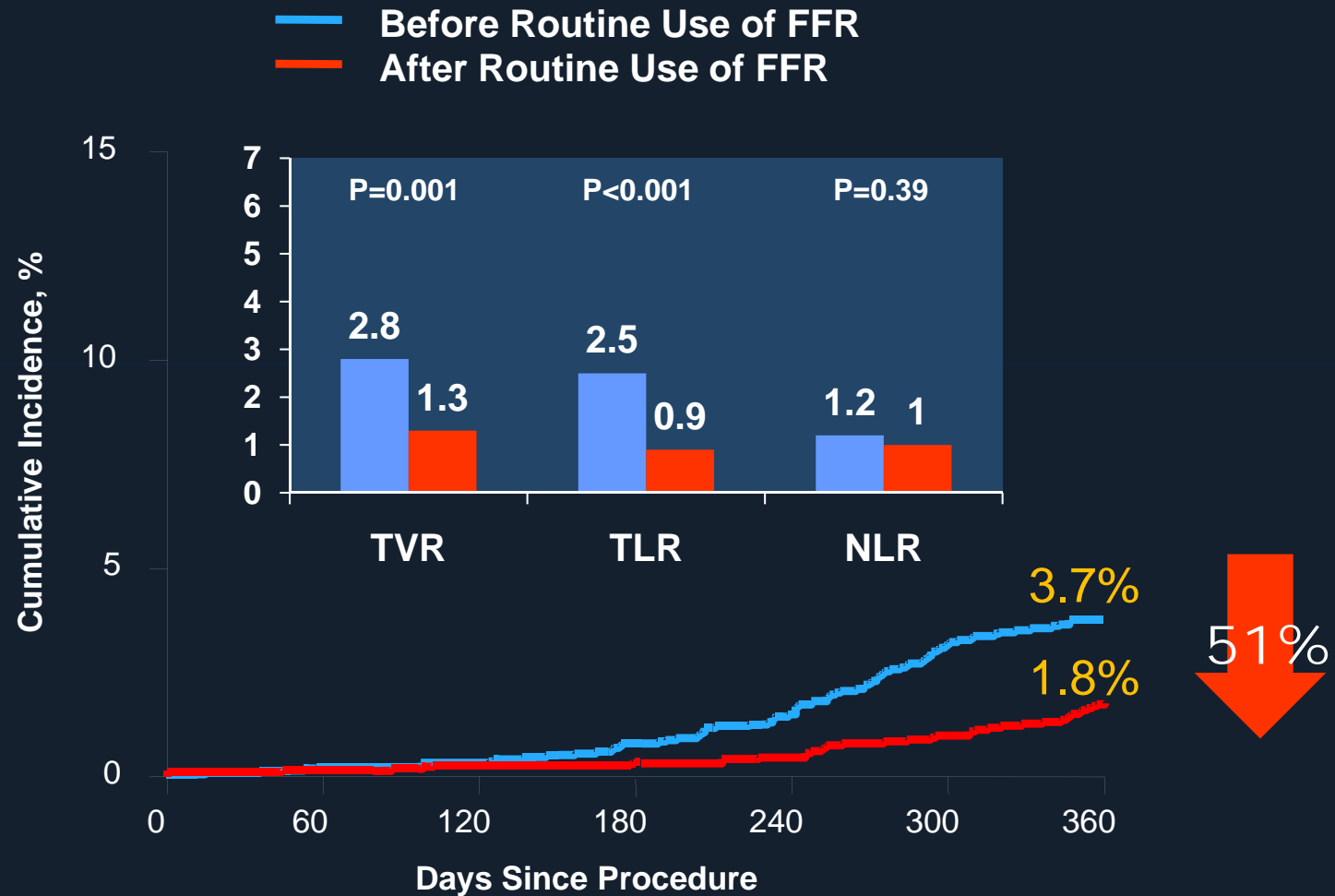
Death or Myocardial Infarction



No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	2178	2071	2041	2041	2036	2036	2036
After Routine Use	2178	2098	2075	2066	2066	2066	2066

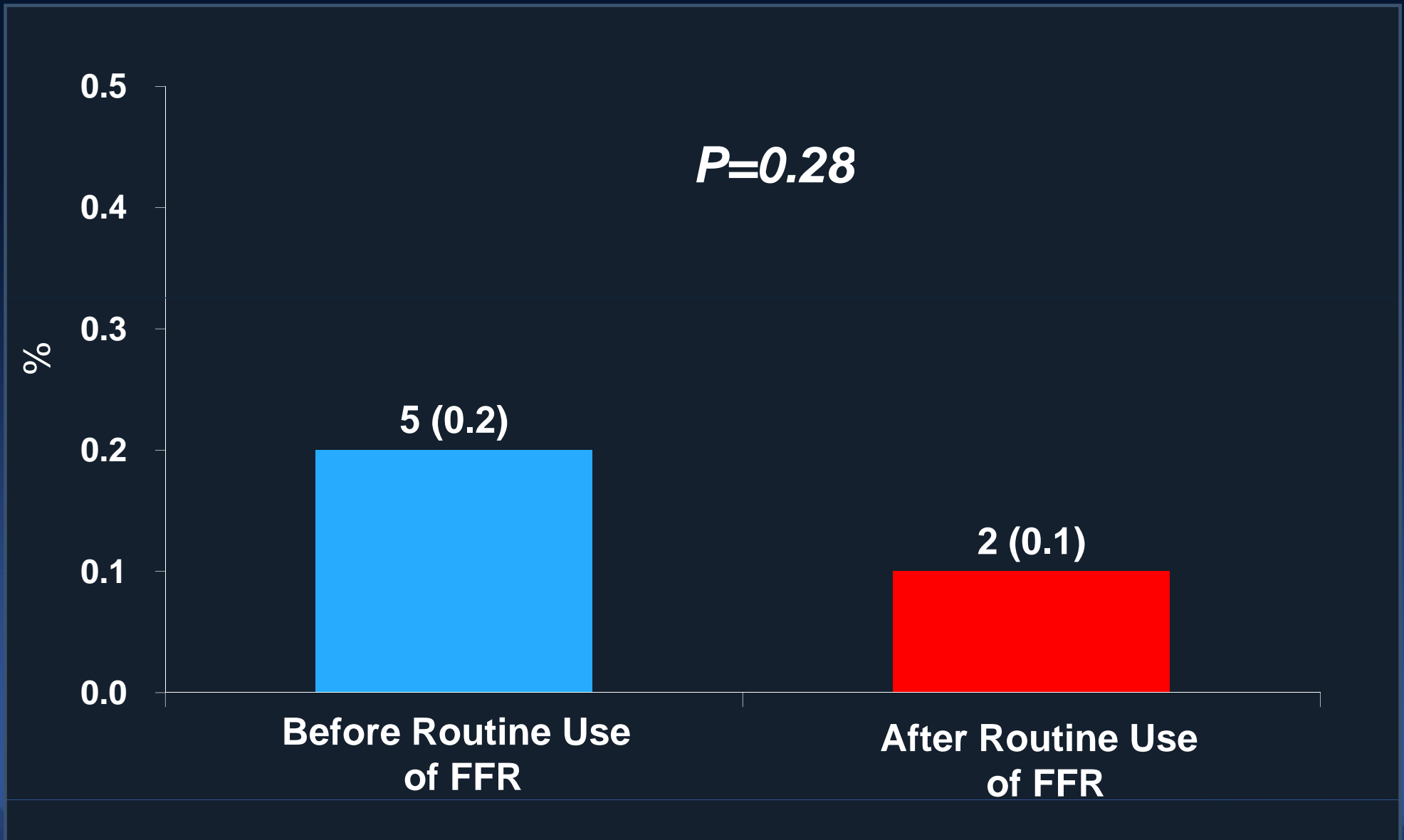
Repeat Revascularization



No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	2178		2151		2095		2048
After Routine Use	2178		2136		2110		2083

Stent Thrombosis at 12 Months*



* ARC defined definite and probable stent thrombosis
CardioVascular Research Foundation

One-Year Outcomes of Defer

FFR was measured in 1267 patients (1551 lesions) during study period

Deferred of PCI

475 patients (575 lesions)

Performed PCI at any lesion

792 patients (976 lesions)

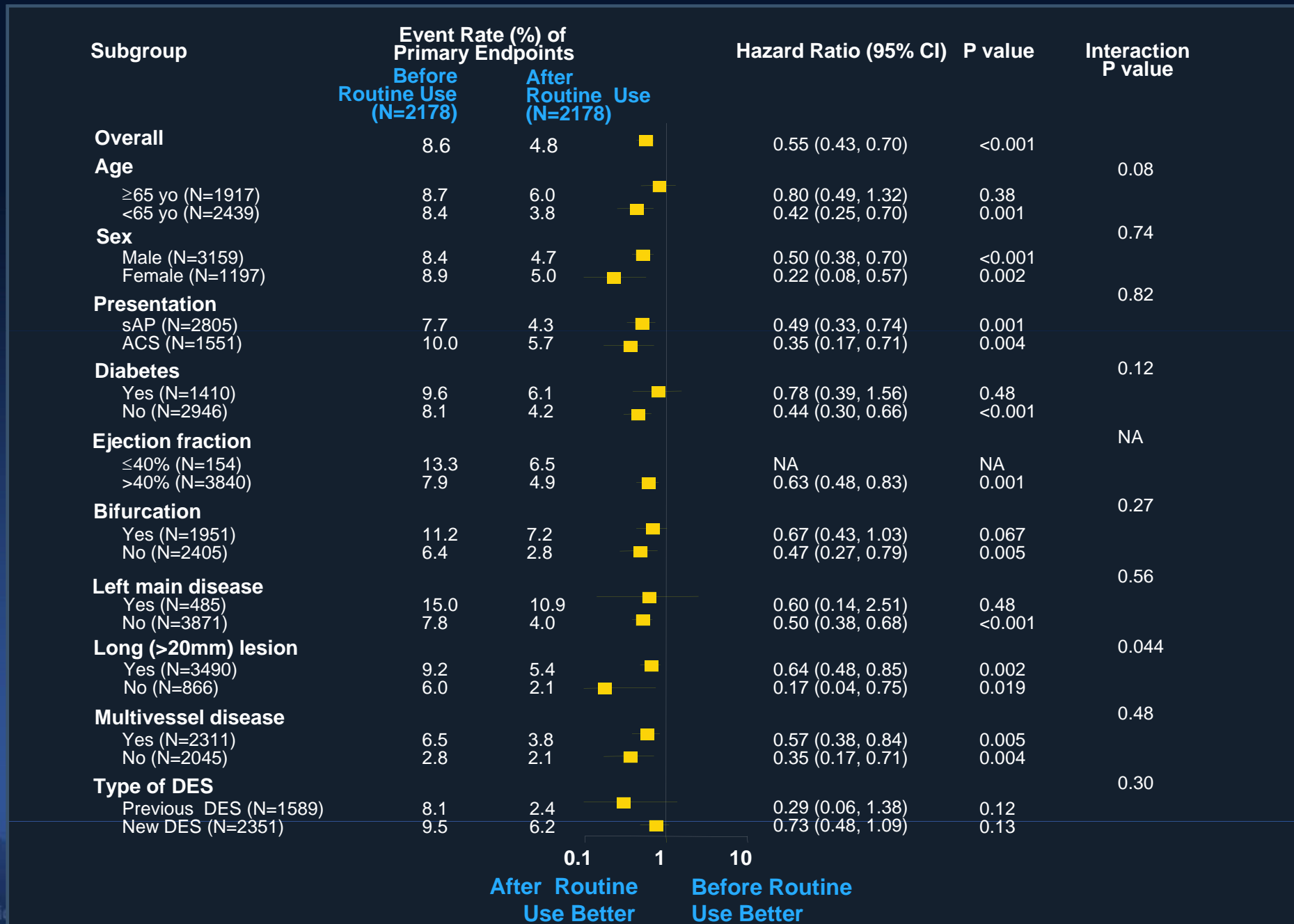
412 lesions deferred,
564 lesions stented

1 year clinical outcomes

Non-cardiac death: 1 patient (0.2%)
Repeat revascularization: 2 patients (0.4%)
(3 deferred lesions, 0.5%)

Death : 3 patients (0.4%)
(Cardiac 1, Non-cardiac 2)
Repeat revascularization: 19 patients (1.9%)
(18 stented lesions 3.2%, 3 deferred lesions 0.7%)

Subgroup Analysis



Independent Predictors of Primary End Point

	Hazard Ratio (95% CI)	P value
Chronic renal failure	2.41 (1.61-3.59)	<0.001
Multivessel disease	1.89 (1.45-2.46)	<0.001
Peripheral vascular disease	1.84 (1.07-3.17)	0.027
Bifurcation lesion	1.37 (1.09-1.71)	0.006
Acute coronary syndrome	1.37 (1.10-1.69)	0.004
Total stent length per patient	1.01 (1.00-1.01)	<0.001
Fractional flow reserve	0.72 (0.53-0.98)	0.036
Intravascular ultrasound	0.57 (0.40-0.81)	0.002

**Absolutely Lower Rate of
Death, MI and Any MACE in AMC Data.**

Why ?

**Additive Impact
of Routine Use of IVUS (98%)
In Our Practice !**

Meta-Analysis **IVUS vs. CAG Guided PCI**

**A total of 23,392 patients
(2 randomized trial and 12 observational studies)**

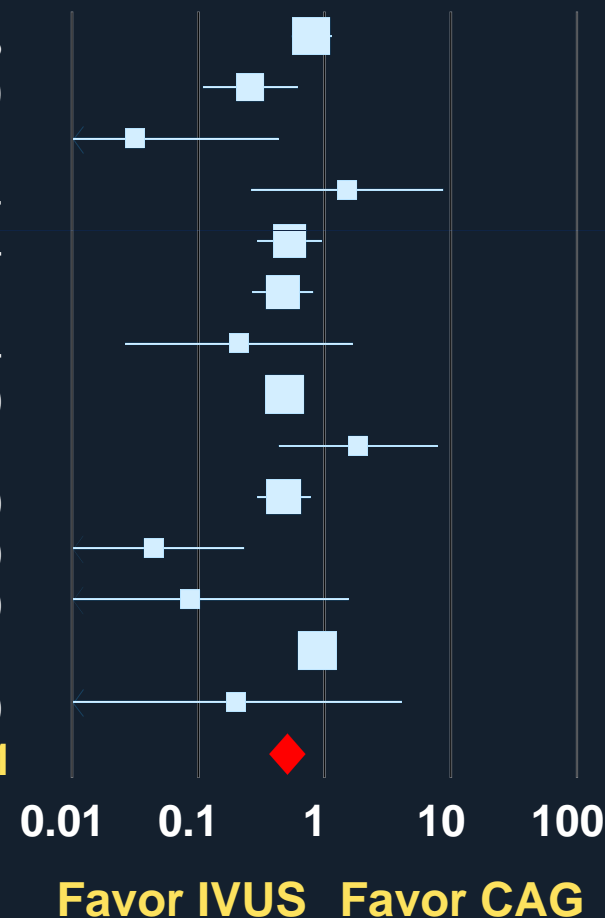
Park SJ, Ahn JM, Unpublished Data, 2013

Death from Any Causes

Study name Time point Statistics for each study Odds ratio and 95% CI

		OR	LL	UL	Z-Value	P
Roy	2008	0.79	0.54	1.16	-1.20	0.23
MAIN-COMPARE	2009	0.26	0.11	0.63	-2.98	0.00
Kim	2010	0.03	0.00	0.44	-2.57	0.01
HOME DES IVUS	2010	1.52	0.26	8.87	0.46	0.64
MATRIX	2011	0.53	0.29	0.97	-2.07	0.04
COBIS	2011	0.47	0.26	0.83	-2.62	0.01
Youn	2011	0.21	0.03	1.70	-1.46	0.14
Hur	2012	0.49	0.36	0.66	-4.60	0.00
EXCELLENT	2012	1.84	0.42	7.99	0.82	0.41
Ahn	2012	0.48	0.29	0.79	-2.88	0.00
Patel	2012	0.04	0.01	0.24	-3.66	0.00
Chen	2012	0.09	0.00	1.58	-1.65	0.10
ADAPT-DES	2012	0.88	0.64	1.20	-0.82	0.41
AVIO	2013	0.20	0.01	4.17	-1.04	0.30
Random pooled estimate		0.50	0.36	0.69	-4.10	<0.001

I²=63



IVUS vs. Angio-Guided PCI

(Meta-analysis n=23,392)

Relative

Death/MI, Benefit !

IVR	↓ 22%	0.02
Stent Thrombosis	↓ 45%	<0.001

Park SJ, Ahn JM et al. Unpublished data, 2013

Why Absolutely Lower Rate of Death, MI and Any MACE in AMC Data ?

We Maximized the Synergetic Incorporation of FFR (58%) and IVUS (98%) in Our Practice !

Conclusion

1. FFR-guided PCI significantly reduced that the risks of death, MI, or repeat revascularization at 1 year in a real-world patient population.
2. The benefit is primarily due to a reduced number of stents used per patients and a subsequent decreased risk of peri-procedural MI and repeat revascularization.

Conclusion

3. Profound reduction of stent used was observed in the territory of RCA and LCX, which can be explained by the higher incidence of “visual-functional mismatch” in this territory (relatively small myocardium).
4. The routine measurement of FFR in daily practice appeared to be associated with a more judicious use of stent implantation and improvement in clinical outcomes at 1 year.