Impact of FFR In Real Practice, Outcomes of PCI and Treatment for 3-Vessel and Left Main Disease

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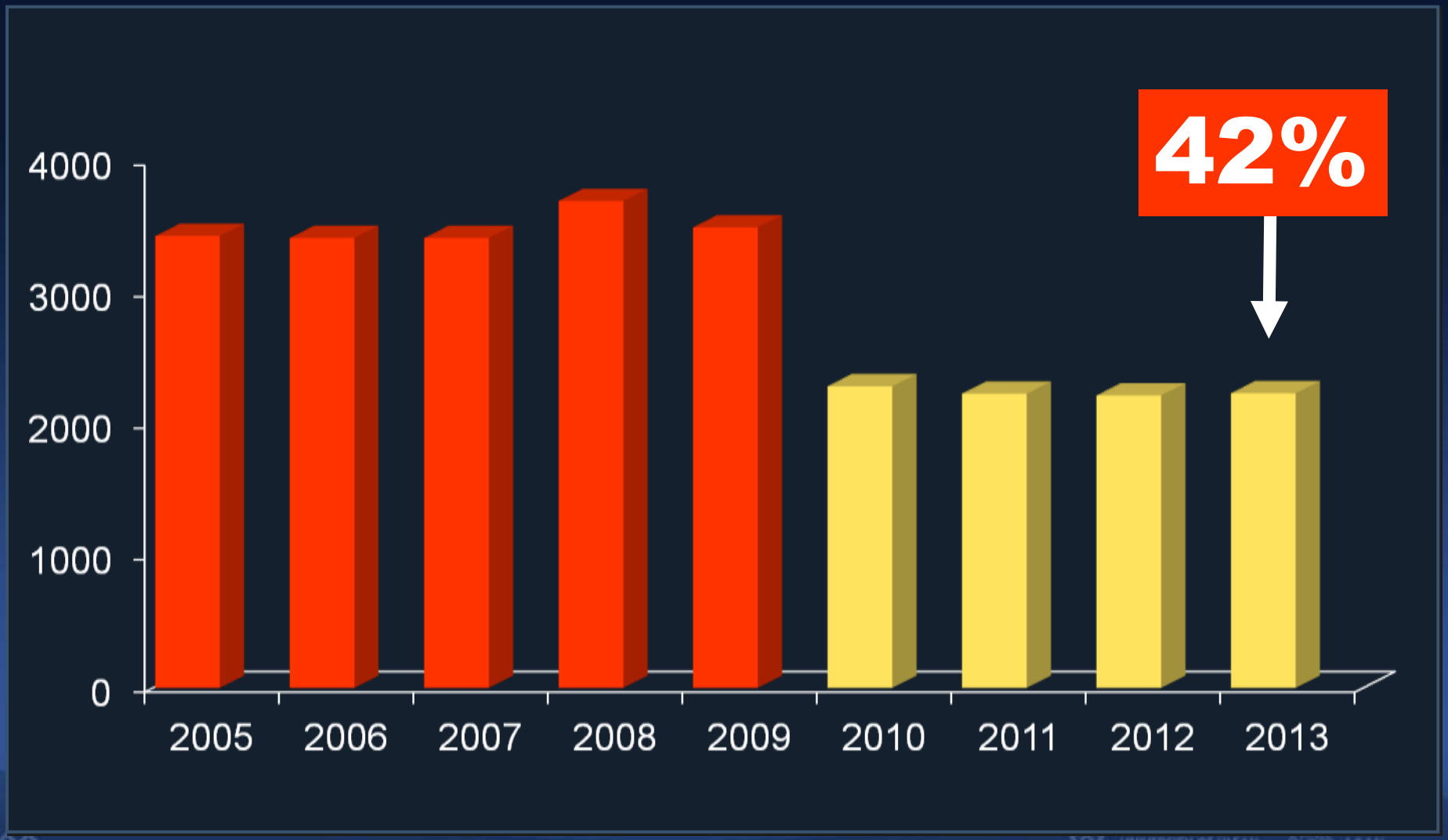
2013, ESC Guidelines

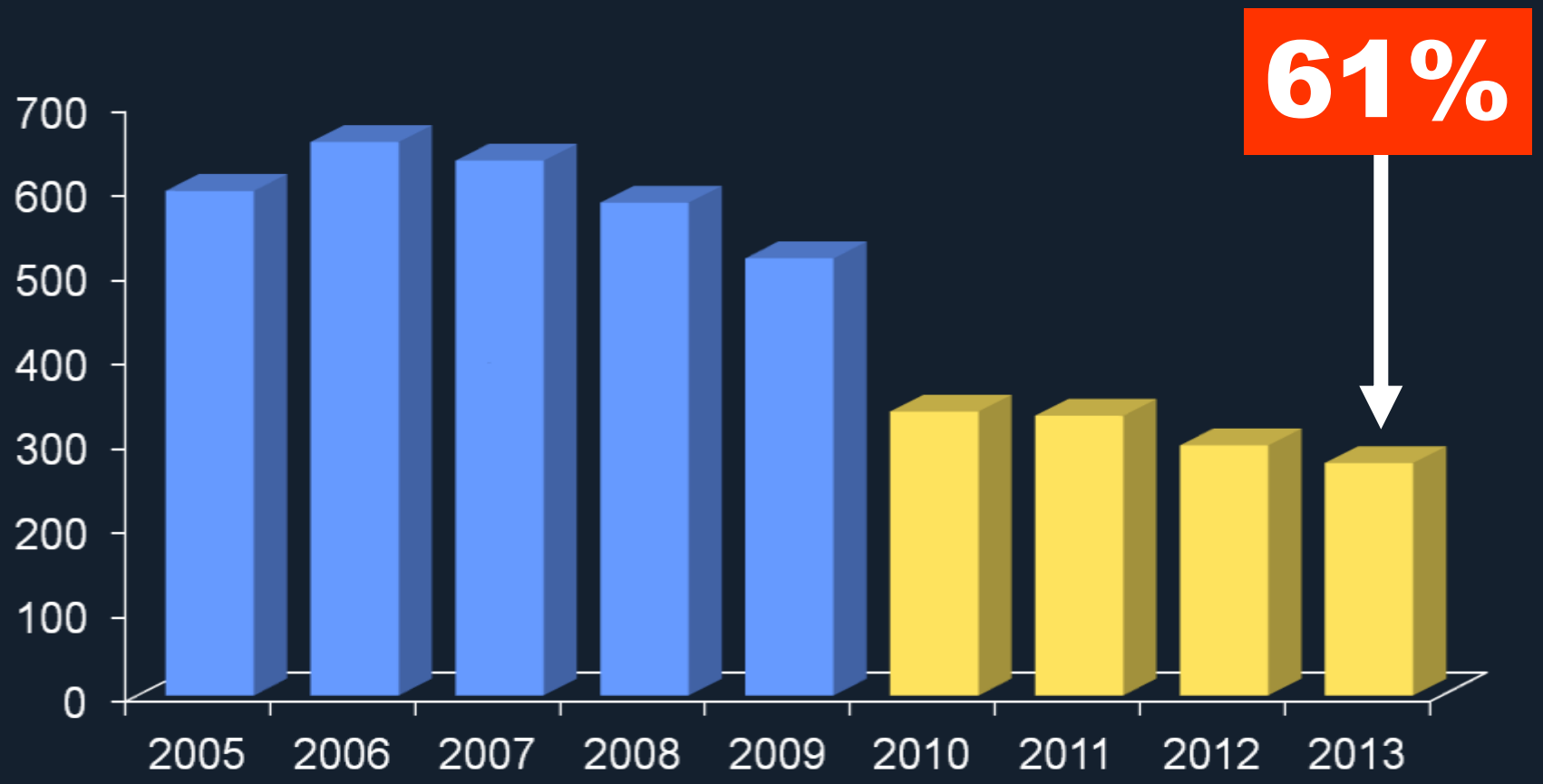
Recommendations	Class	Level
FFR is recommended to identify hemodynamically relevant coronary lesion(s) when evidence of ischemia is not available.	I	A
Revascularization of stenosis with FFR <0.80 is recommended in patients with angina symptoms or a positive stress test.	I	B
Revascularization of an angiographically intermediate stenosis without related ischemia or without FFR <0.80 is not recommended.	III	B

Impact of FFR
In Real Practice *At AMC*

Number of Stent Decreased



Number of CABG Decreased

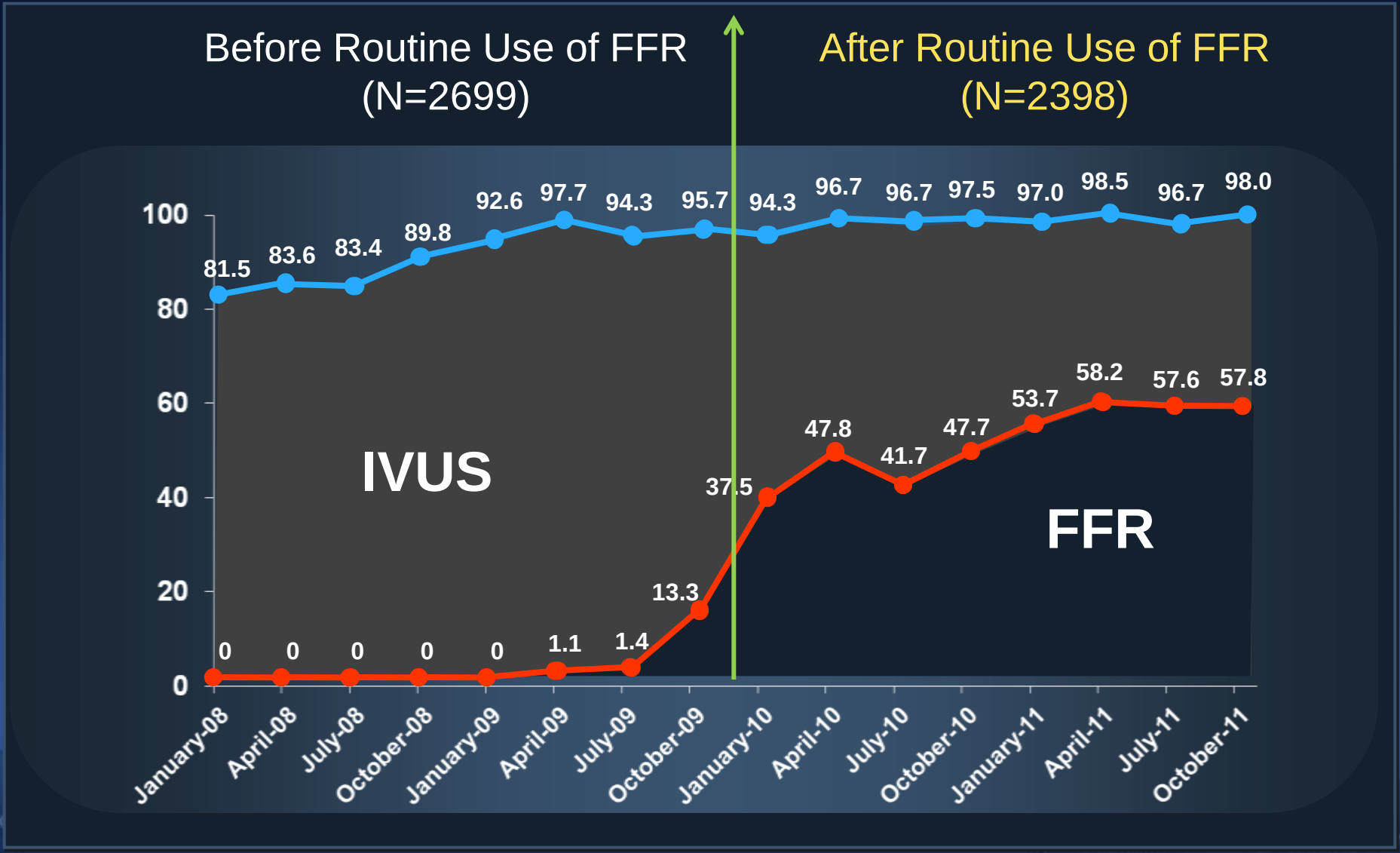


Impact of Routine Use of FFR for PCI Outcomes.

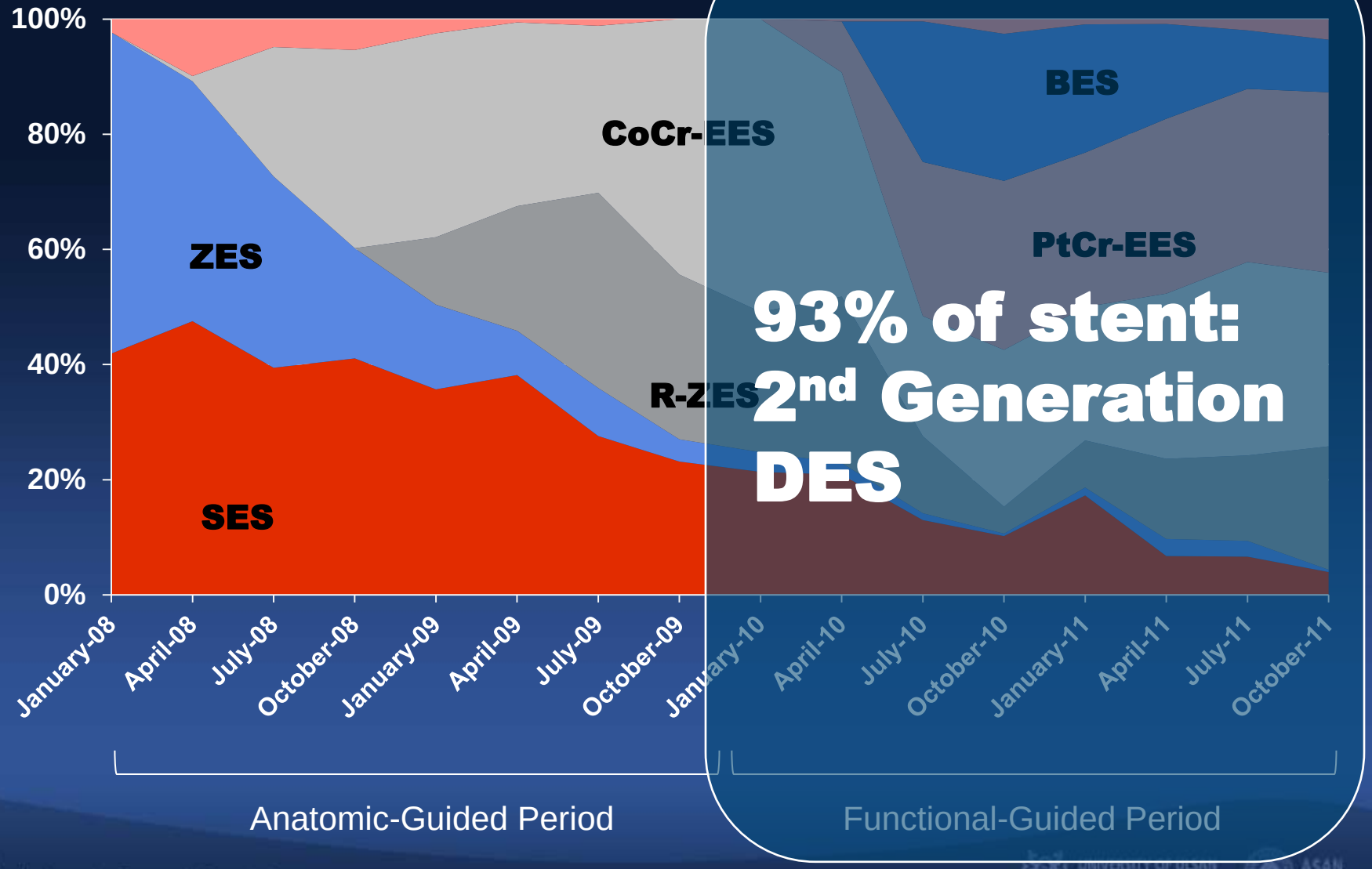
Data from ASAN PCI Registry (1)

Park SJ, European Heart Journal. 2013 Nov;34(43):3353-61.

Integrated Use of FFR and IVUS
(AMC data, n=5,097)



Type of DES


100%
80%
60%
40%
20%
0%
ZES
SES
CoCr-EES
R-ZES
BES
PtCr-EES
93% of stent: 2nd Generation DES
January-08
April-08
July-08
October-08
January-09
April-09
July-09
October-09
January-10
April-10
July-10
October-10
January-11
April-11
July-11
October-11
Anatomic-Guided Period
Functional-Guided Period

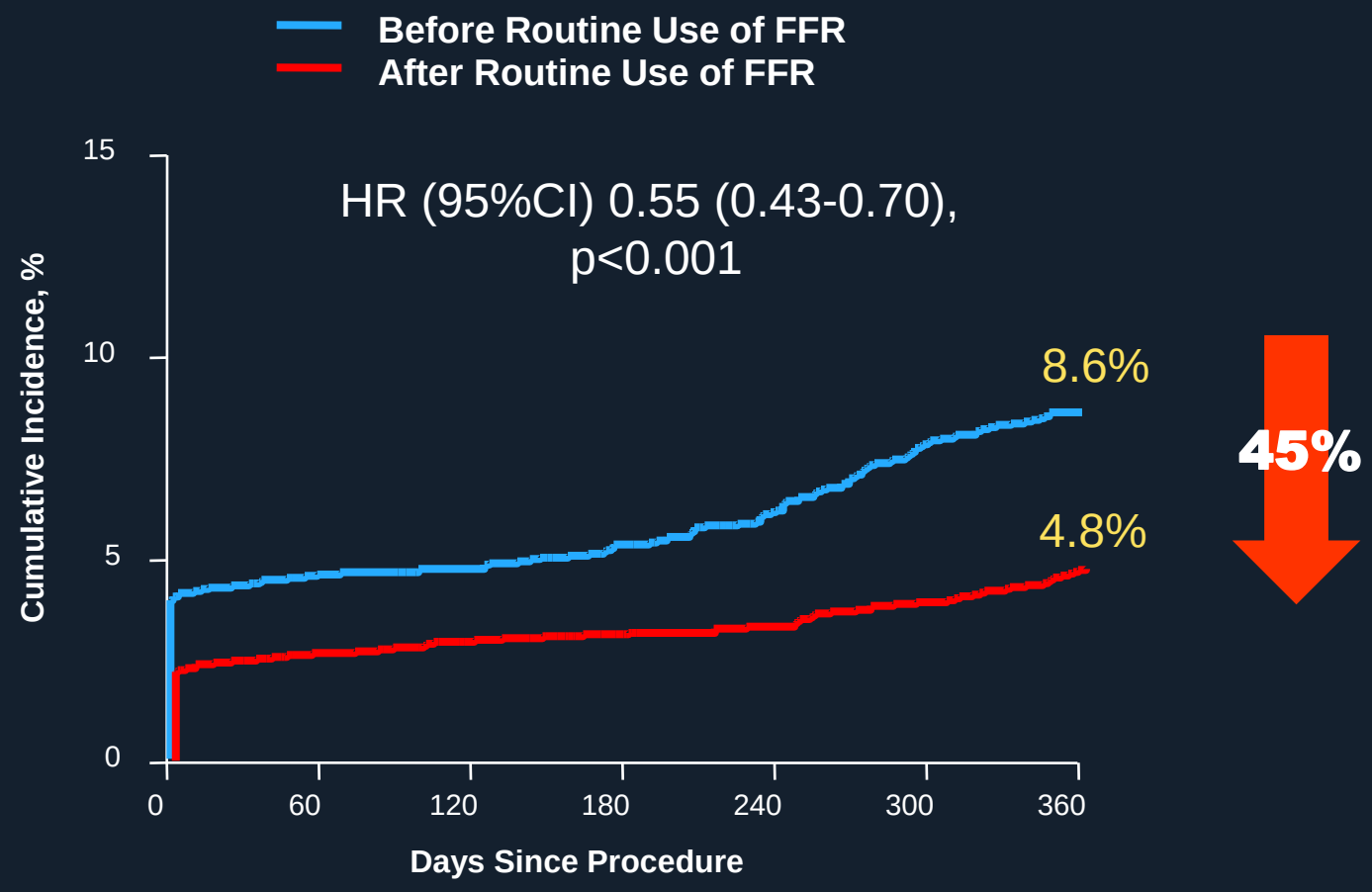
Results

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

Primary End Point
(Death, MI, or Repeat Revascularization)



No. at Risk

Before Routine Use	2178	2066	2011	1960
After Routine Use	2178	2092	2067	2037

Propensity Score Matched Population

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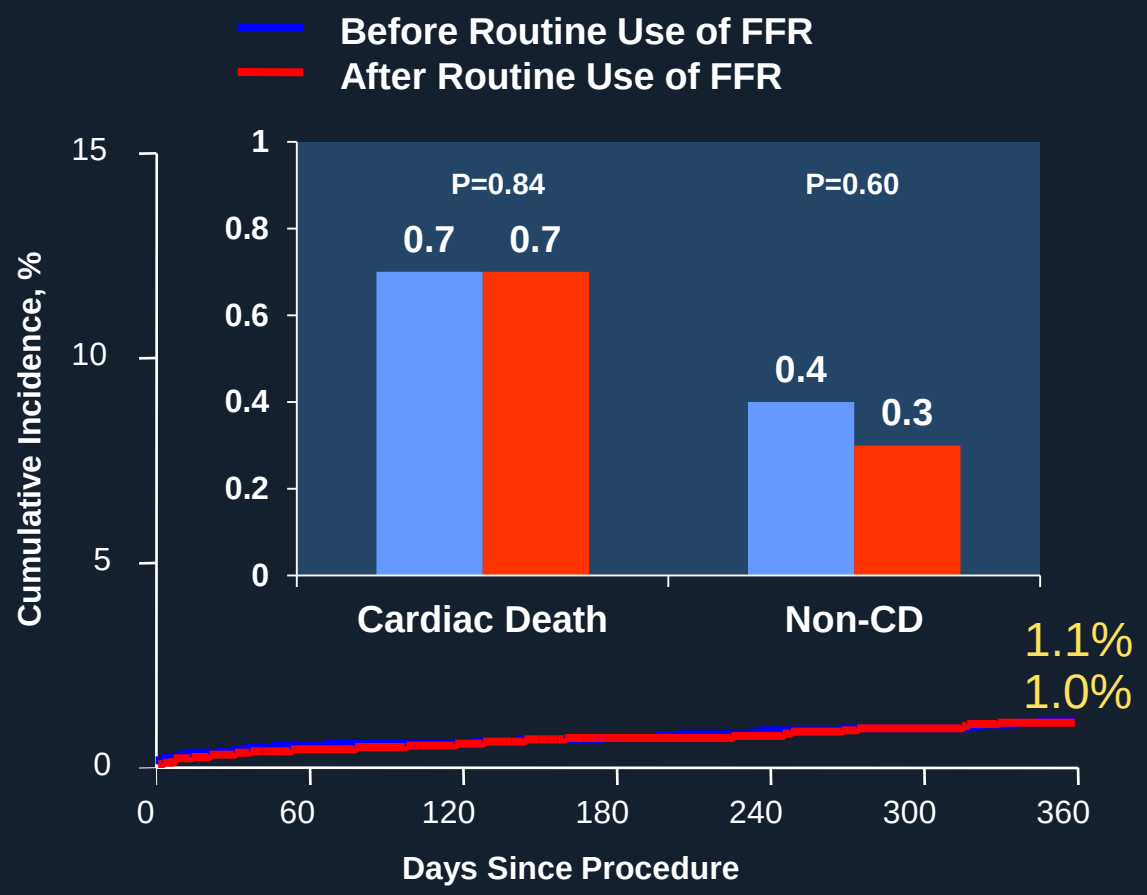
ASAN Medical Center

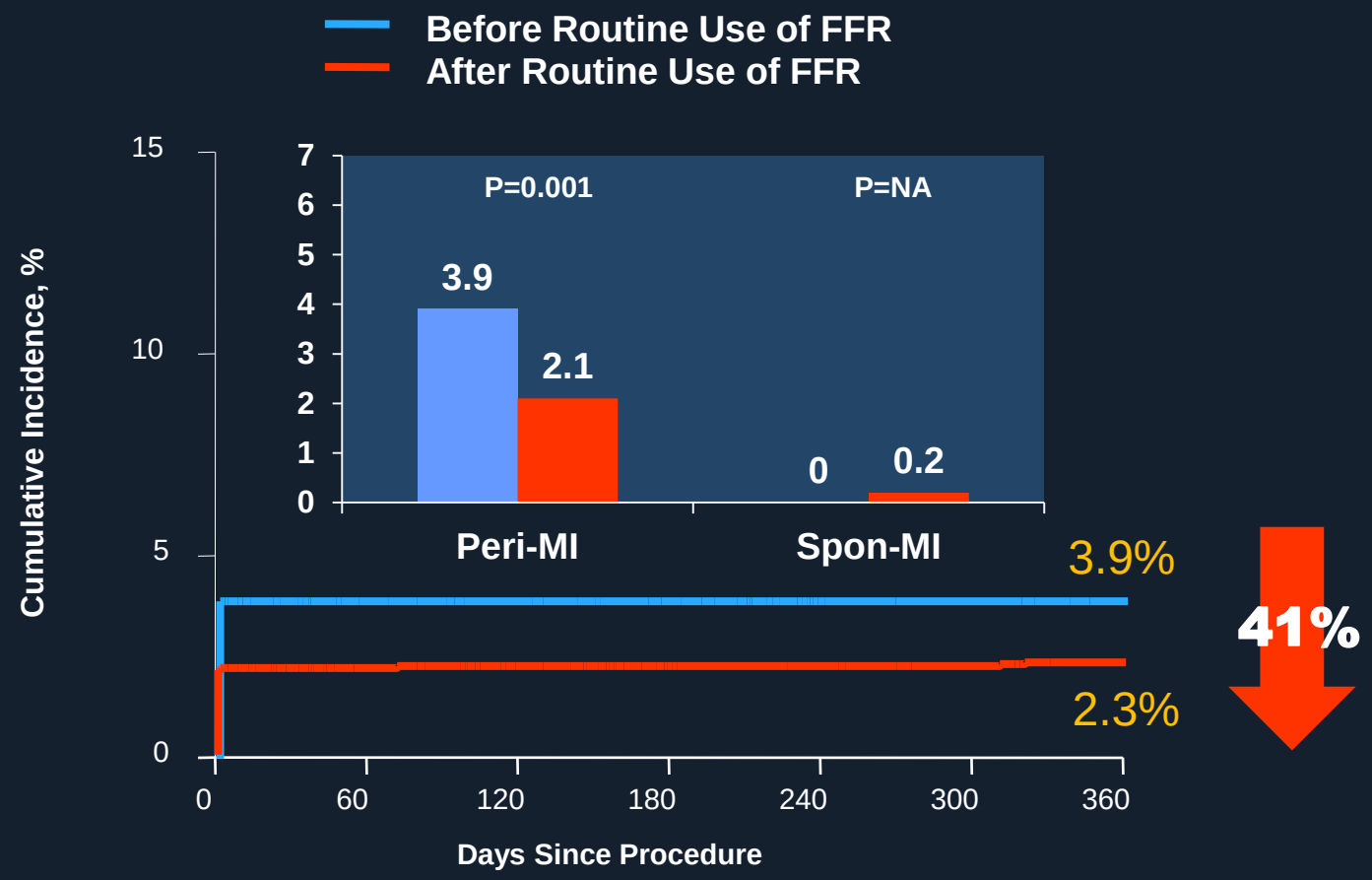
Park SJ, European Heart Journal. 2013 Nov;34(43):3353-61.

Death



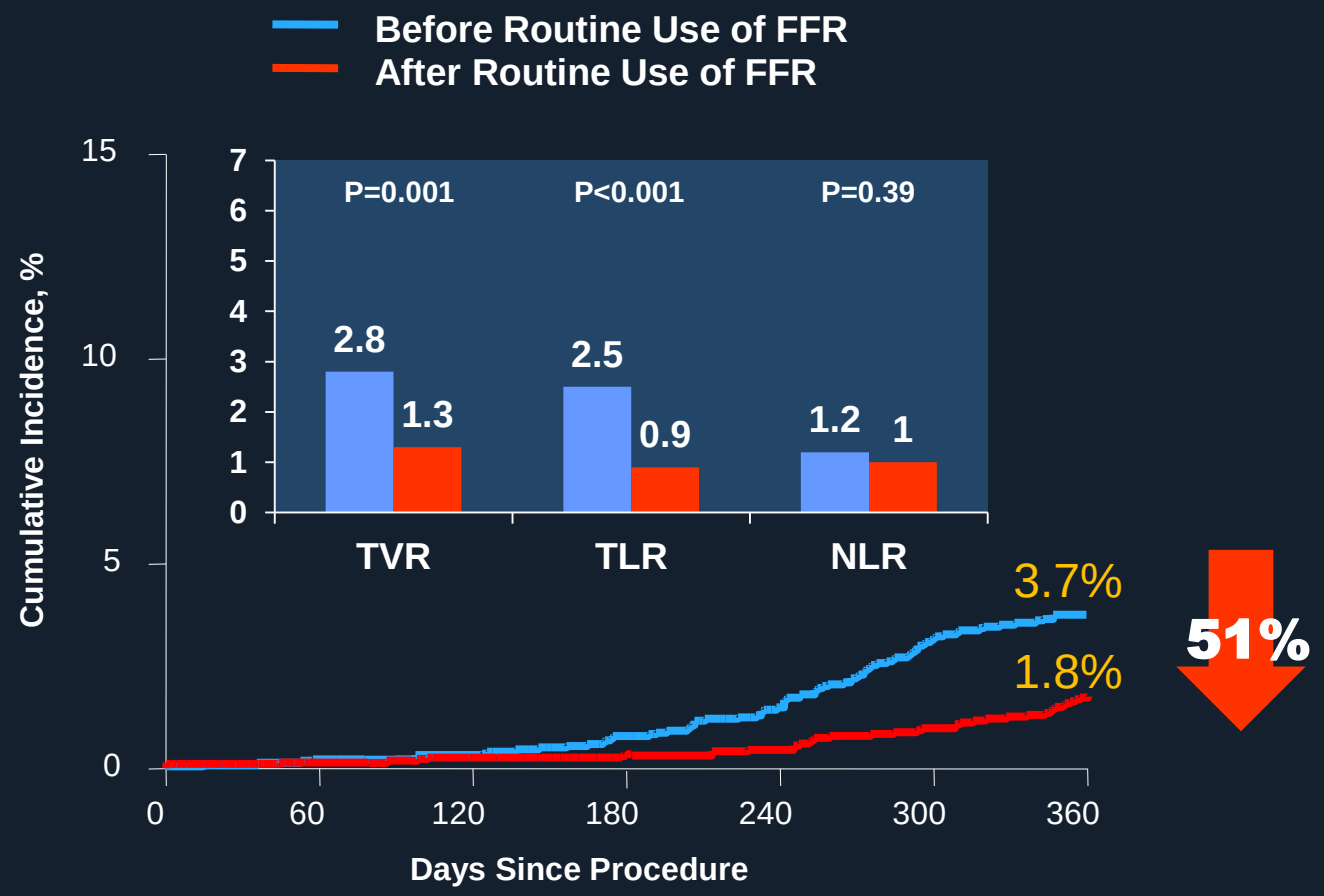
No. at Risk				
Before Routine Use	2178	2156	2126	2121
After Routine Use	2178	2143	2120	2113

Myocardial Infarction



No. at Risk				
Before Routine Use	2178	2071	2041	2036
After Routine Use	2178	2098	2075	2066

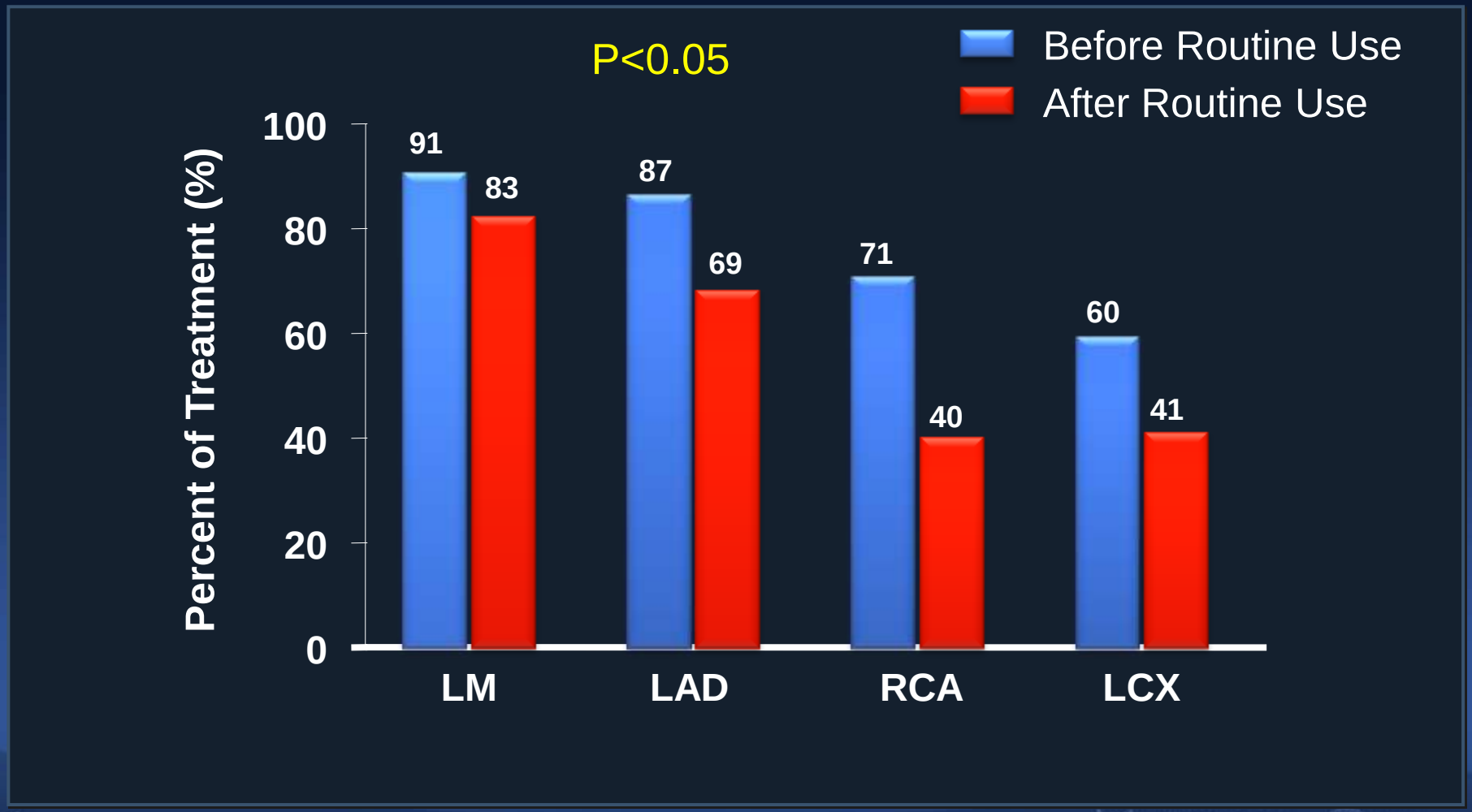
Repeat Revascularization



No. at Risk

Before Routine Use	2178	2151	2095	2048
After Routine Use	2178	2136	2110	2083

Treated Vessel Territory



Park SJ, European Heart Journal. 2013 Nov;34(43):3353-61.

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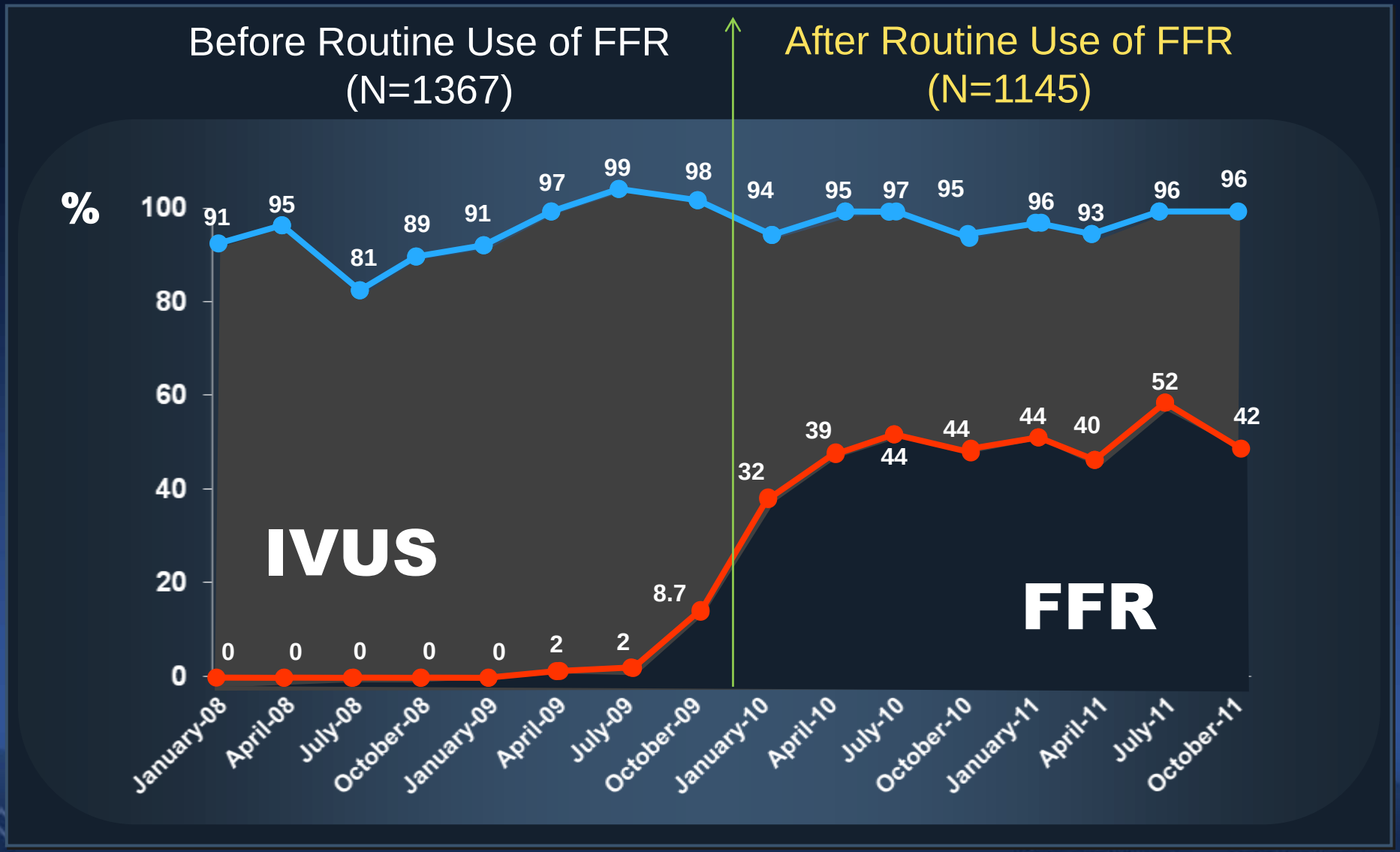
Impact of Routine Use of FFR for Left Main and 3-Vessel Disease.

Data from ASAN Multi-Vessel Registry
and Left Main Disease Registry (2)

Integrated Use of FFR and IVUS

(AMC data, n=2,512)



Baseline Clinical Characteristics

* p<0.05	Before Routine FFR (Year 2008-2009)			After Routine FFR (Year 2010-2011)		
	CABG (N=770)	PCI (N=663)	DEFER (N=34)	CABG (N=494)	PCI (N=566)	DEFER (N=85)
Age, year	63.8±9.4	64.0±10.1	64.3±9.9	63.9±9.2	63.7±10.0	63.9±9.8
Male sex	570 (74.0)	487 (73.5)	28 (82.4)	387 (78.3)	435 (76.9)	57 (67.1)
BMI	24.7±2.9	24.8±3.0	25.1±2.9	24.5±2.9	25.0±2.9	25.6±3.8
Hypertension	480 (62.3)	425 (64.1)	21 (61.8)	226 (45.7)*	369 (65.2)	59 (69.4)
DM	323 (41.9)	239 (36.0)	15 (44.1)	173 (35.0)	226 (39.9)	29 (34.1)
Current smoker	199 (25.8)	192 (29.0)	9 (26.5)	125 (25.3)	158 (27.9)	20 (23.5)
Hyperlipidemia	370 (48.1)	365 (55.1)	15 (44.1)	320 (64.8)	375 (66.3)	52 (61.2)
Previous MI	44 (5.7)	35 (5.3)	4 (11.8)	47 (9.5)	36 (6.4)	6 (7.1)
Previous PCI	109 (14.2)*	115 (17.3)	15 (44.1)	83 (16.8)	90 (15.9)	19 (22.4)

Baseline Angiographic Characteristics

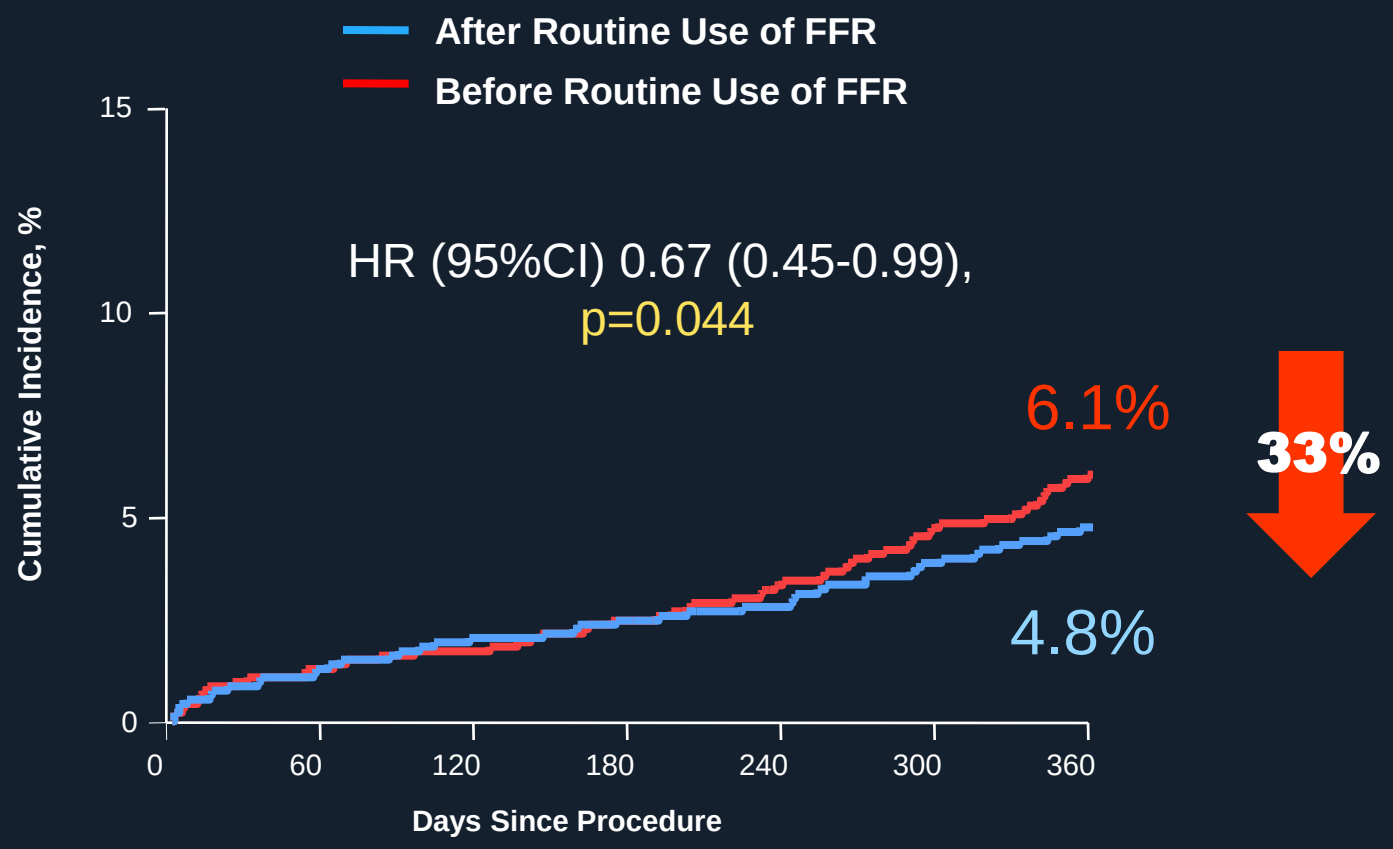
* p<0.05	Before Routine FFR (Year 2008-2009)			After Routine FFR (Year 2010-2011)		
	CABG (N=770)	PCI (N=663)	DEFER (N=34)	CABG (N=494)	PCI (N=566)	DEFER (N=85)
Extent						
3-Vessel Disease	467 (60.6)*	368 (55.5)	27 (79.4)	344 (69.6)*	320 (56.5)	57 (67.1)
Left main disease	303 (39.4)	295 (44.5)	7 (20.6)	150 (30.4)	246 (43.5)	28 (32.9)
Isolated LM	3 (1.0)	26 (8.8)	0	2 (1.3)	22 (8.9)	1 (3.6)
LM + 1VD	22 (7.3)	73 (24.7)	2 (28.6)	5 (3.3)	64 (26.0)	17 (60.7)
LM + 2VD	62 (20.5)	117 (39.7)	0	22 (14.7)	97 (39.4)	4 (14.3)
LM + 3VD	216 (71.3)*	79 (26.8)	5 (71.4)	121 (80.7)*	63 (25.6)	6 (21.4)
LAD involvement	749 (97.3)*	615 (92.8)	33 (97.1)	487 (98.6)*	524 (92.6)	73 (85.9)
RCA involvement	709 (92.1)*	498 (75.1)	32 (94.1)	471 (95.3)*	425 (75.1)	66 (77.6)
Total occlusion ≥1	284 (36.9)*	29 (4.4)	0	214 (43.3)*	36 (6.4)	19 (22.4)

Propensity Matched Population
Overall Clinical Outcomes

Before Routine Use of FFR vs.
After Routine Use of FFR (971 pairs)

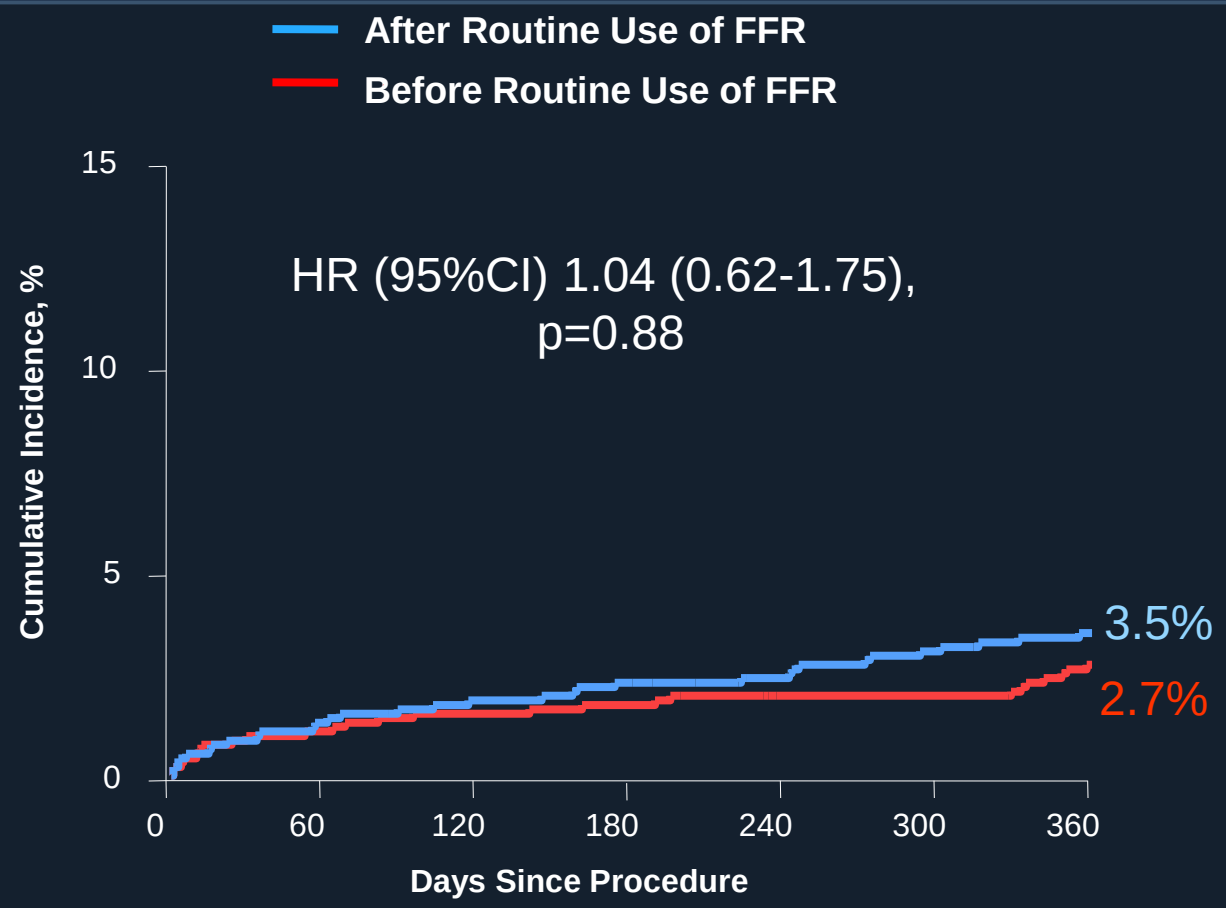
Primary End Point

Death, MI, Stroke or Repeat Revascularization



No. at Risk				
Before Routine Use	917	901	883	857
After Routine Use	917	898	886	869

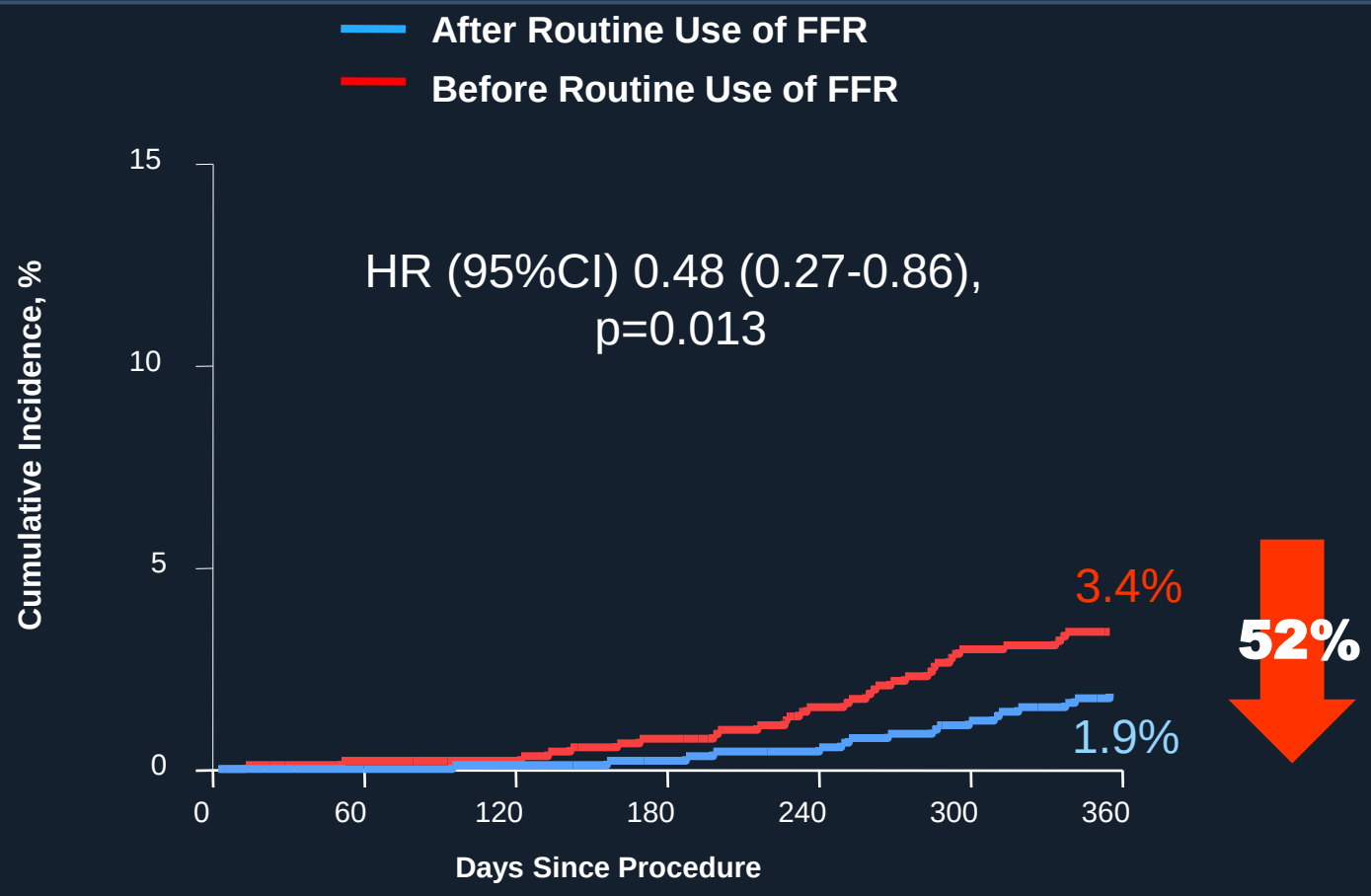
Death, MI or Stroke



No. at Risk

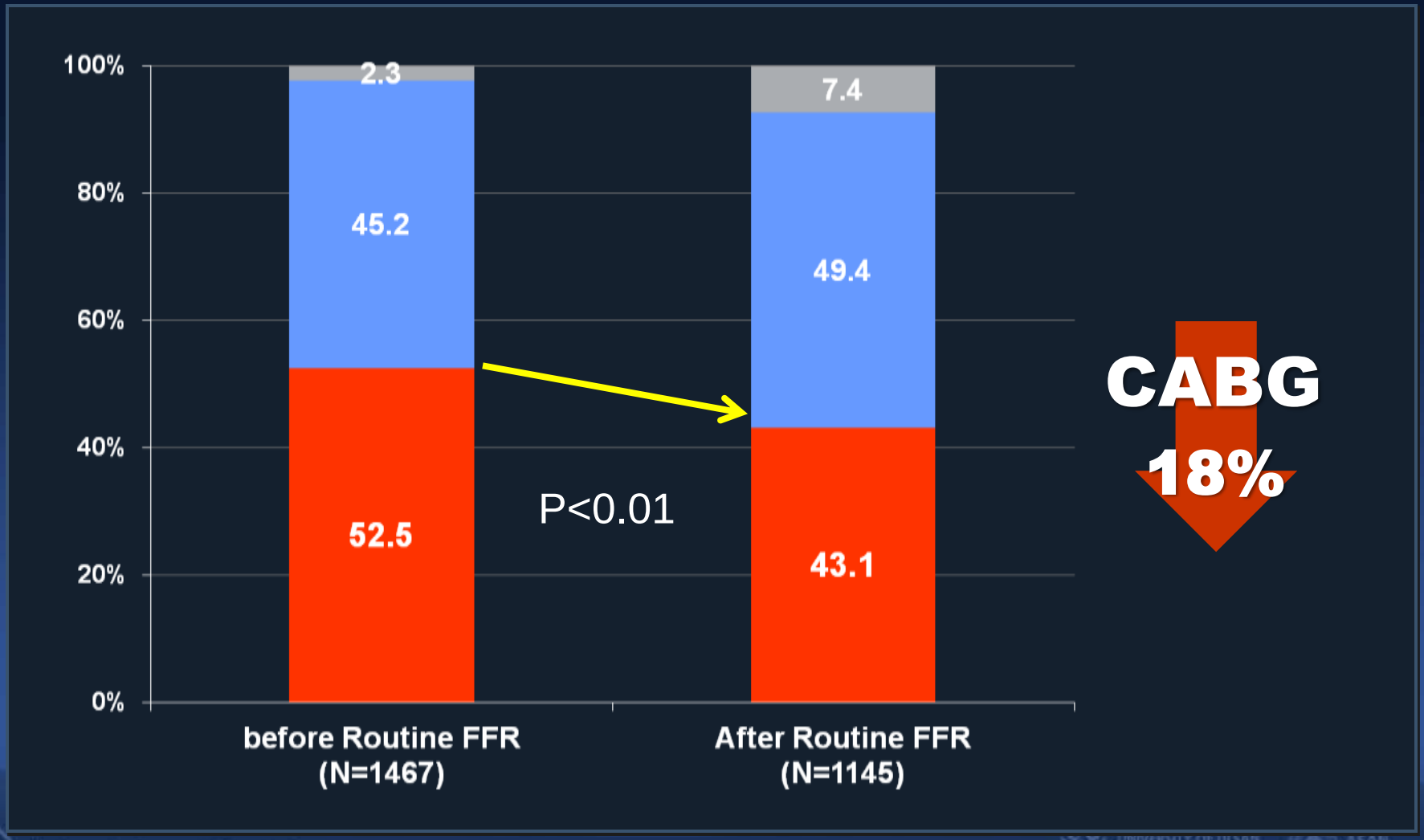
Before Routine Use	917	903	896	888
After Routine Use	917	899	889	879

Repeat Revascularization

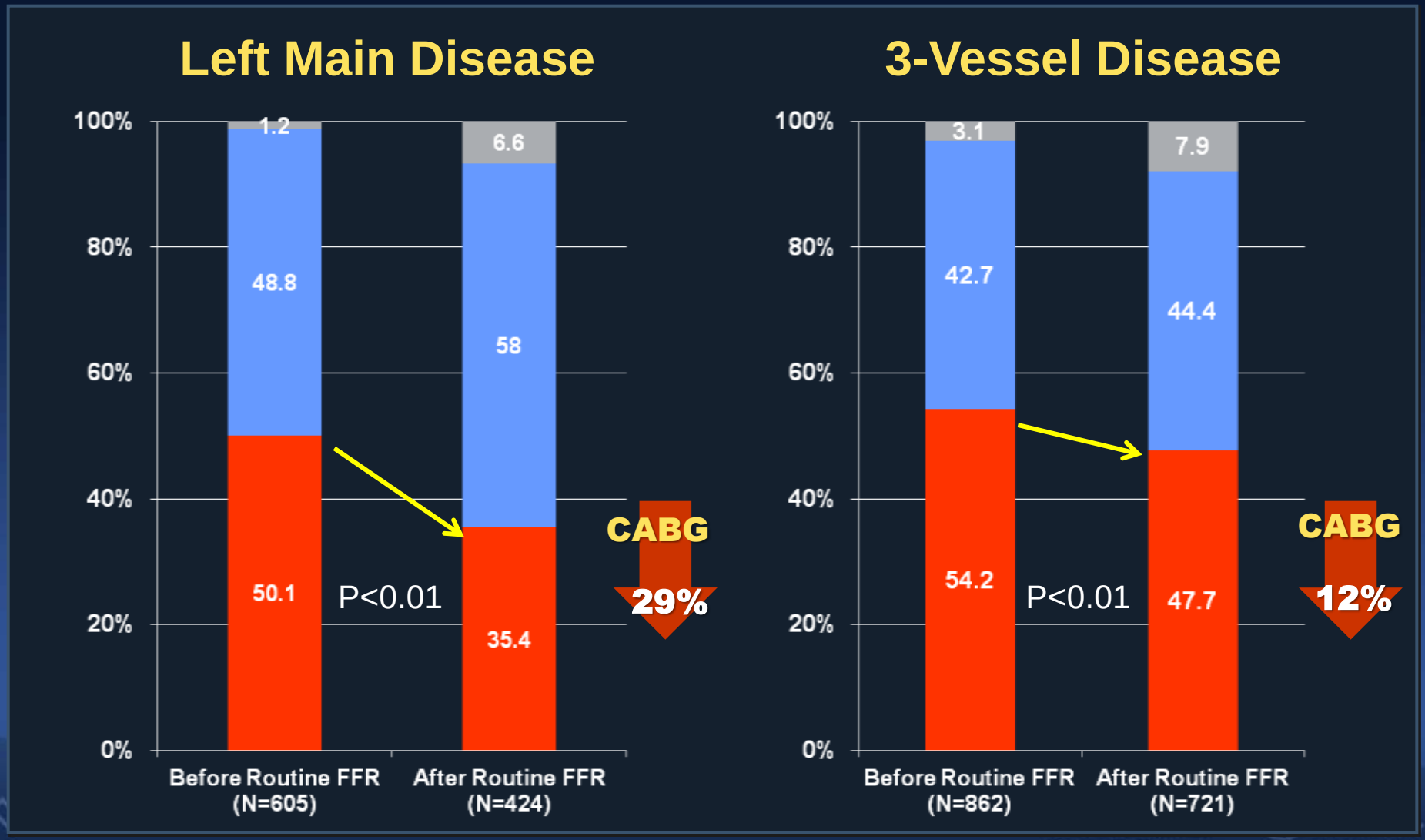


No. at Risk				
Before Routine Use	917	905	886	863
After Routine Use	917	904	897	883

Treatment Strategy *Changes*



Treatment Strategy *Changes*



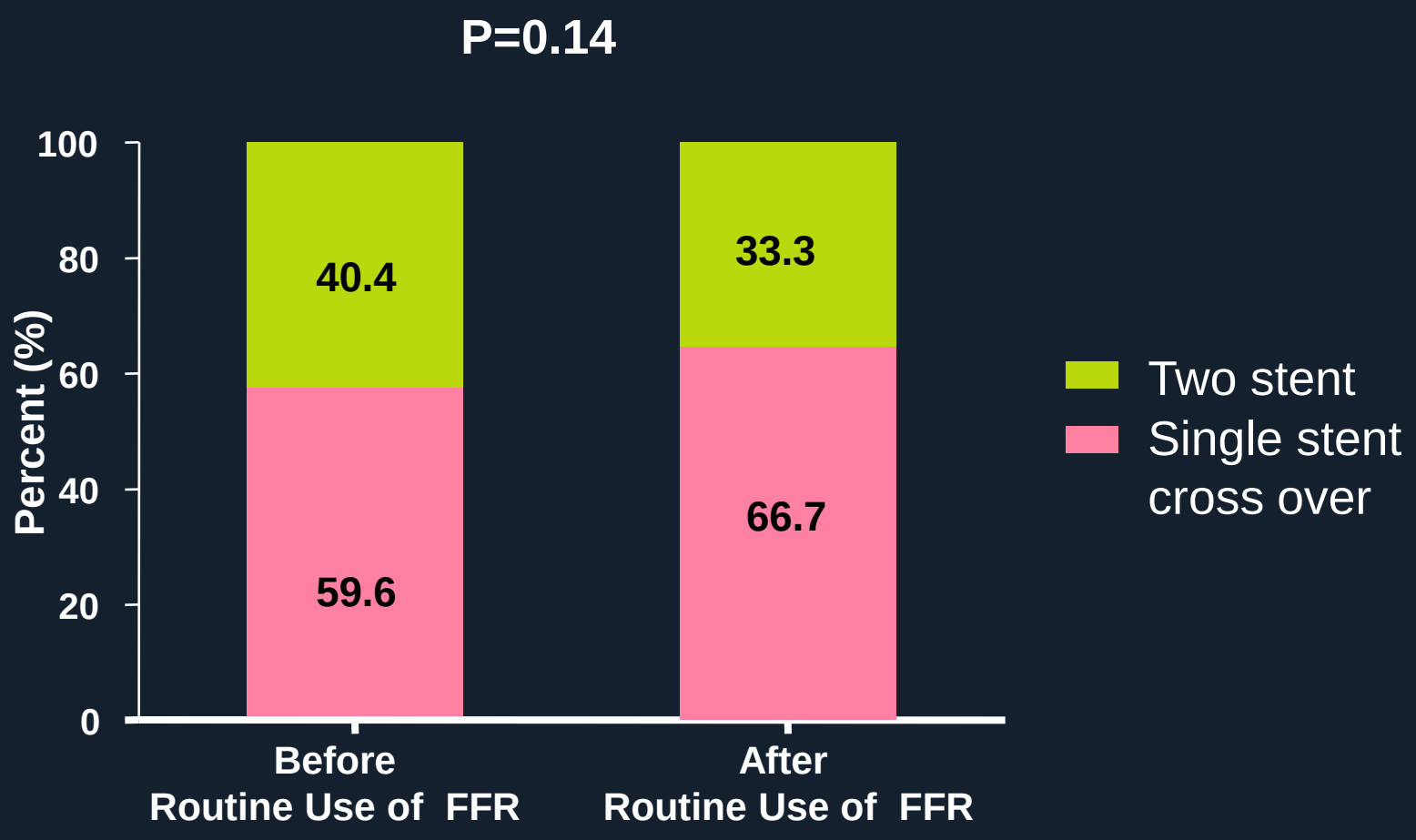
Procedural Characteristics of PCI

	Before Routine FFR (N=663)	After Routine FFR (N=566)	P value
Fractional flow reserve	13 (2.0)	237 (41.9)	<0.001
Mean	0.87±0.08	0.77±0.12	
>0.80	13 (86.7)	133 (39.8)	
0.75-0.80	0	77 (23.1)	
<0.75	2 (13.3)	124 (37.1)	
N. of Deferred lesions	13 (86.7)	145 (43.4)	
No. of stents	3.04±1.52	2.51±1.39	<0.001
Total stent length, mm	77.7±40.9	65.6±39.0	<0.001
Average stent diameter, mm	3.32±0.28	3.33±0.32	0.63

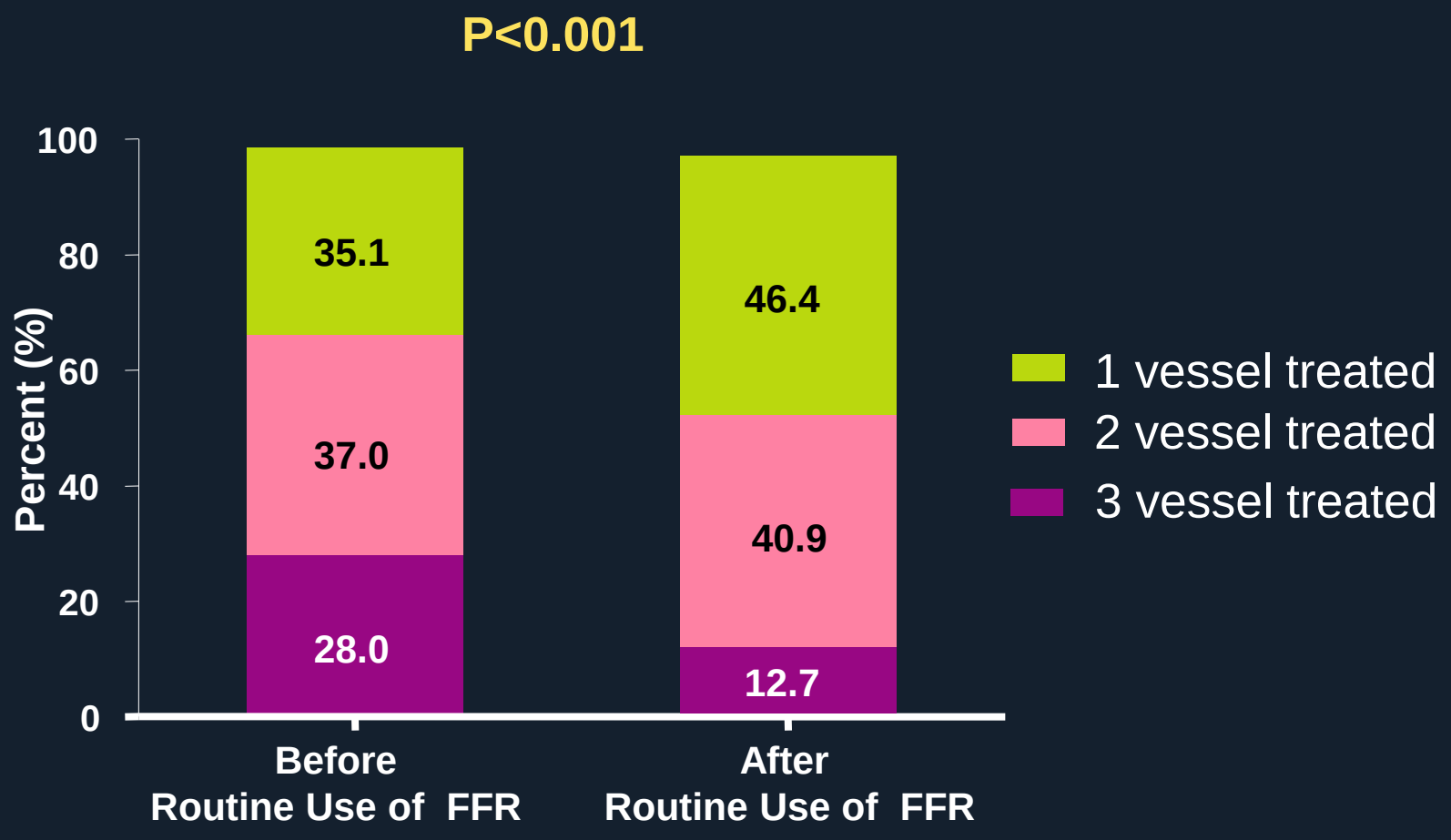
Procedural Characteristics of CABG

	Before Routine FFR (N=770)	After Routine FFR (N=494)	P value
Number of conduit	2.97±0.94	3.08±0.94	0.038
Number of vein conduit	1.17±0.90	1.30±0.85	0.009
Number of arterial conduit	1.80±0.87	1.78±0.90	0.69
Internal thoracic artery	757 (98.3)	481 (97.4)	0.25
Off-pump	499 (64.8)	433 (87.7)	<0.001

Procedural Change in PCI
Distal LM Treatment



Procedural Change in PCI
3 Vessel Disease, Treatment



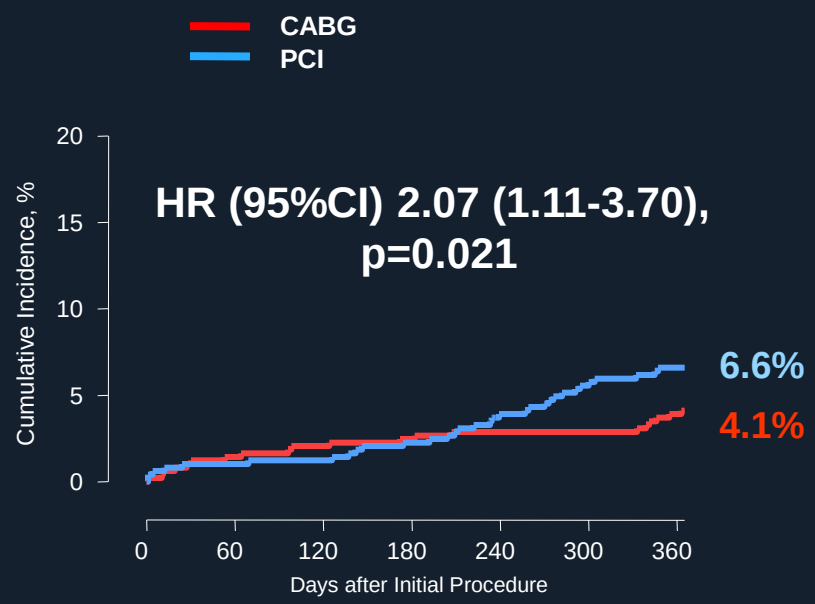
Propensity Matched Population
CABG vs. PCI

Before Routine Use of FFR: CABG versus PCI (486 pairs)
After Routine Use of FFR: CABG versus PCI (316 pairs)

Primary End Point

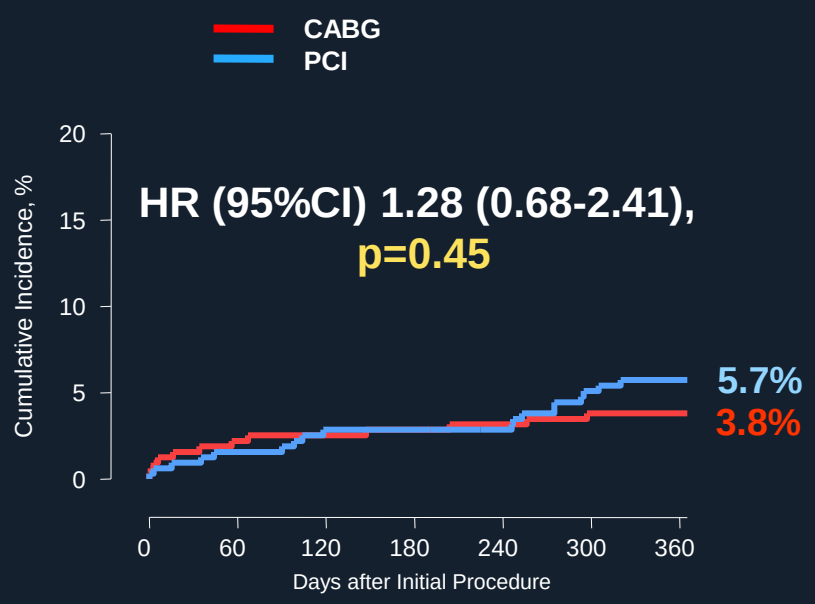
(Death, MI, Stroke or Repeat Revascularization)

Before Routine FFR (2008-2009)



CABG	486	477	472	467
PCI	486	481	466	453

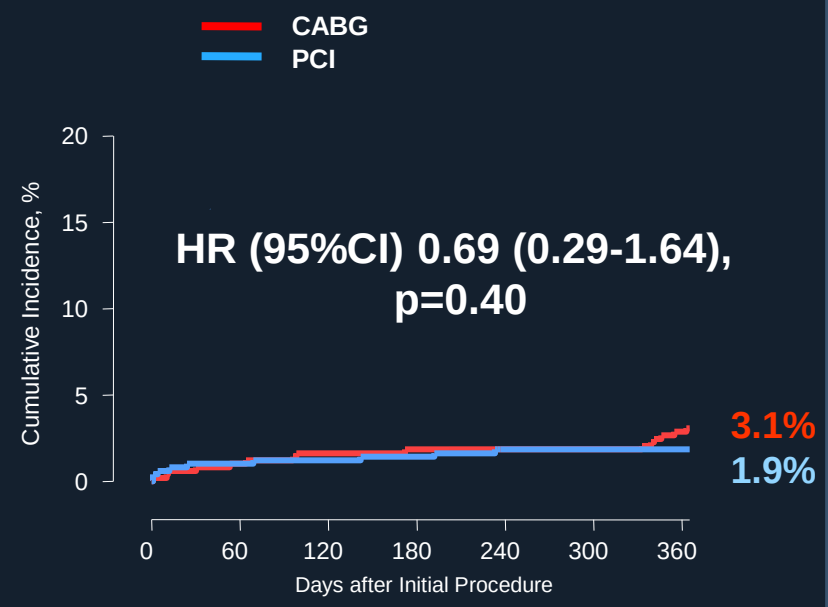
After Routine FFR (2010-2011)



CABG	315	308	306	304
PCI	315	307	304	295

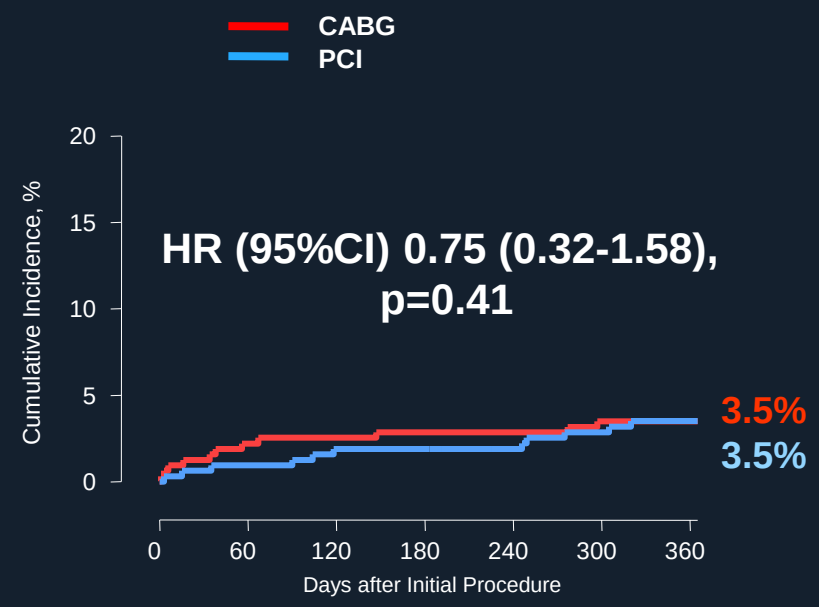
Death, MI or Stroke

Before Routine FFR (2008-2009)



CABG	486	479	477	472
PCI	486	481	476	476

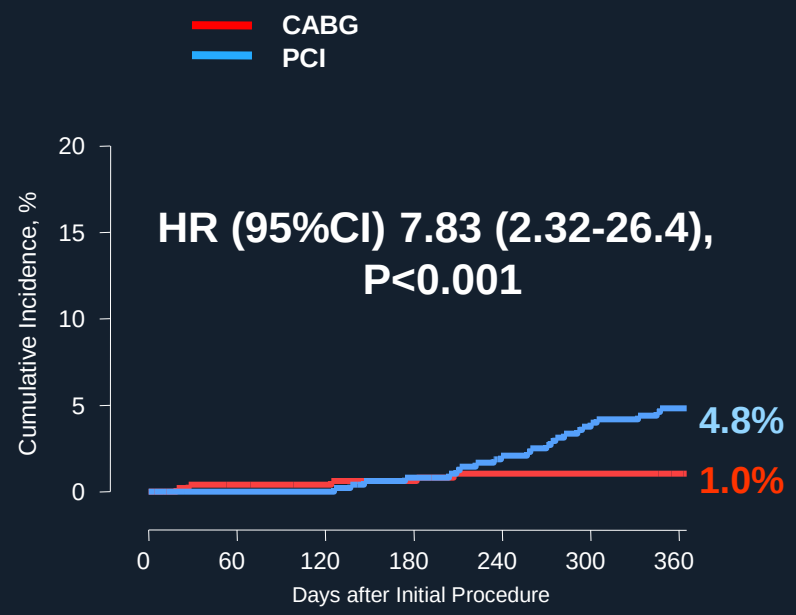
After Routine FFR (2010-2011)



CABG	315	308	307	305
PCI	315	310	307	302

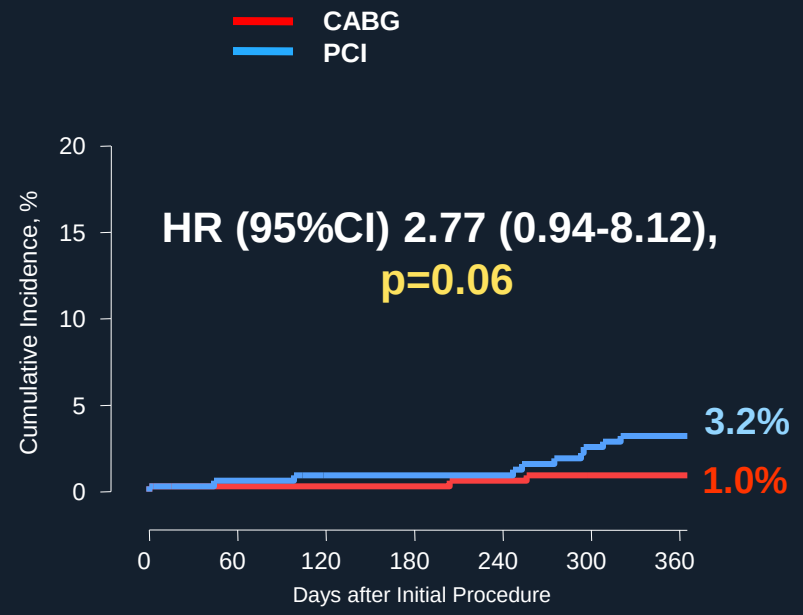
Repeat Revascularization

Before Routine FFR (2008-2009)



CABG	486	479	475	472
PCI	486	482	466	453

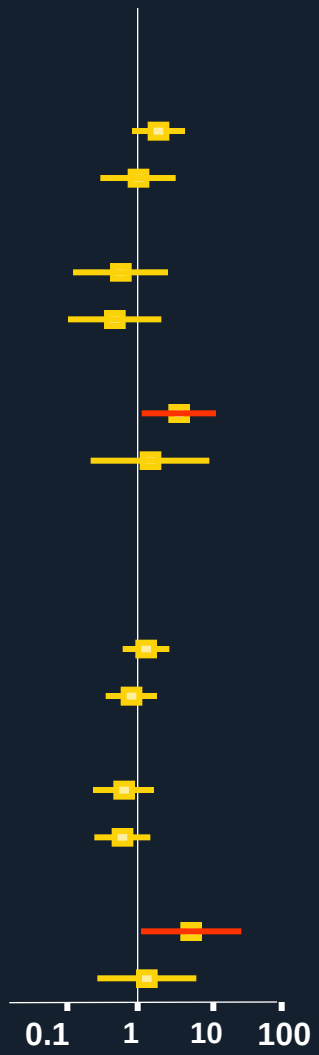
After Routine FFR (2010-2011)



CABG	315	311	309	307
PCI	315	307	307	300

LM and 3-Vessel, Subgroup Analysis

	1 Year Event Rate (%) CABG	1 Year Event Rate (%) PCI	Adjusted Hazard Ratio (95% CI)	P value
Left Main Disease	N=231	N=231		
MACCE				
Before Routine FFR	15 (5.0)	25 (8.5)	1.89 (0.84-4.25)	0.12
After Routine FFR	7 (4.6)	15 (6.2)	1.02 (0.32-3.21)	0.97
Death, MI, or stroke				
Before Routine FFR	10 (3.3)	4 (1.4)	0.60 (0.14-2.54)	0.49
After Routine FFR	6 (4.0)	6 (2.5)	0.50 (0.12-2.06)	0.34
Any Repeat Revascularization				
Before Routine FFR	5 (1.7)	21 (7.2)	3.53 (1.14-11.0)	0.029
After Routine FFR	2 (1.3)	10 (4.2)	1.48 (0.24-8.98)	0.67
3 Vessel Disease	N=529	N=529		
MACCE				
Before Routine FFR	21 (4.5)	24 (6.5)	1.30 (0.63-2.65)	0.48
After Routine FFR	18 (5.3)	15 (4.7)	0.83 (0.38-1.81)	0.65
Death, MI, or stroke				
Before Routine FFR	18 (3.9)	9 (2.5)	0.67 (0.27-1.65)	0.38
After Routine FFR	17 (5.0)	9 (2.8)	0.63 (0.27-1.48)	0.29
Any Repeat Revascularization				
Before Routine FFR	3 (0.7)	15 (4.2)	5.12 (1.11-23.7)	0.036
After Routine FFR	3 (0.9)	8 (2.5)	1.33 (0.30-5.97)	0.71



PCI Better **CABG Better**

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

Impact of FFR in Real Practice, *2014*

1. Integrated Use of FFR and IVUS Can Make a Good Clinical Outcomes, Mainly Due to Reduced the Number of Stents and the Rate of Any Repeat Revascularization of PCI.

2. FFR guided PCI Showed Similar Clinical Outcomes with Concurrent CABG at 1 year and It Had Reduced Role of CABG as the Primary Treatment Strategy.

Thank You !!

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