Clinical Impact of Routine FFR Measurement

Jung-Min Ahn, MD

Heart Institute, University of Ulsan College of Medicine
Asan Medical Center, Seoul, Korea

Two Registry

- **ASAN PCI Registry**
  The Change of PCI Outcome

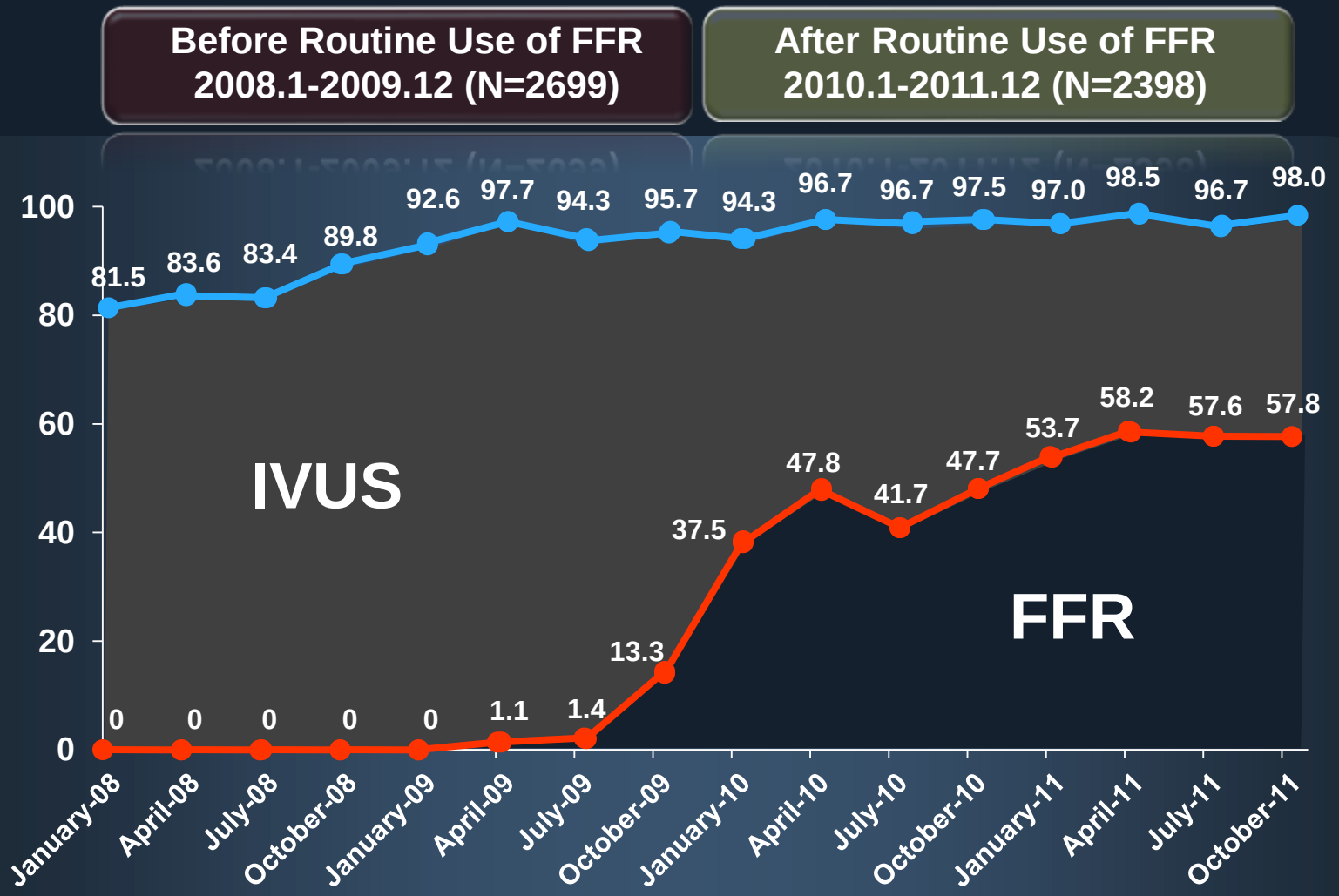
  (Eur Heart J. 2013 Nov;34(43):3353-61)

- **ASAN LM and Multivessel Registry**
  The Change of Severe CAD Outcome

  (Am J Cardiol. 2015 Oct 15;116(8):1163-71)

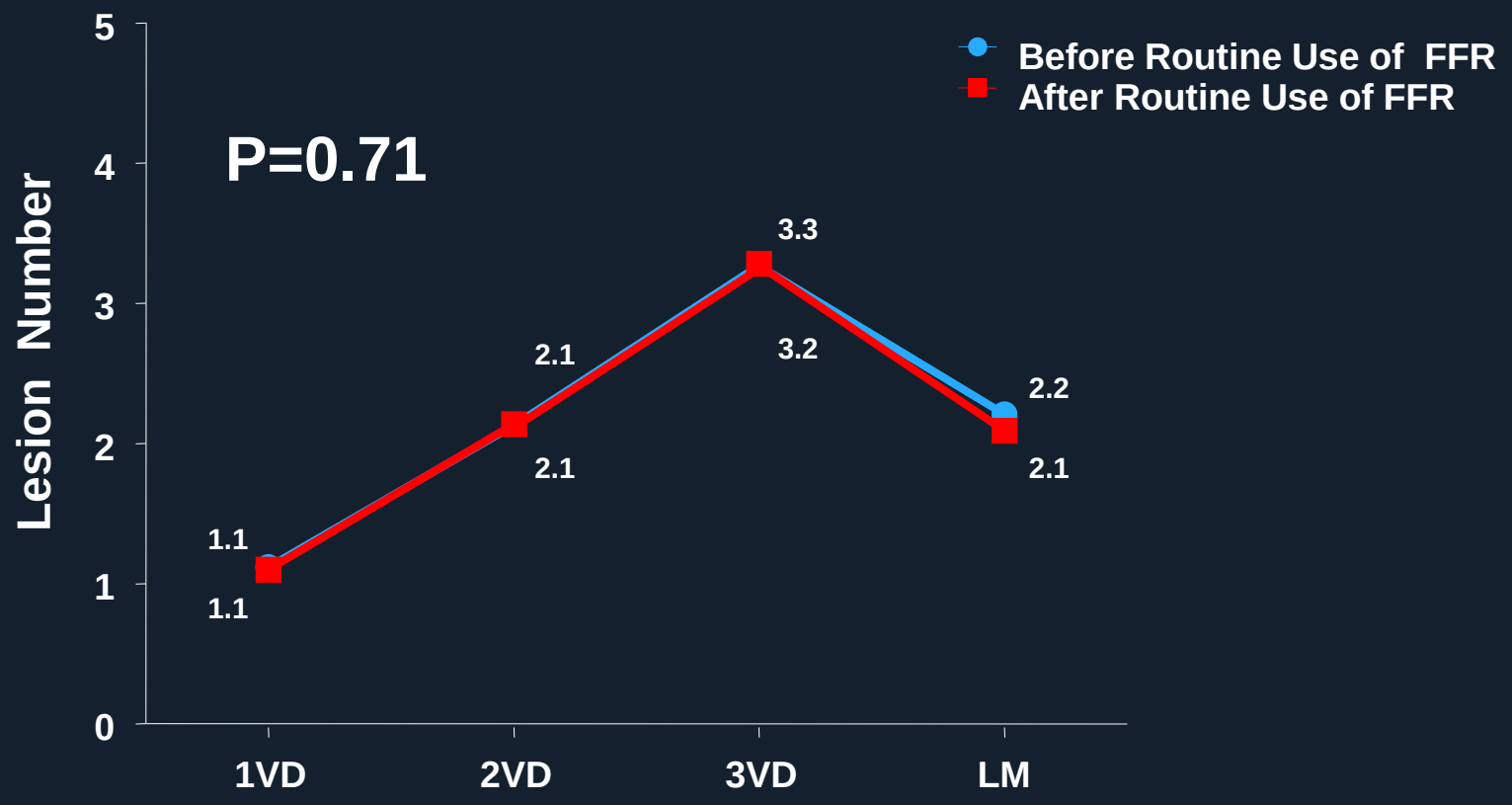
ASAN PCI Registry (N=5097)

FFR in Asan Medical Center

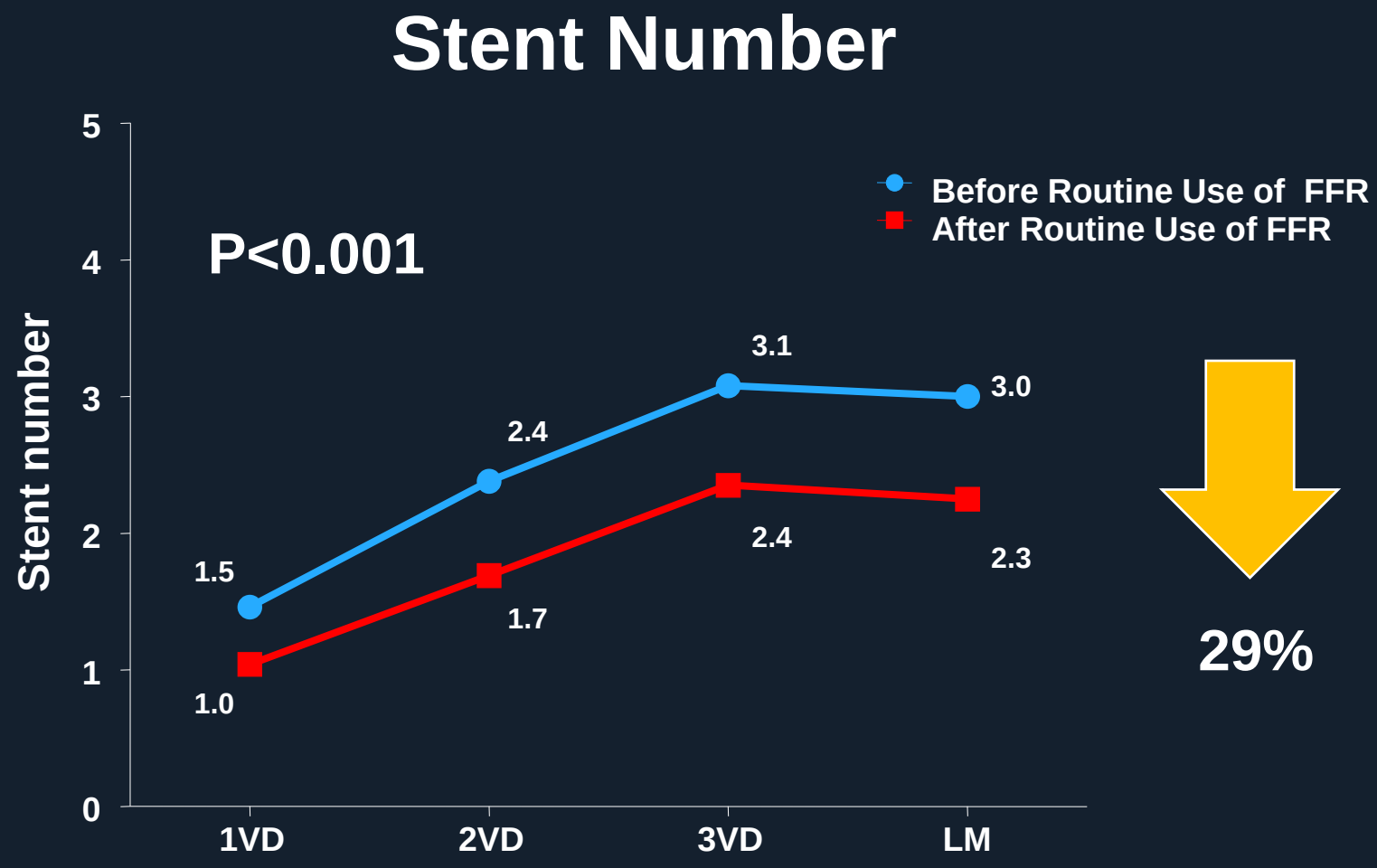


Changes in PCI procedure

Lesion Number

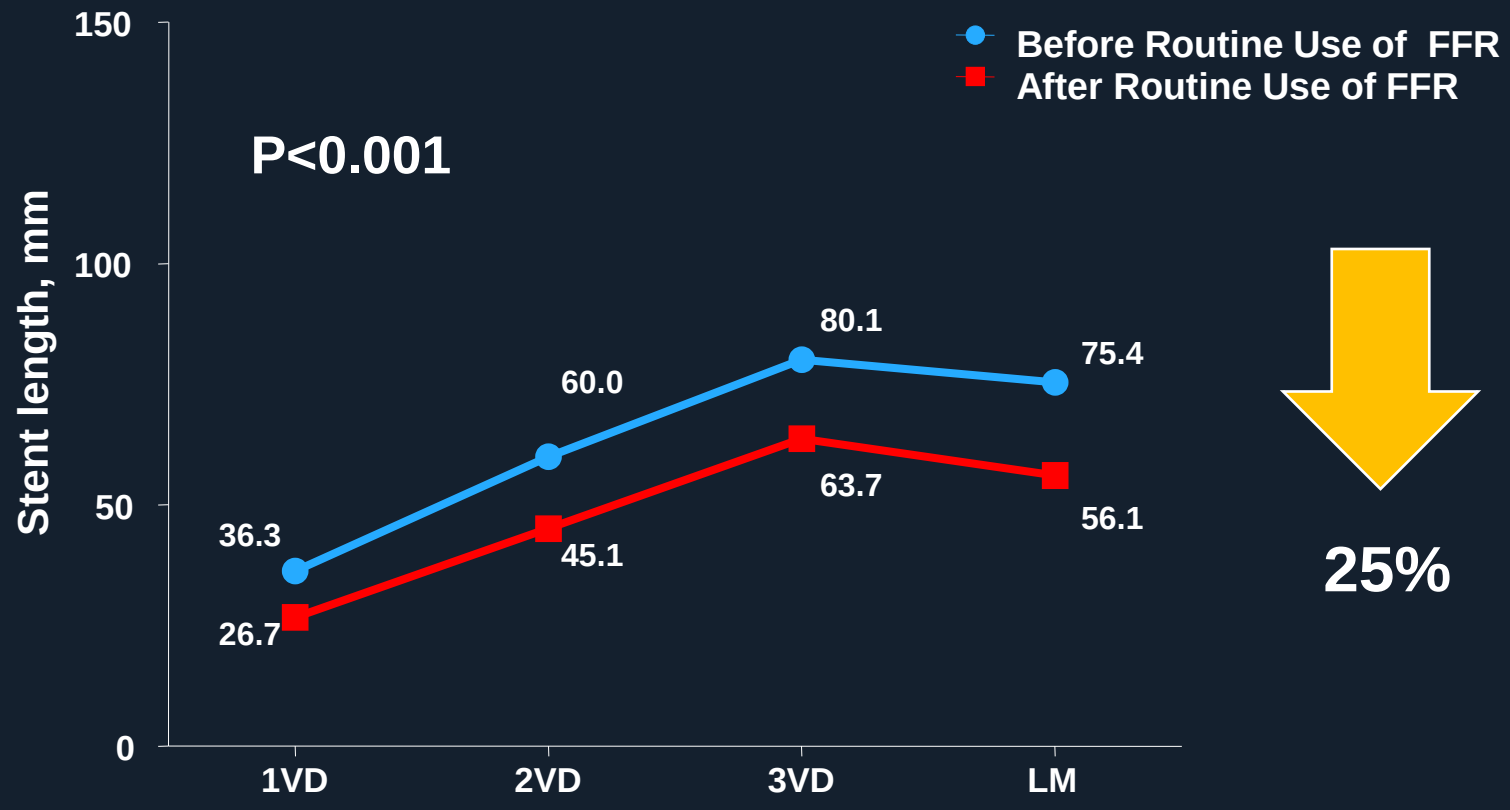


Changes in PCI procedure



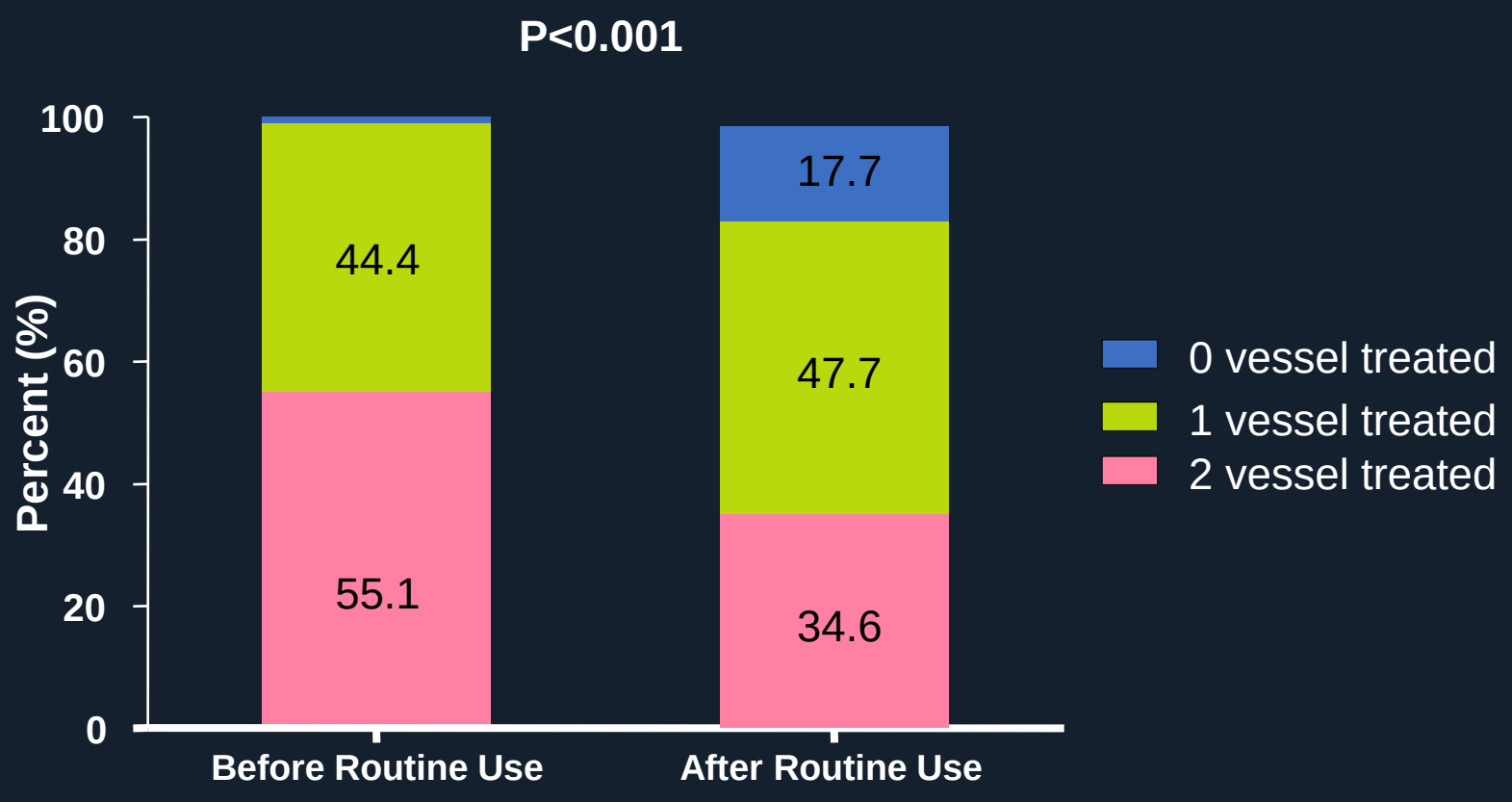
Changes in PCI procedure

Stent Length

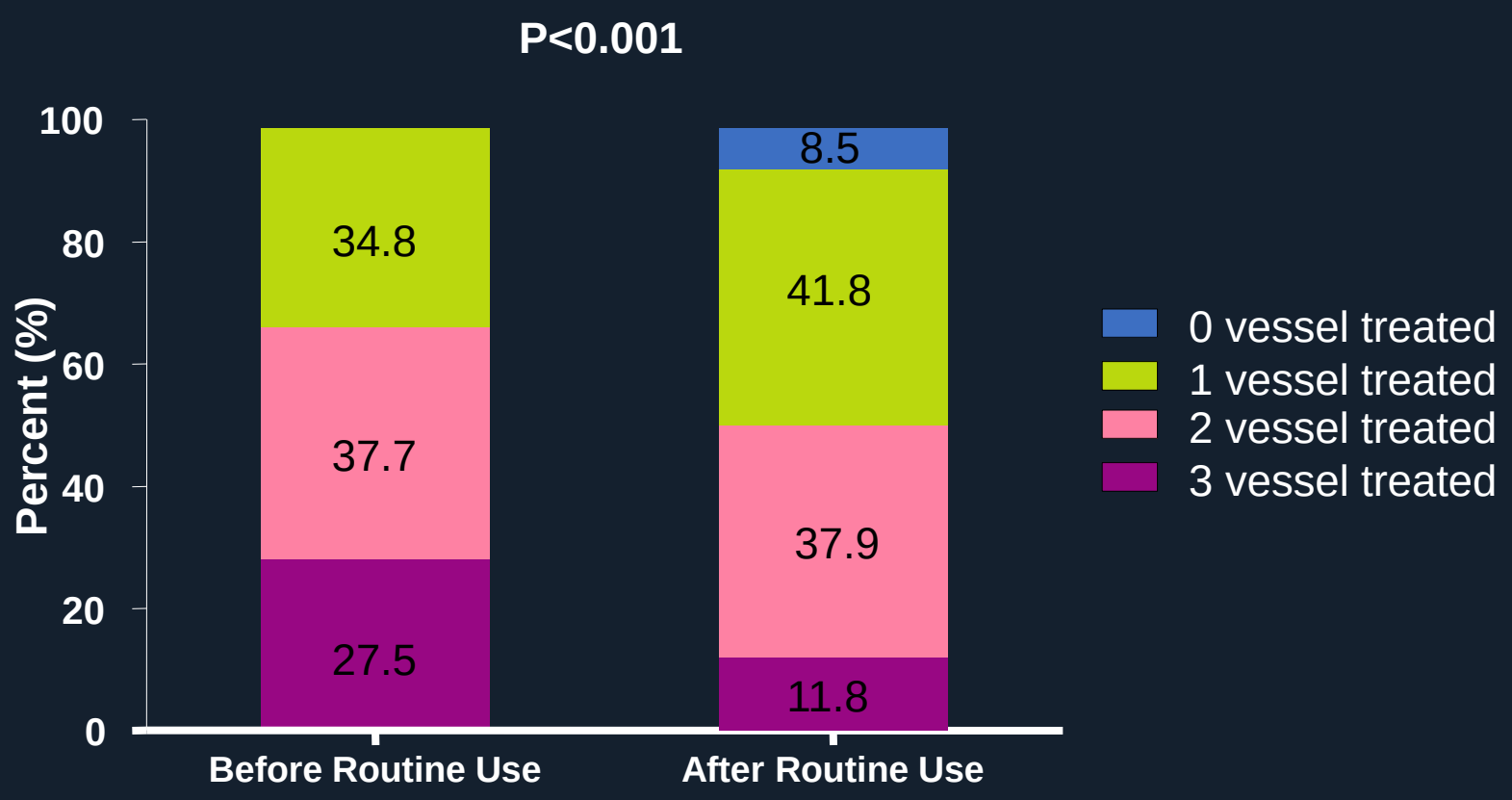


Changes in PCI procedure

Two Vessel Disease

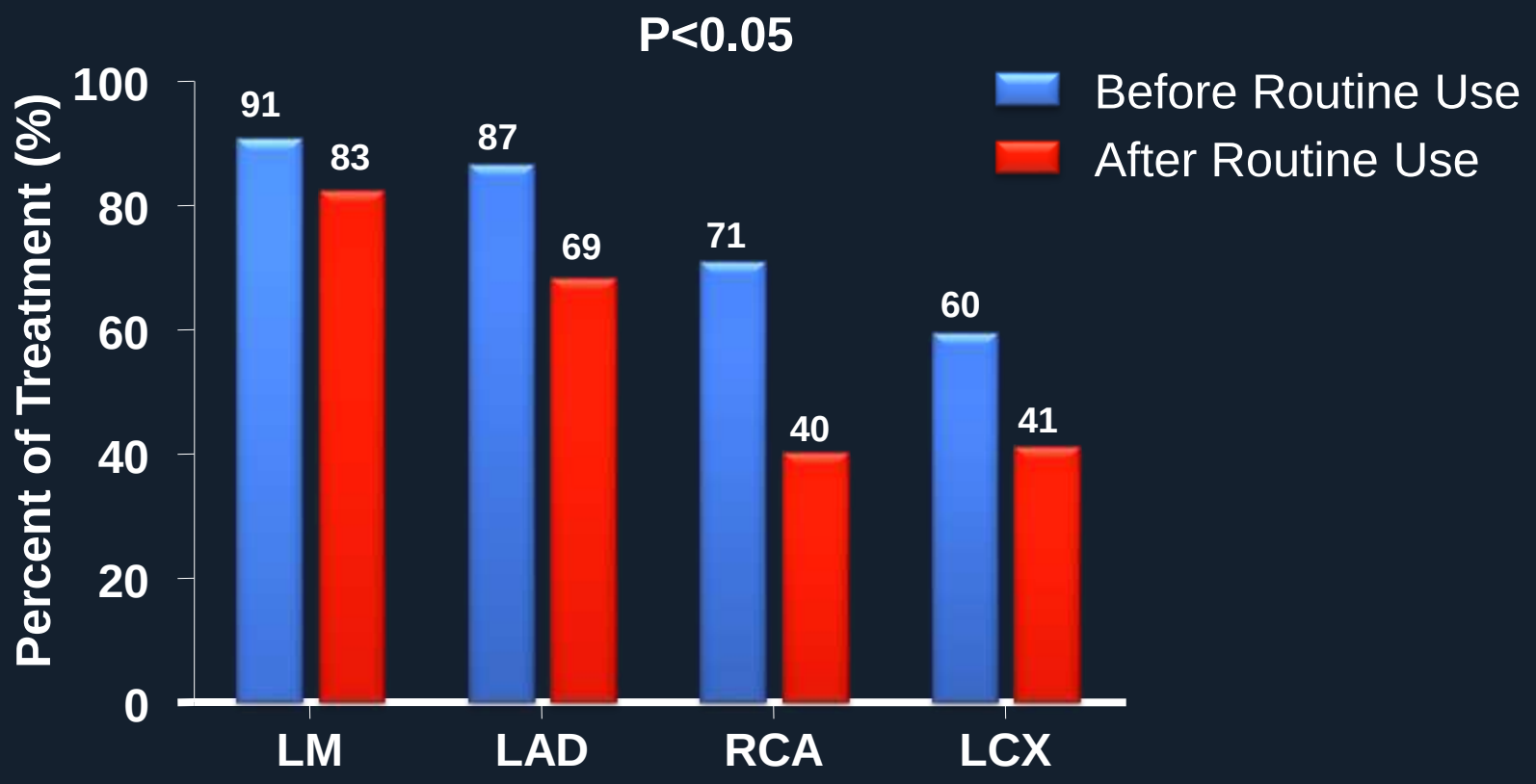


Changes in PCI procedure



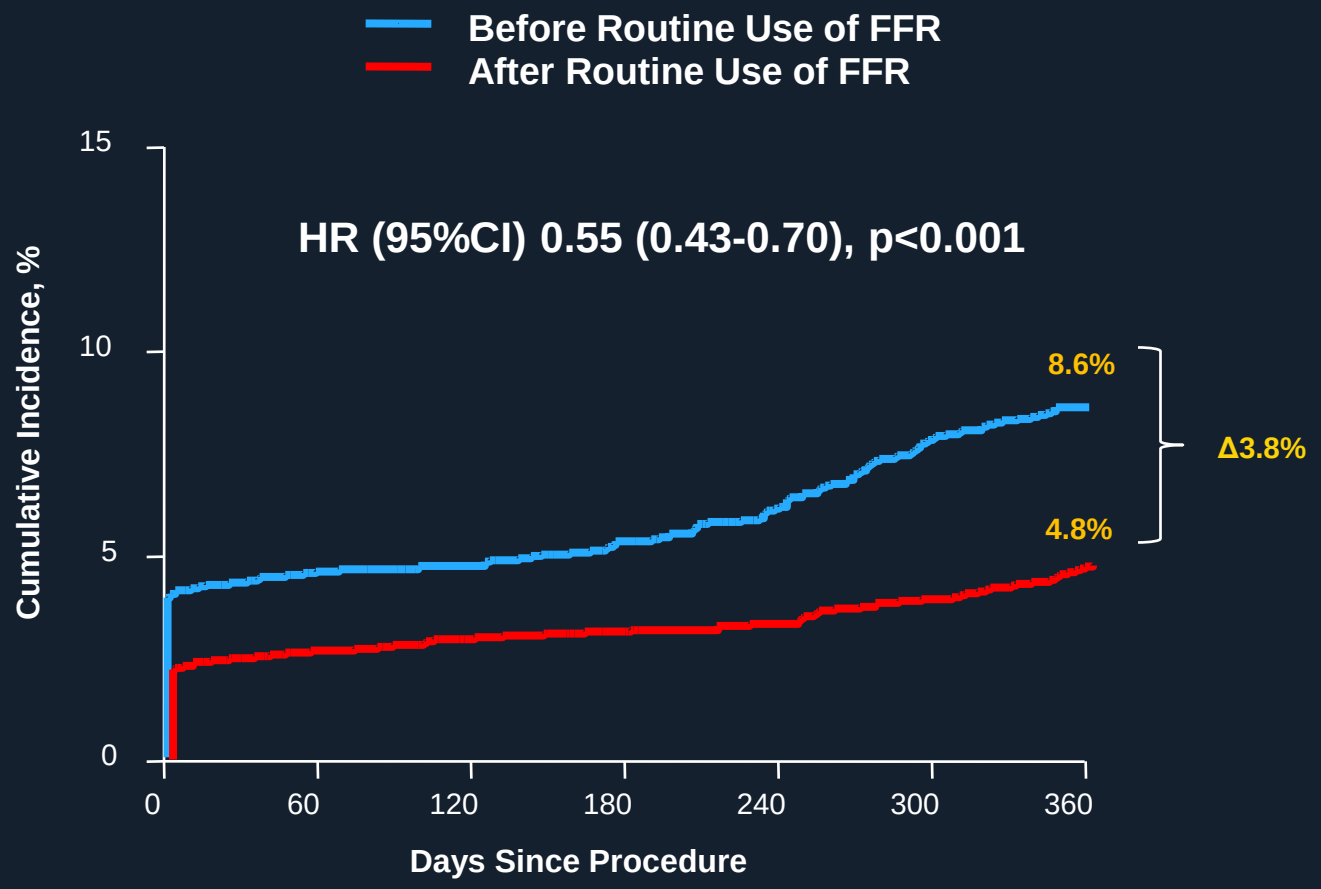
Changes in PCI procedure

Diseased Vessel Territory



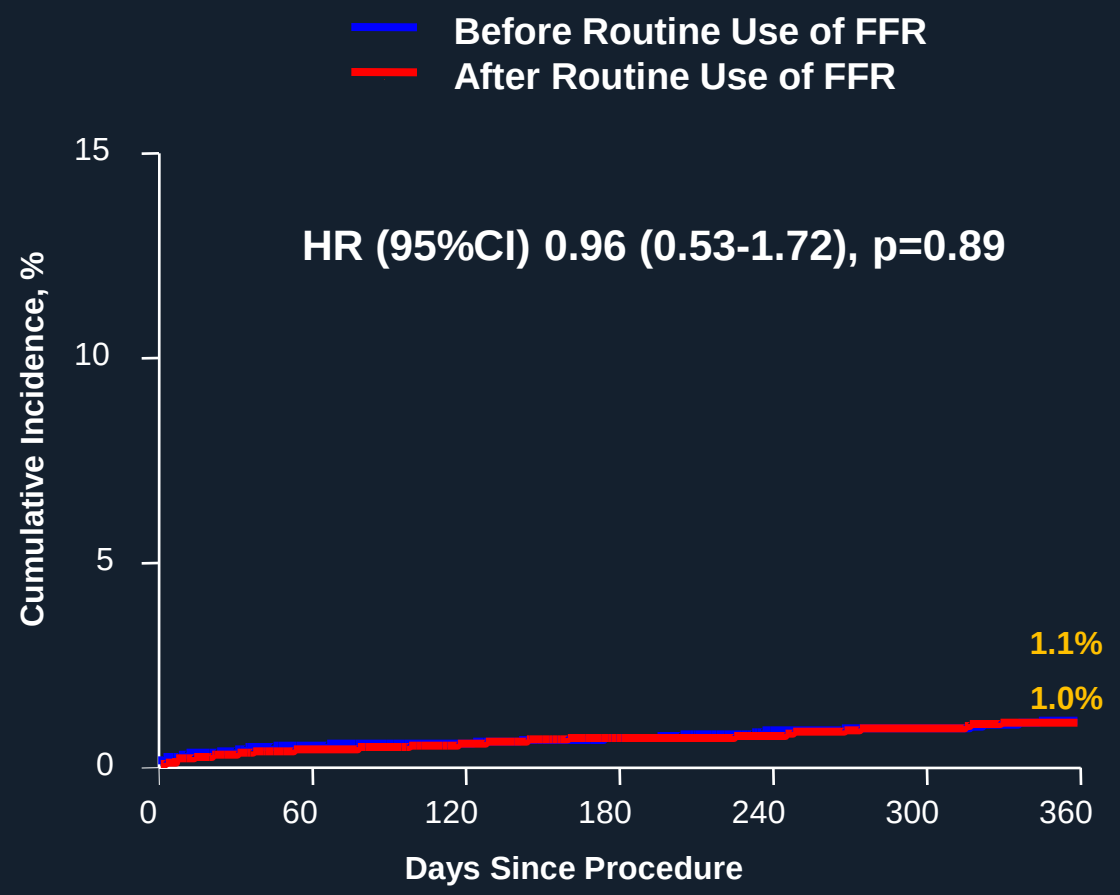
Primary End Point

(Death, MI, or Repeat Revascularization)



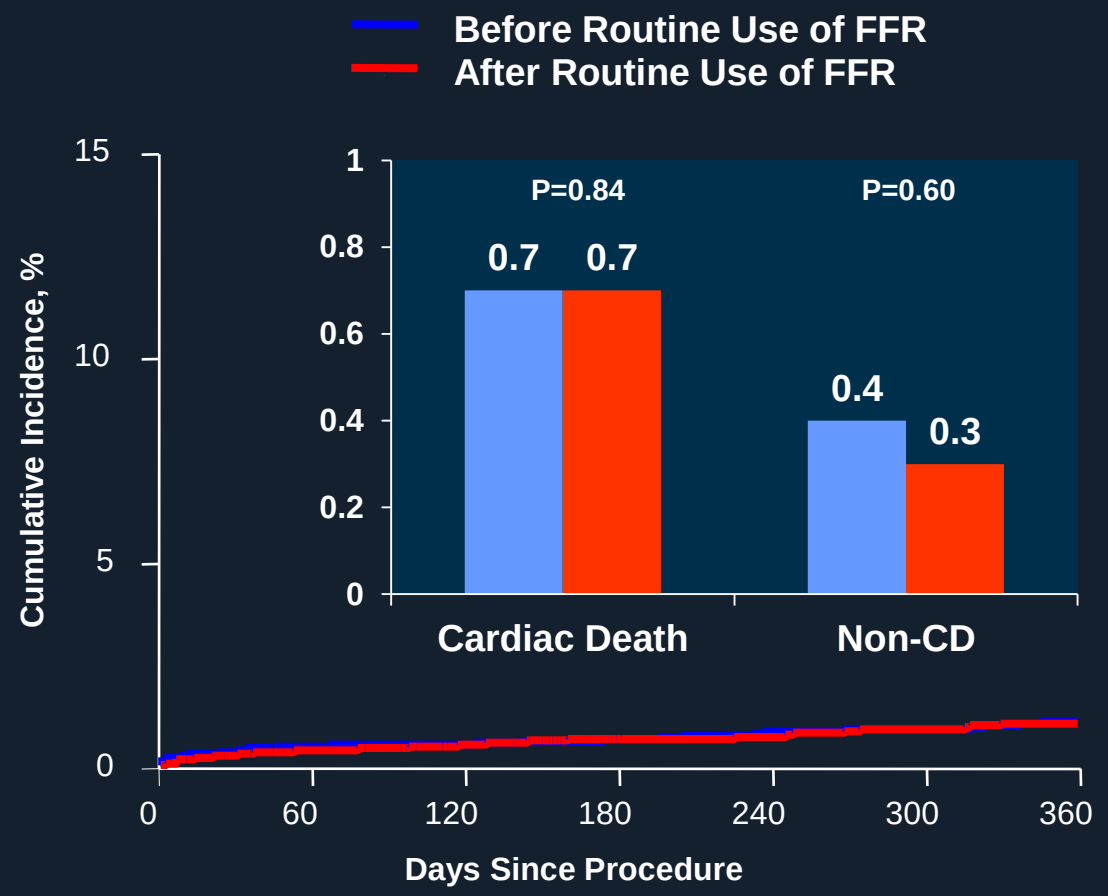
No. at Risk				
Before Routine Use	2178	2066	2011	1960
After Routine Use	2178	2092	2067	2037

Death



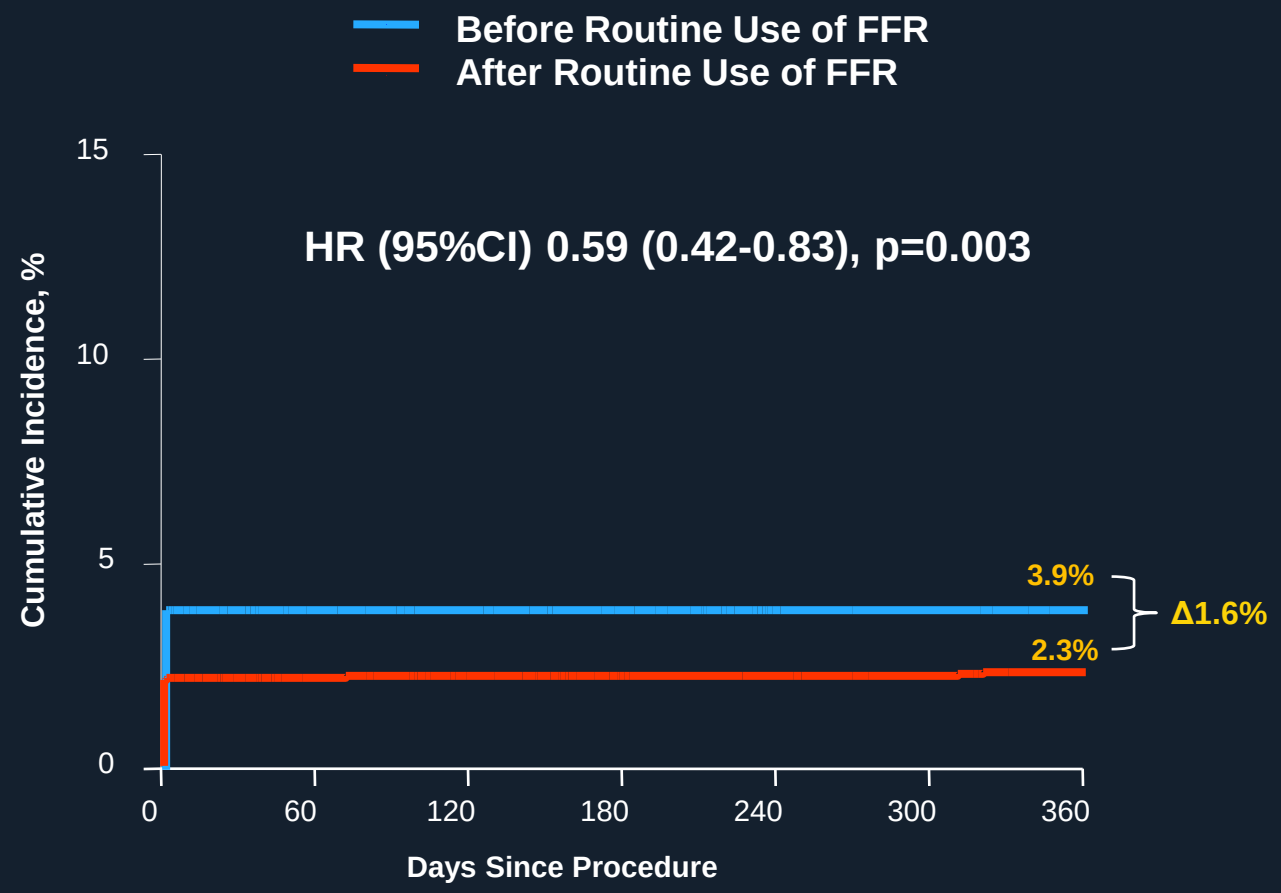
No. at Risk				
Before Routine Use	2178	2156	2126	2121
After Routine Use	2178	2143	2120	2113

Death



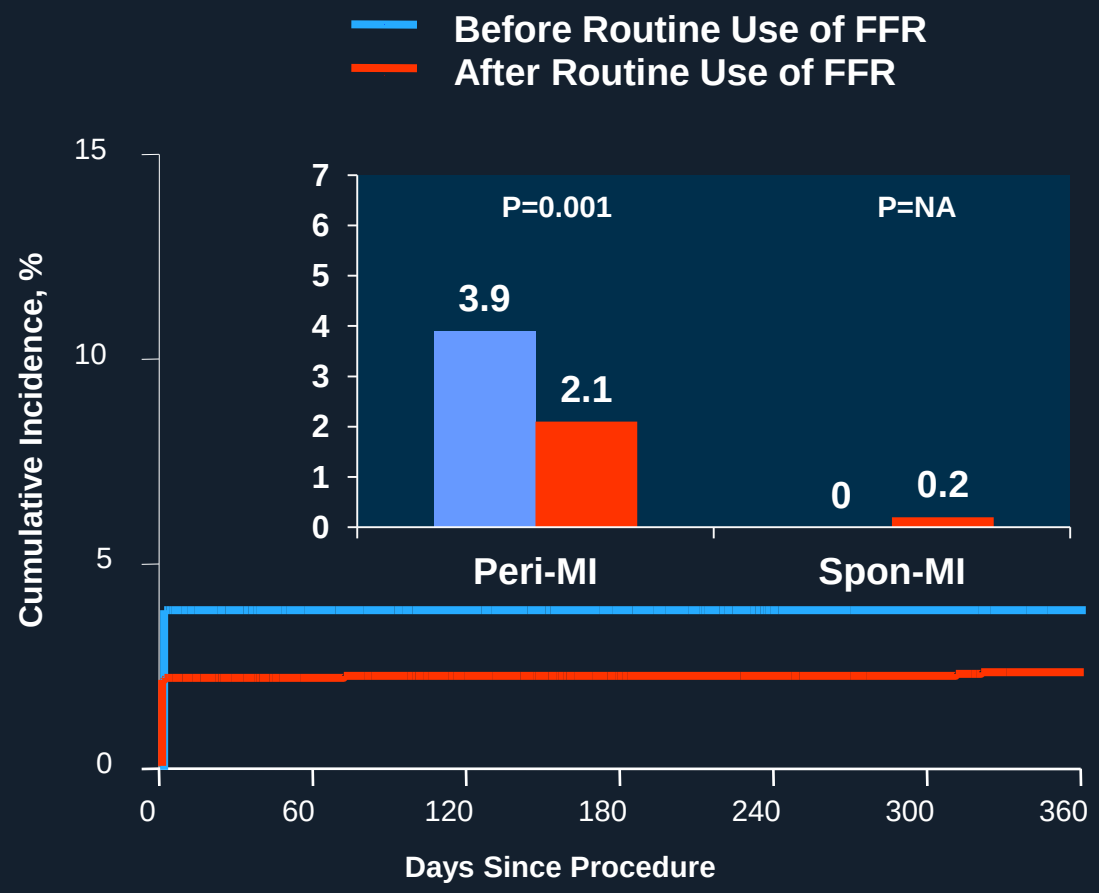
No. at Risk				
Before Routine Use	2178	2156	2126	2121
After Routine Use	2178	2143	2120	2113

Myocardial Infarction



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

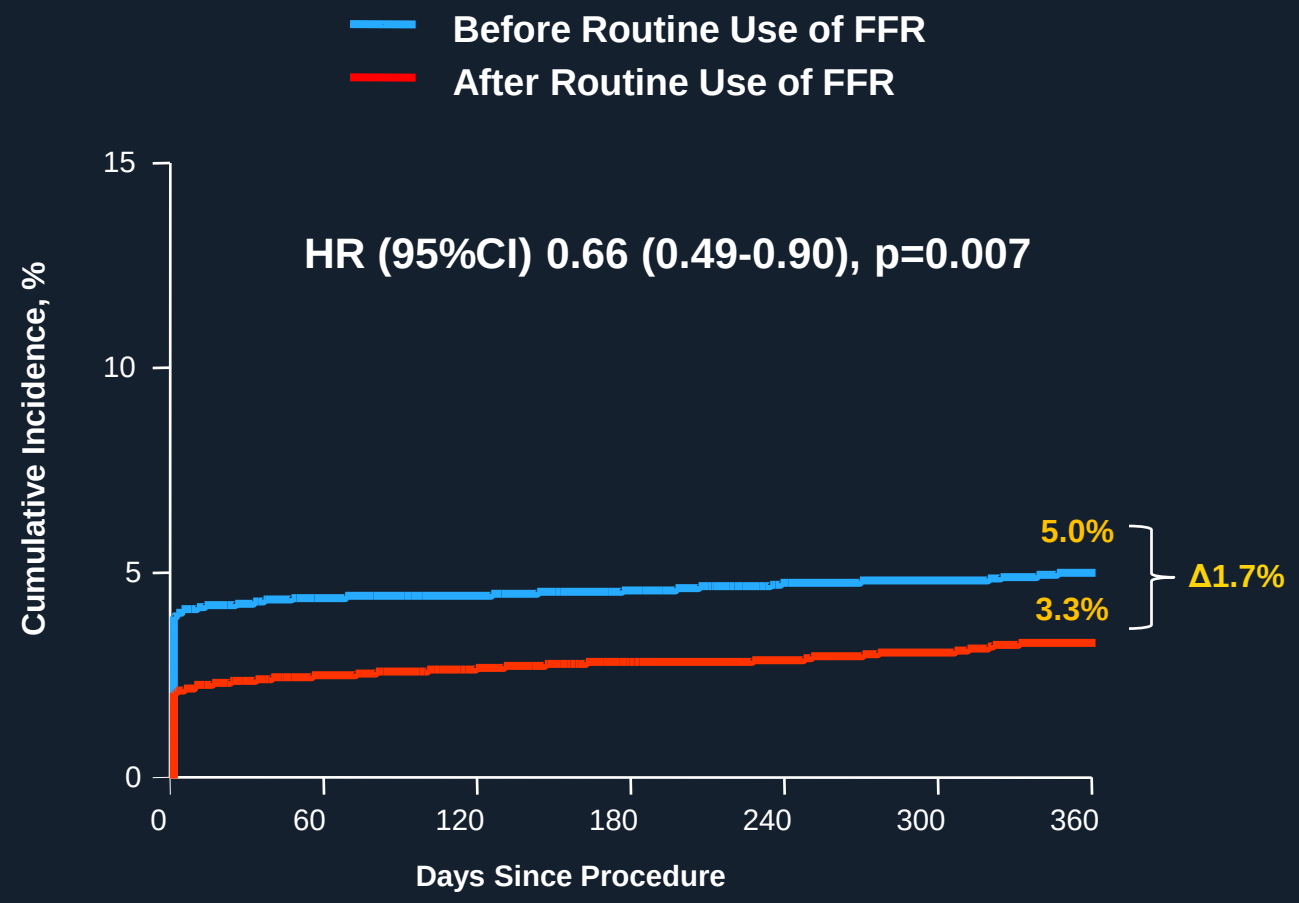
Myocardial Infarction



No. at Risk

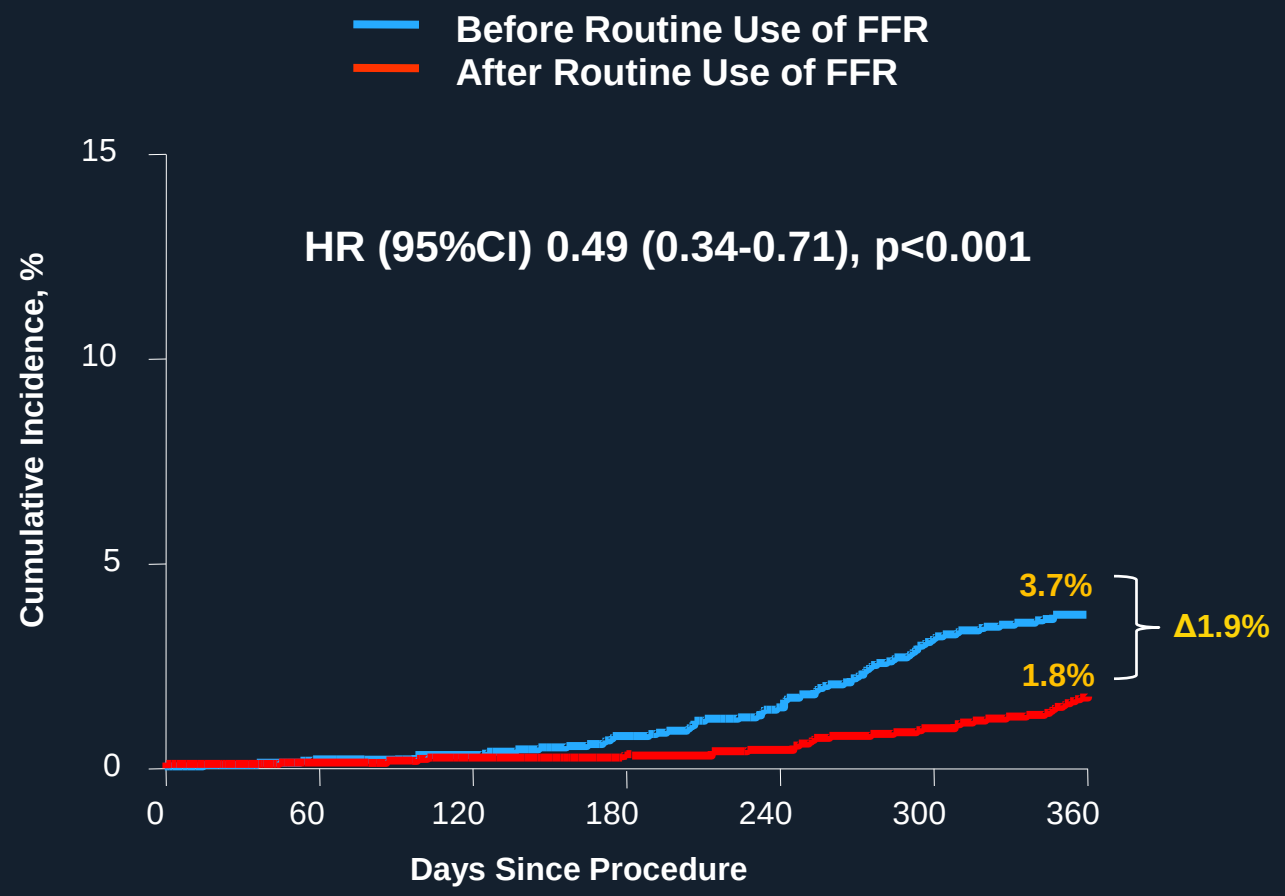
Before Routine Use	2178	2071	2041	2036
After Routine Use	2178	2098	2075	2066

Death or Myocardial Infarction



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

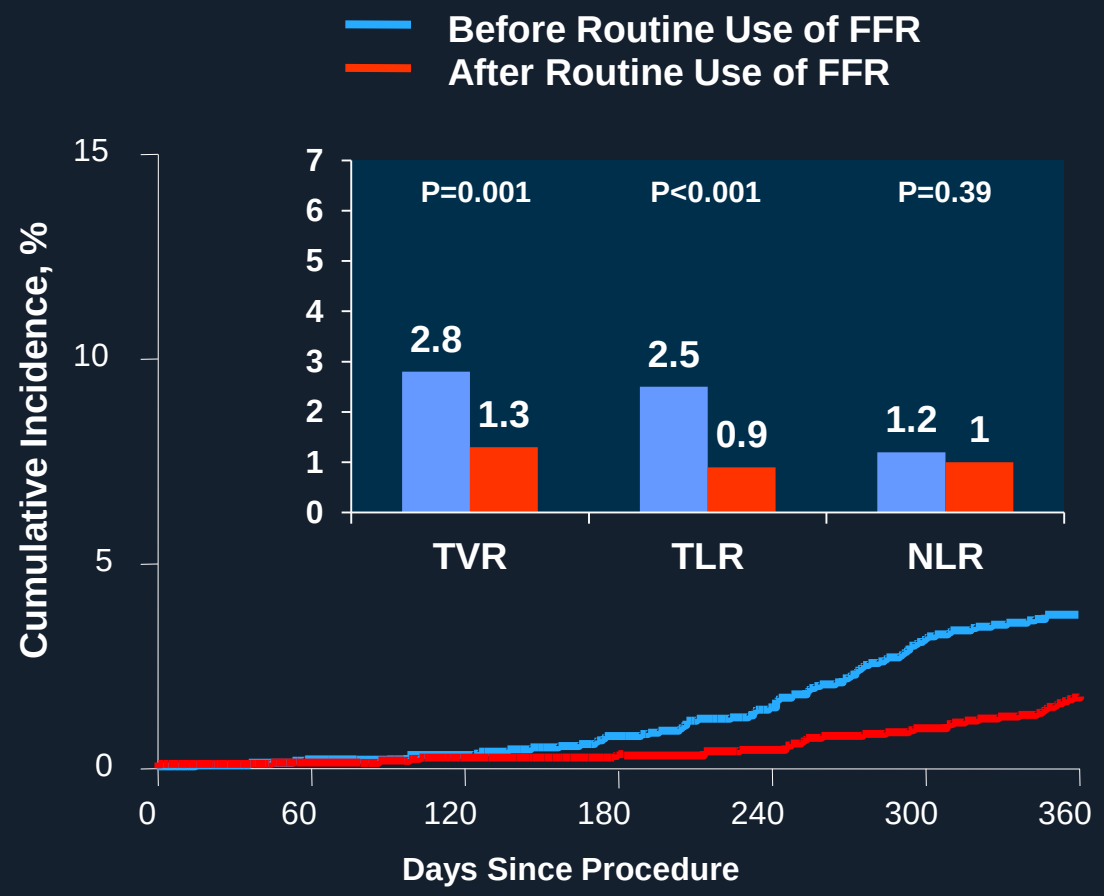
Repeat Revascularization



No. at Risk

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

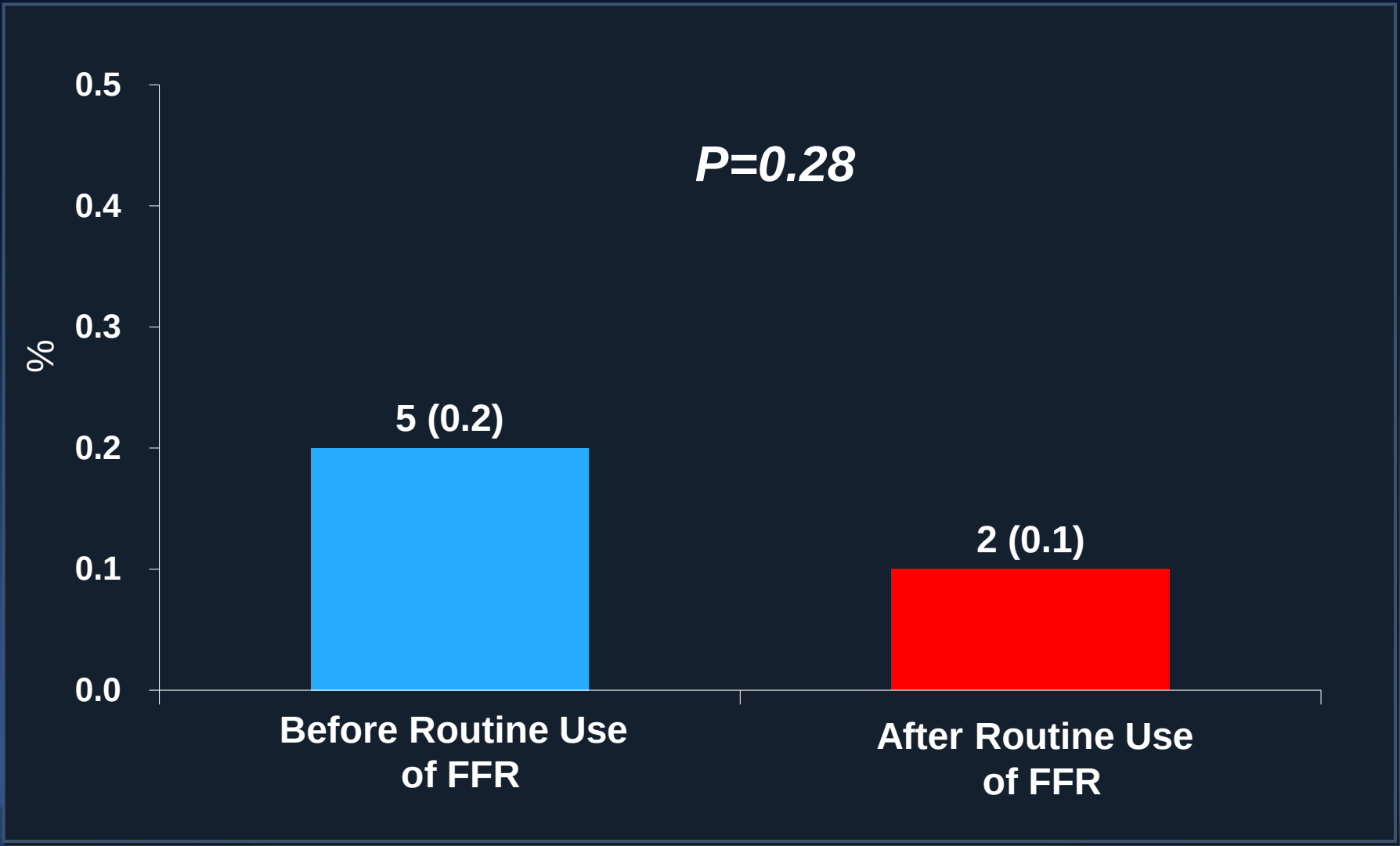
Repeat Revascularization



No. at Risk

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

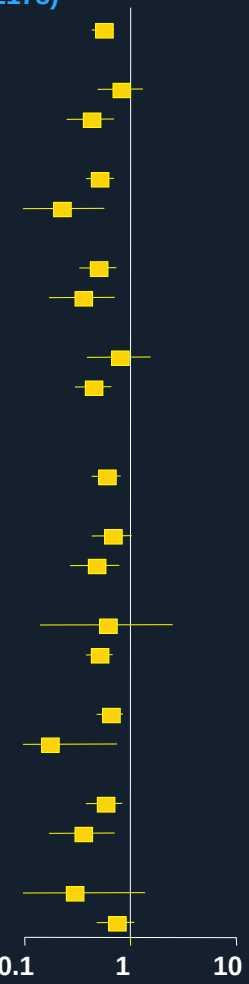
Stent Thrombosis at 12 Months*



* ARC defined definite and probable stent thrombosis

Subgroup Analysis

Subgroup	Event Rate (%) of Primary Endpoints: Before Routine Use (N=2178)	Event Rate (%) of Primary Endpoints: After Routine Use (N=2178)	Hazard Ratio (95% CI)	P value	Interaction P value
Overall	8.6	4.8	0.55 (0.43, 0.70)	<0.001	
Age					0.08
≥65 yo (N=1917)	8.7	6.0	0.80 (0.49, 1.32)	0.38	
<65 yo (N=2439)	8.4	3.8	0.42 (0.25, 0.70)	0.001	
Sex					0.74
Male (N=3159)	8.4	4.7	0.50 (0.38, 0.70)	<0.001	
Female (N=1197)	8.9	5.0	0.22 (0.08, 0.57)	0.002	
Presentation					0.82
sAP (N=2805)	7.7	4.3	0.49 (0.33, 0.74)	0.001	
ACS (N=1551)	10.0	5.7	0.35 (0.17, 0.71)	0.004	
Diabetes					0.12
Yes (N=1410)	9.6	6.1	0.78 (0.39, 1.56)	0.48	
No (N=2946)	8.1	4.2	0.44 (0.30, 0.66)	<0.001	
Ejection fraction					NA
≤40% (N=154)	13.3	6.5	NA	NA	
>40% (N=3840)	7.9	4.9	0.63 (0.48, 0.83)	0.001	
Bifurcation					0.27
Yes (N=1951)	11.2	7.2	0.67 (0.43, 1.03)	0.067	
No (N=2405)	6.4	2.8	0.47 (0.27, 0.79)	0.005	
Left main disease					0.56
Yes (N=485)	15.0	10.9	0.60 (0.14, 2.51)	0.48	
No (N=3871)	7.8	4.0	0.50 (0.38, 0.68)	<0.001	
Long (>20mm) lesion					0.044
Yes (N=3490)	9.2	5.4	0.64 (0.48, 0.85)	0.002	
No (N=866)	6.0	2.1	0.17 (0.04, 0.75)	0.019	
Multivessel disease					0.48
Yes (N=2311)	6.5	3.8	0.57 (0.38, 0.84)	0.005	
No (N=2045)	2.8	2.1	0.35 (0.17, 0.71)	0.004	
Type of DES					0.30
Previous DES (N=1589)	8.1	2.4	0.29 (0.06, 1.38)	0.12	
New DES (N=2351)	9.5	6.2	0.73 (0.48, 1.09)	0.13	



Conclusion

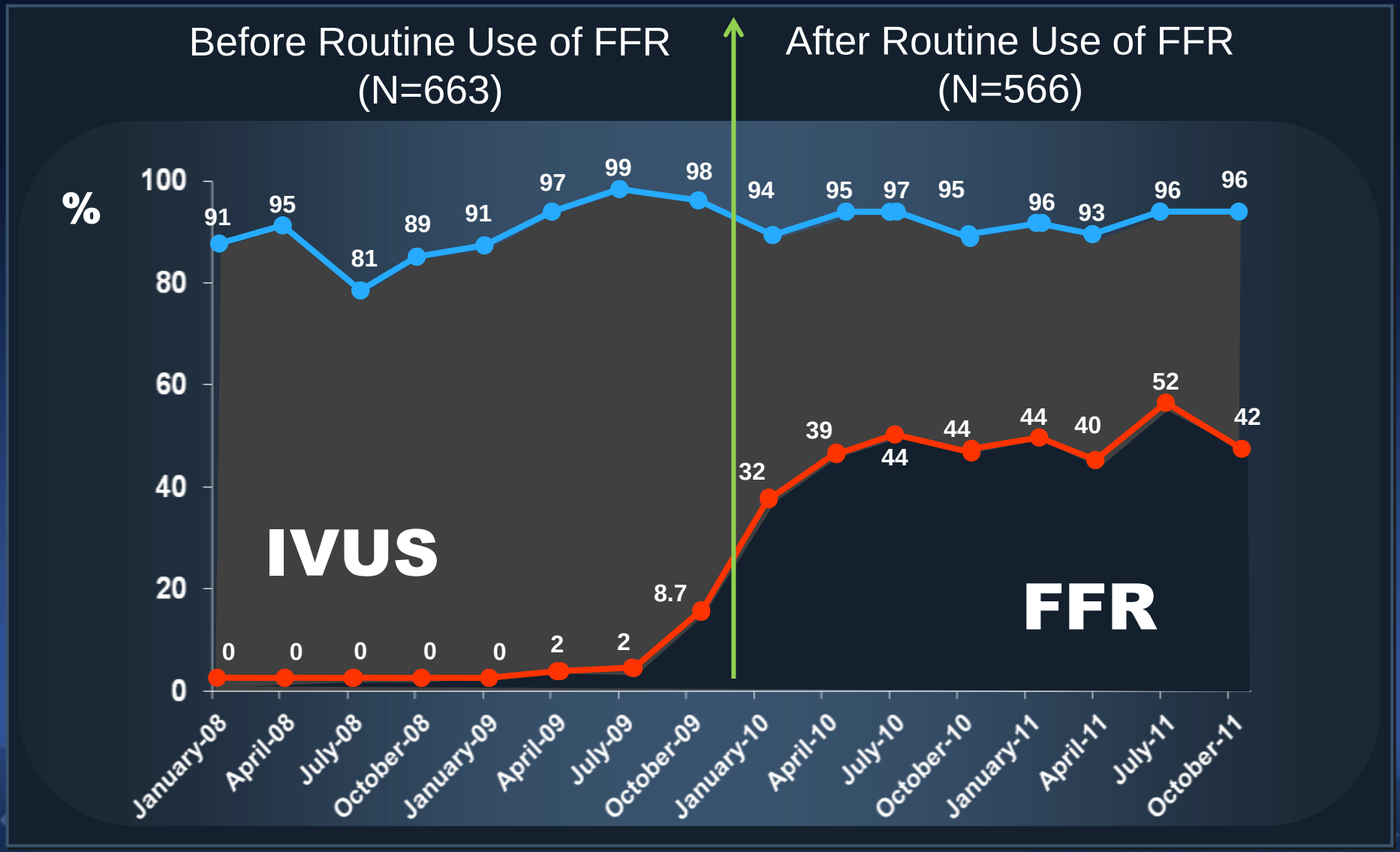
- The current study confirmed the benefit of FFR-guided PCI in a real-world patient population.
- Temporal comparison of two cohorts using propensity-score matching showed that the risks of death, MI, or repeat revas-cularization at 1 year were significantly reduced when FFR is used routinely.
- The benefit is primarily due to a reduced number of stents used per patients and a subsequent decreased risk of peri-procedrual MI and repeat revascularization.

Conclusion

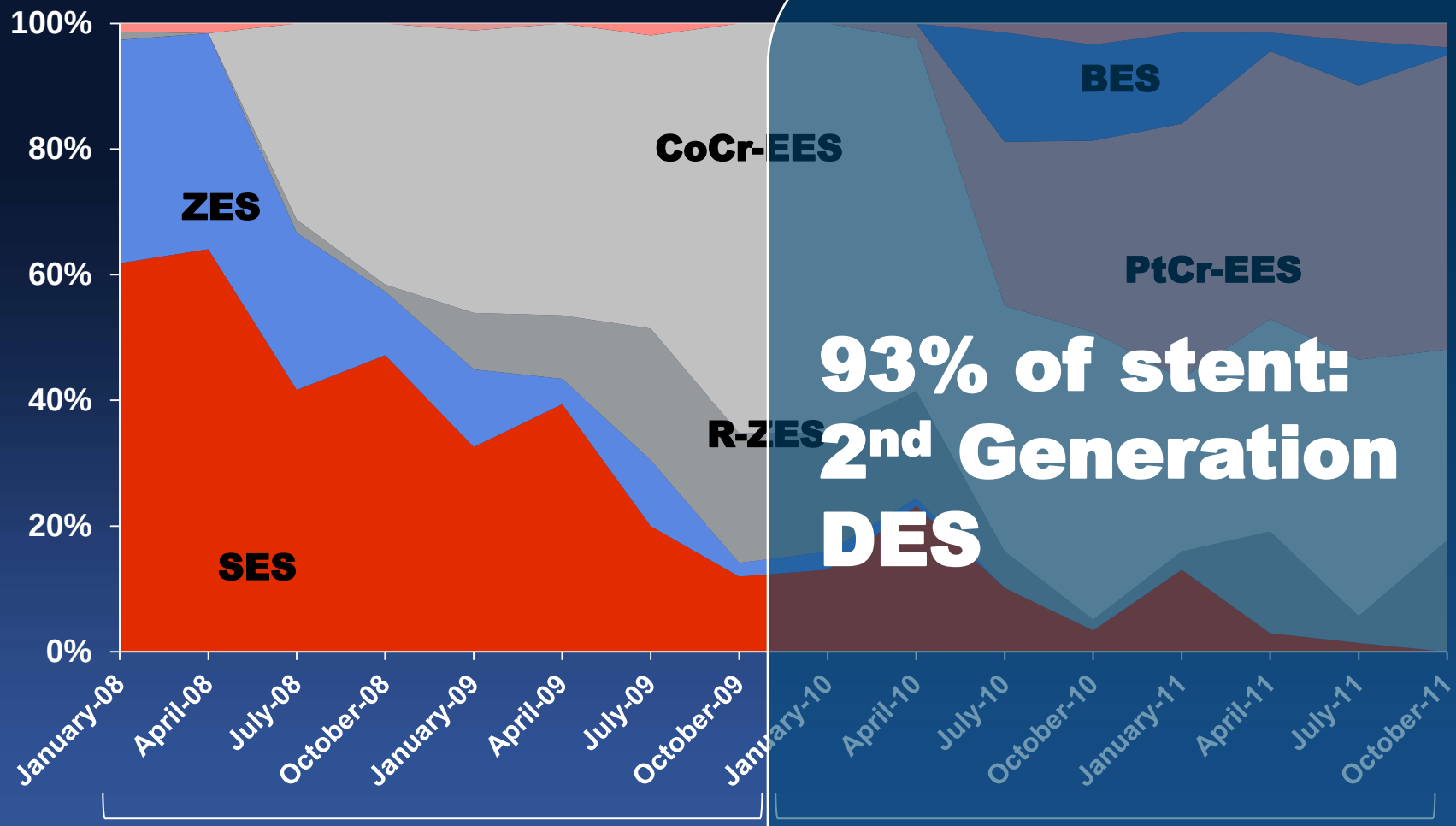
- Profound reduction of stent used was observed in the territory of RCA and LCX, which can be explained by the higher incidence of “visual-functional mismatch” in this territory.
- The routine measurement of FFR in daily practice appeared to be associated with a more judicious use of stent implantation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

ASAN LM and MV Registry (N=1229)

FFR and IVUS During PCI
(n=1229)



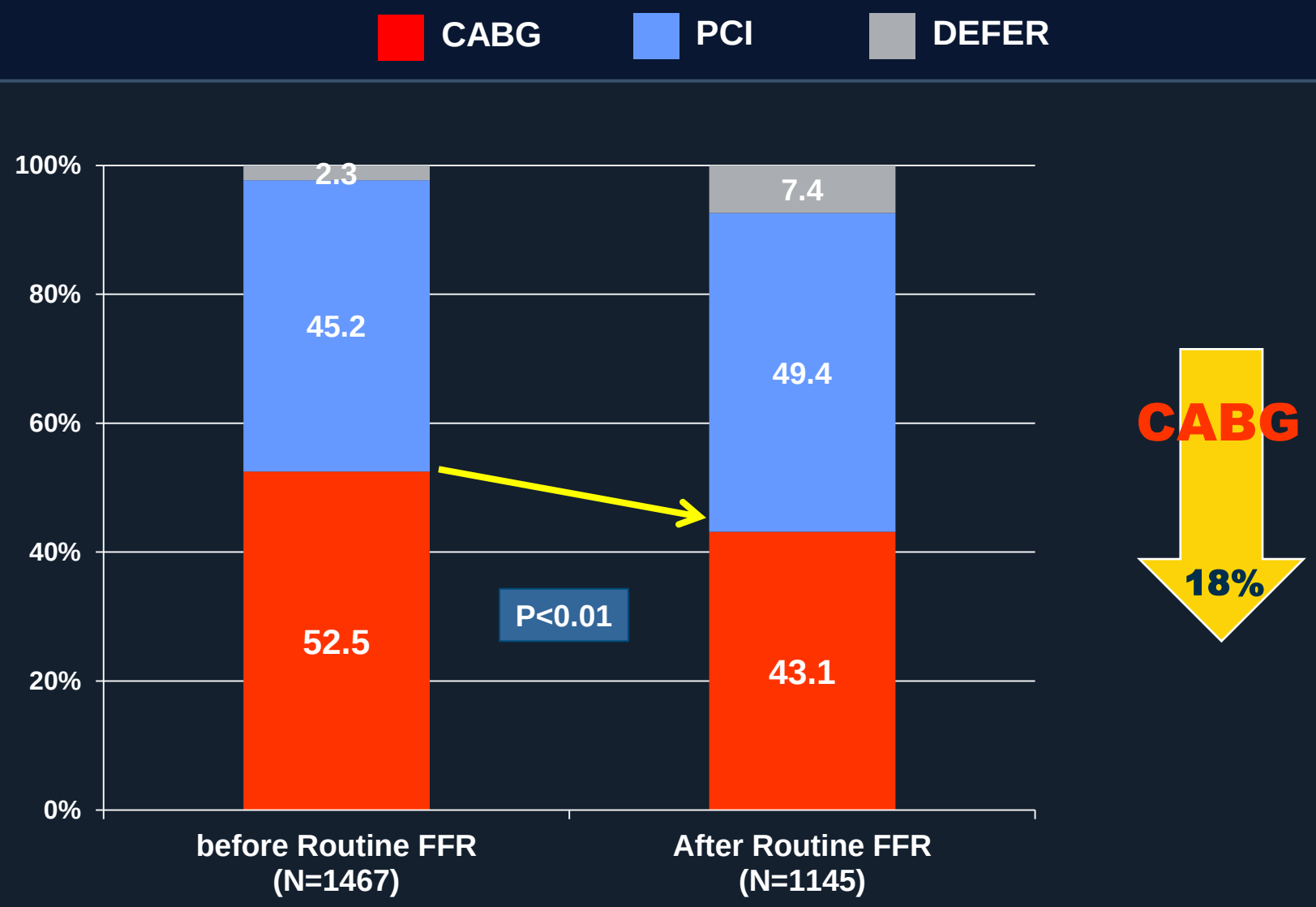
Type of DES



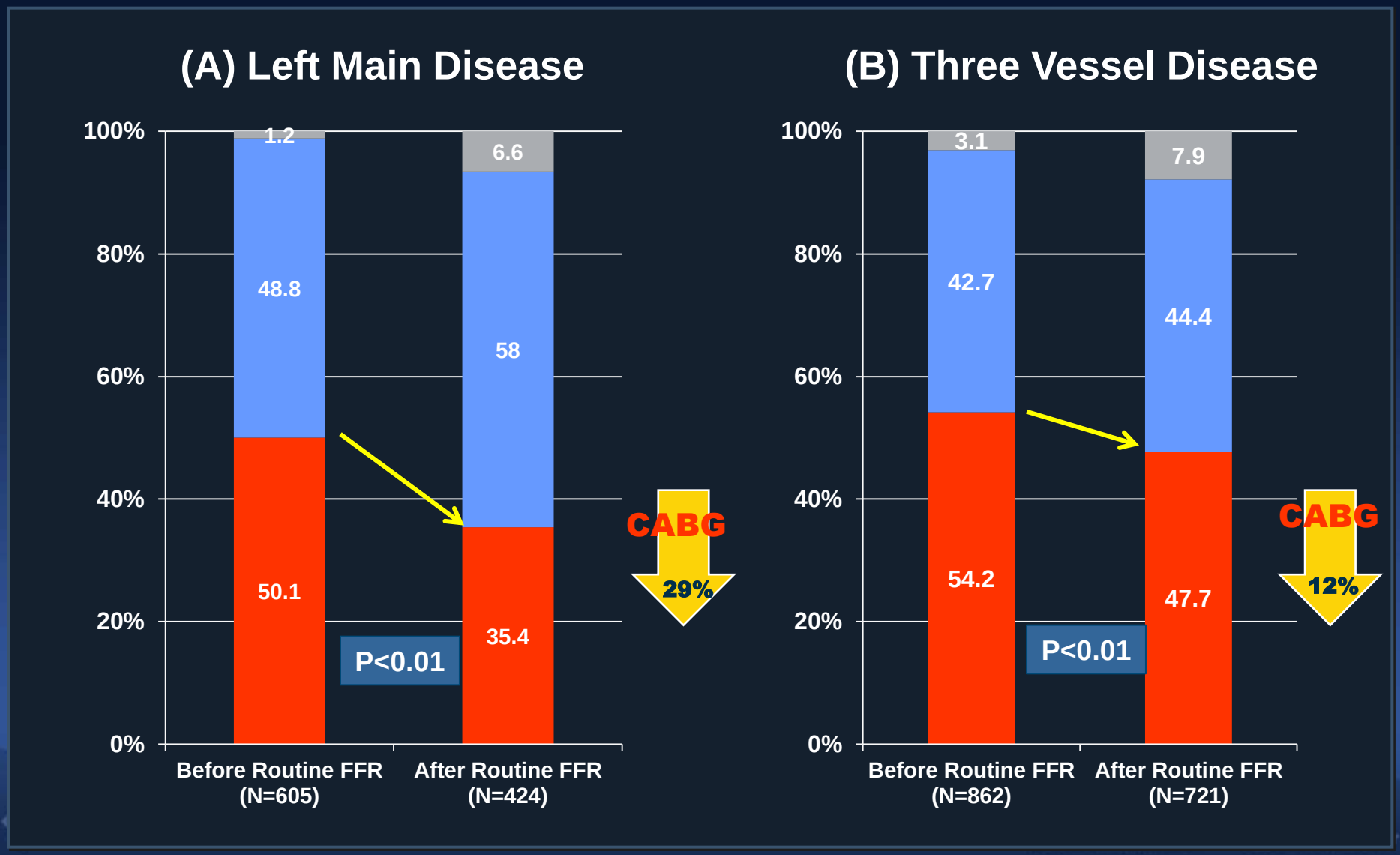
Before Routine Use of FFR
(Year 2008-2009)

After Routine Use of FFR
(Year 2010-2011)

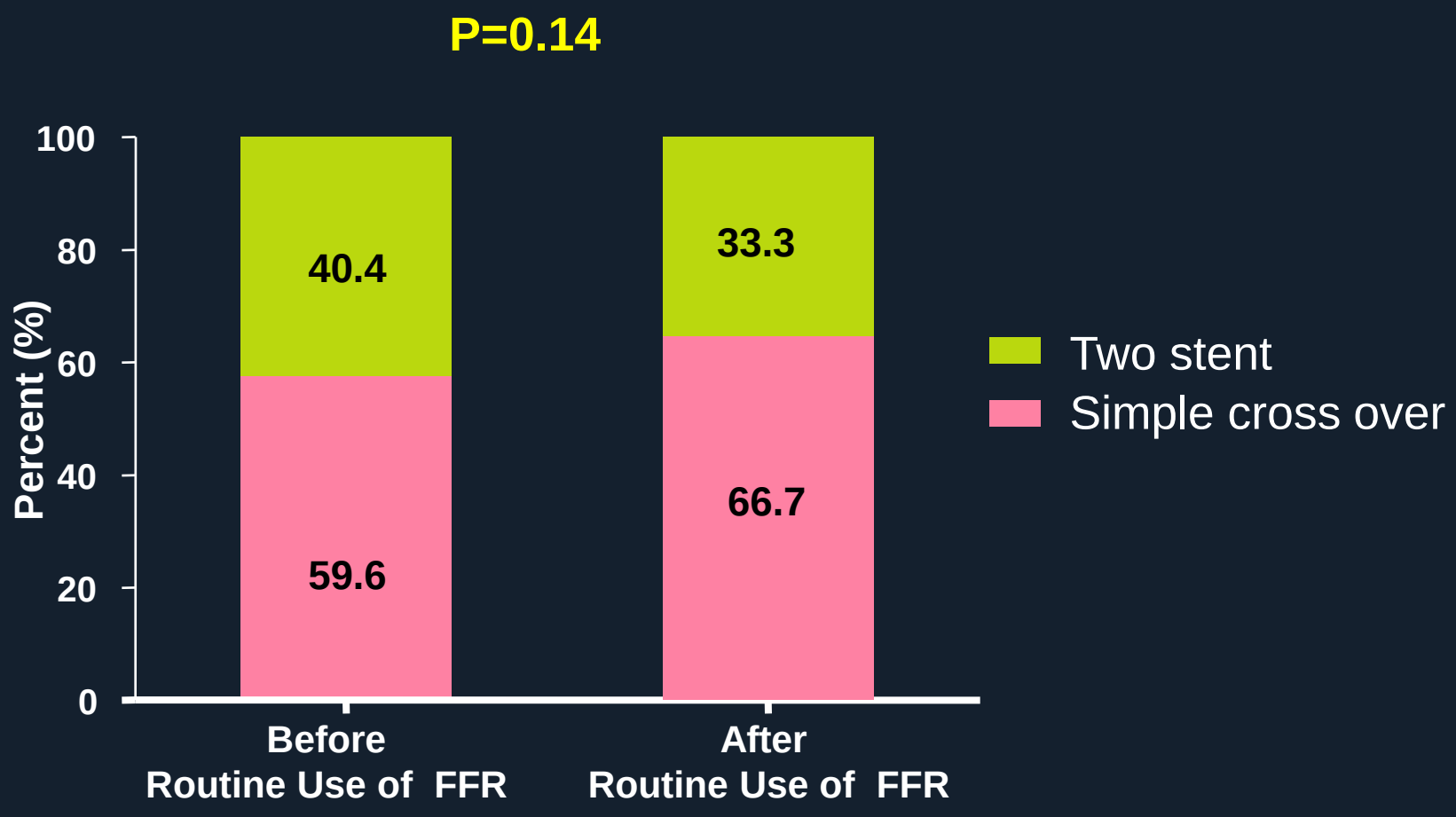
Treatment Strategy



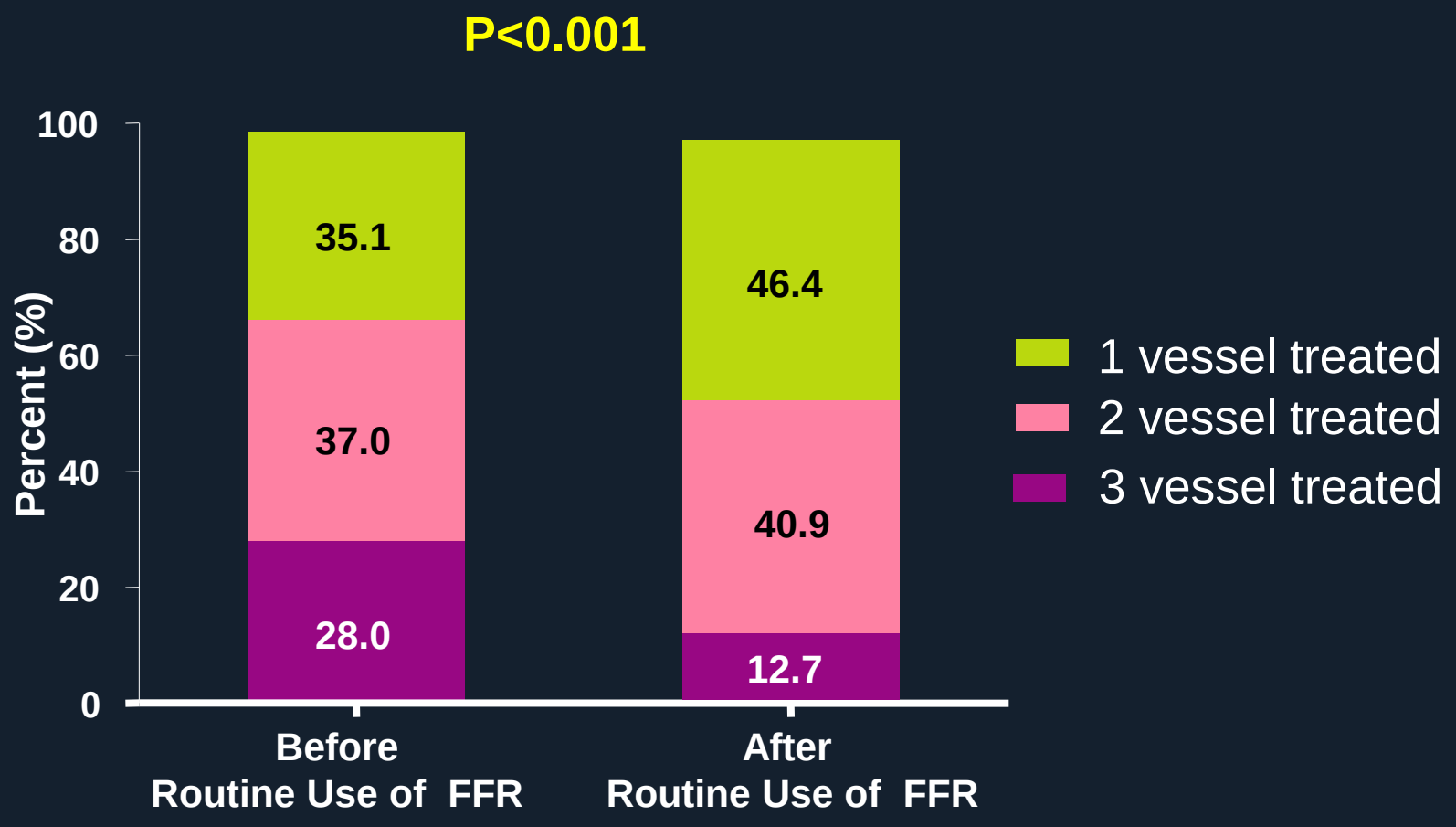
Treatment Strategy



Procedural Change in PCI
Distal LM Treatment in LM Subset



Procedural Change in PCI
Three Vessel Subset



Propensity Matched Population

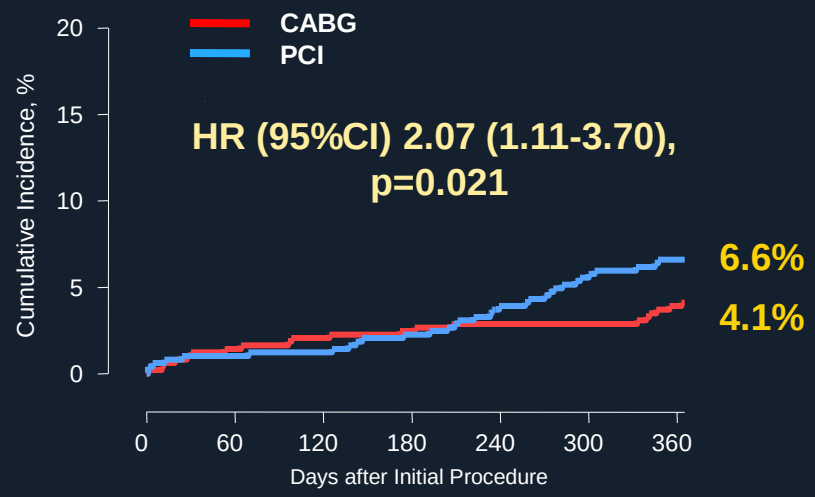
Before Routine Use of FFR: CABG versus PCI (486 pairs)

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

Primary End Point

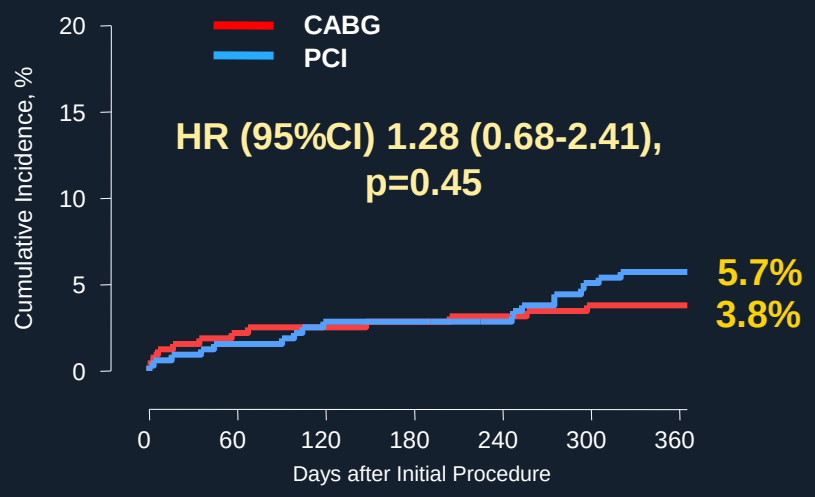
(Death, MI, Stroke or Repeat Revascularization)

Before Routine FFR (2008-2009)



CABG	486	477	472	467
PCI	486	481	466	453

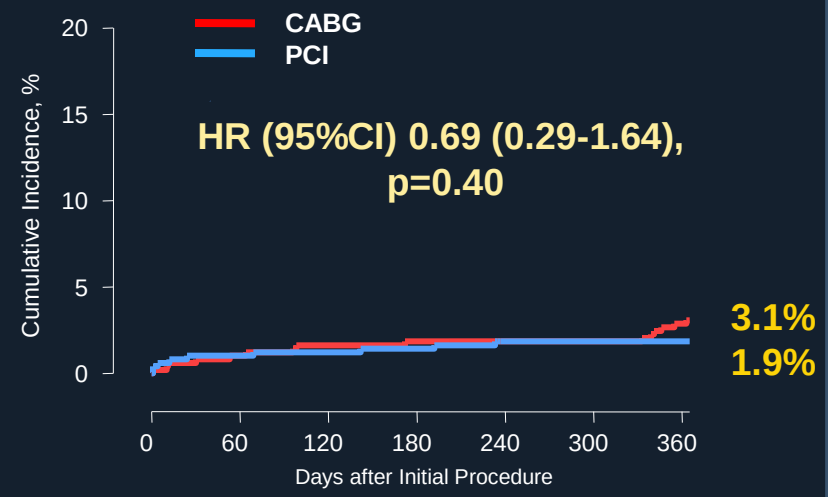
After Routine FFR (2010-2011)



CABG	315	308	306	304
PCI	315	307	304	295

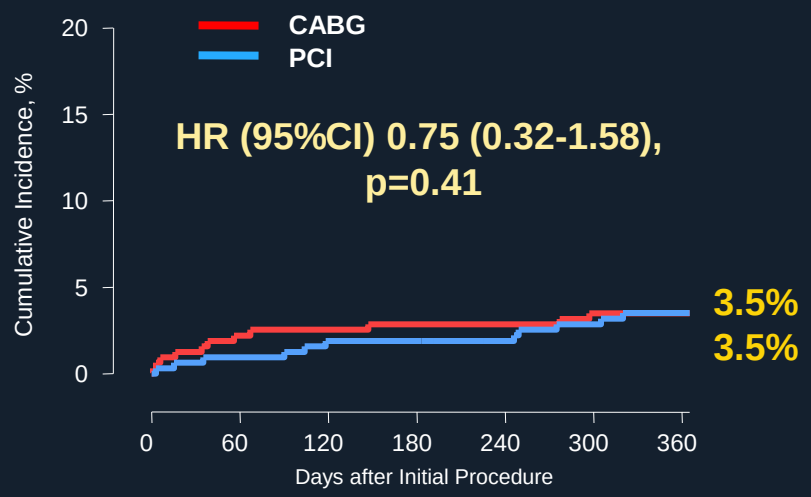
Death, MI or Stroke

Before Routine FFR (2008-2009)



CABG	486	479	477	472
PCI	486	481	476	476

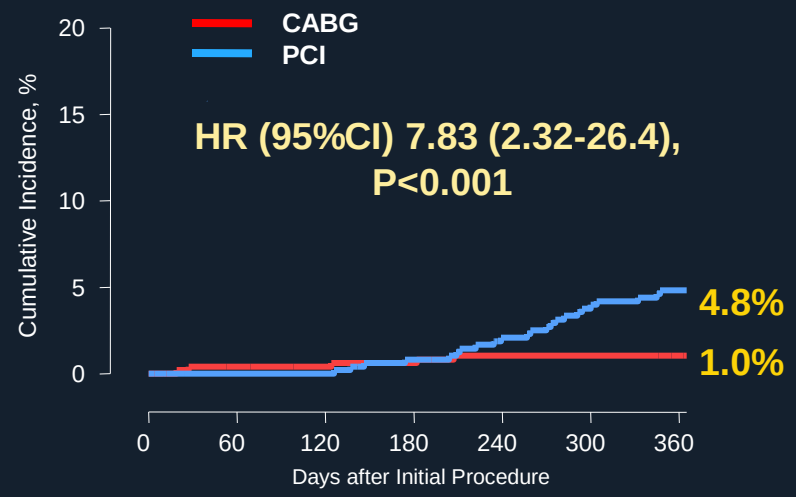
After Routine FFR (2010-2011)



CABG	315	308	307	305
PCI	315	310	307	302

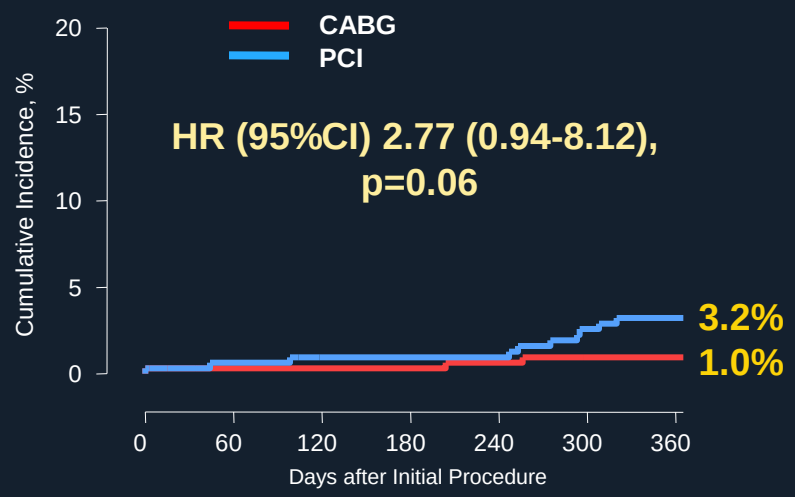
Repeat Revascularization

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

Subgroup Analysis

	1 Year Event Rate (%) CABG	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
Triple 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

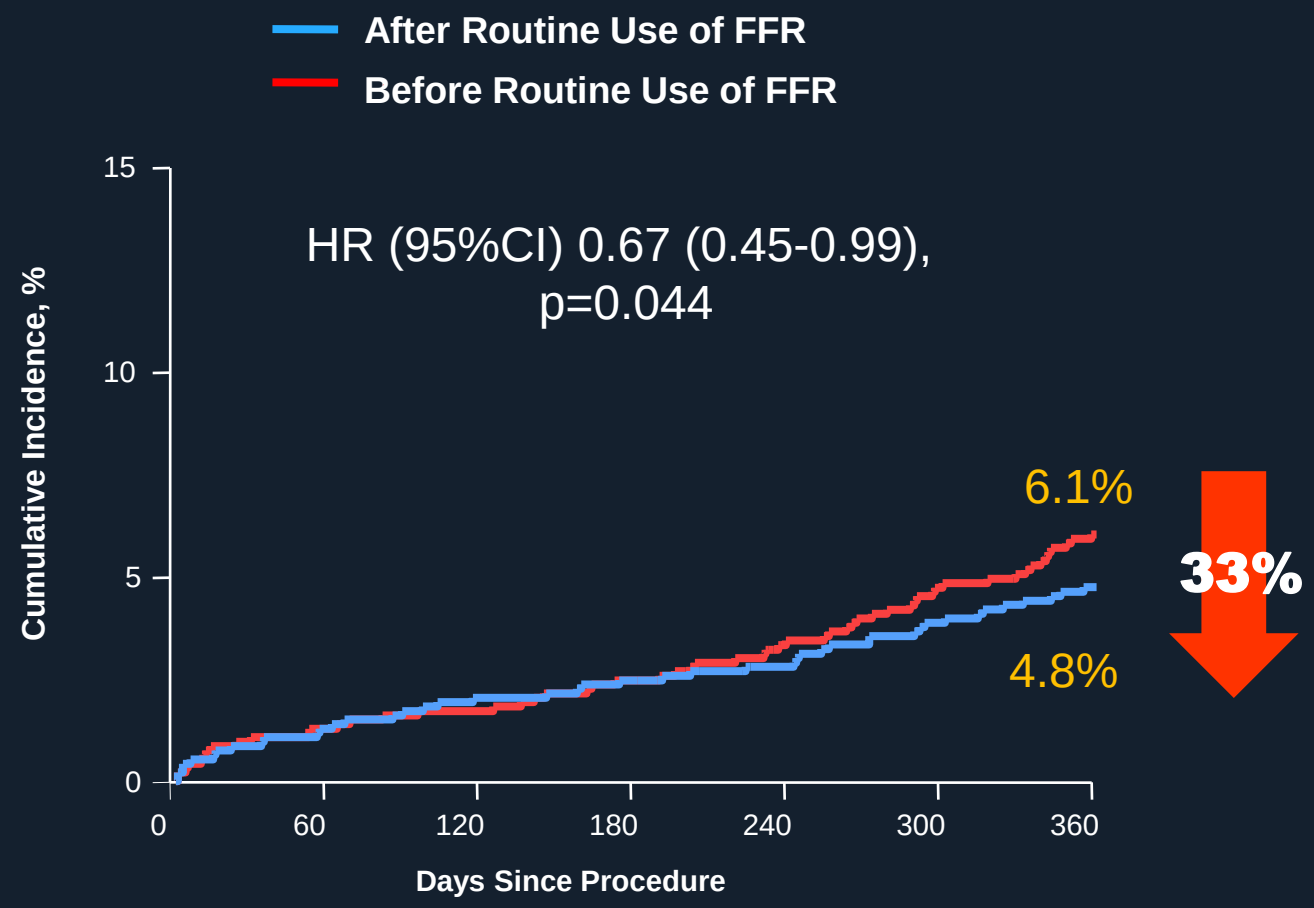
Propensity Matched Population

Before Routine Use of FFR vs. After Routine Use of FFR

(971 pairs)

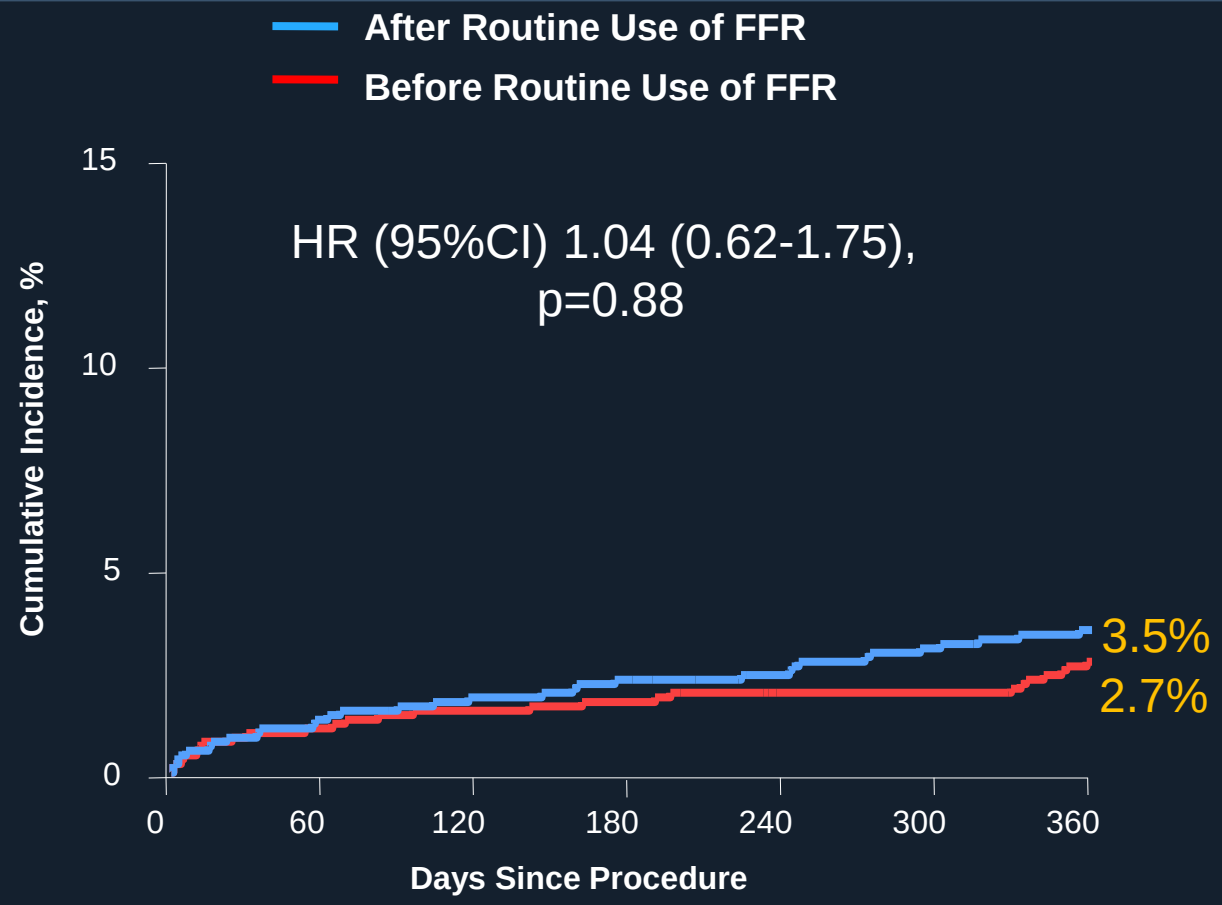
Primary End Point

(Death, MI, Stroke or Repeat Revascularization)



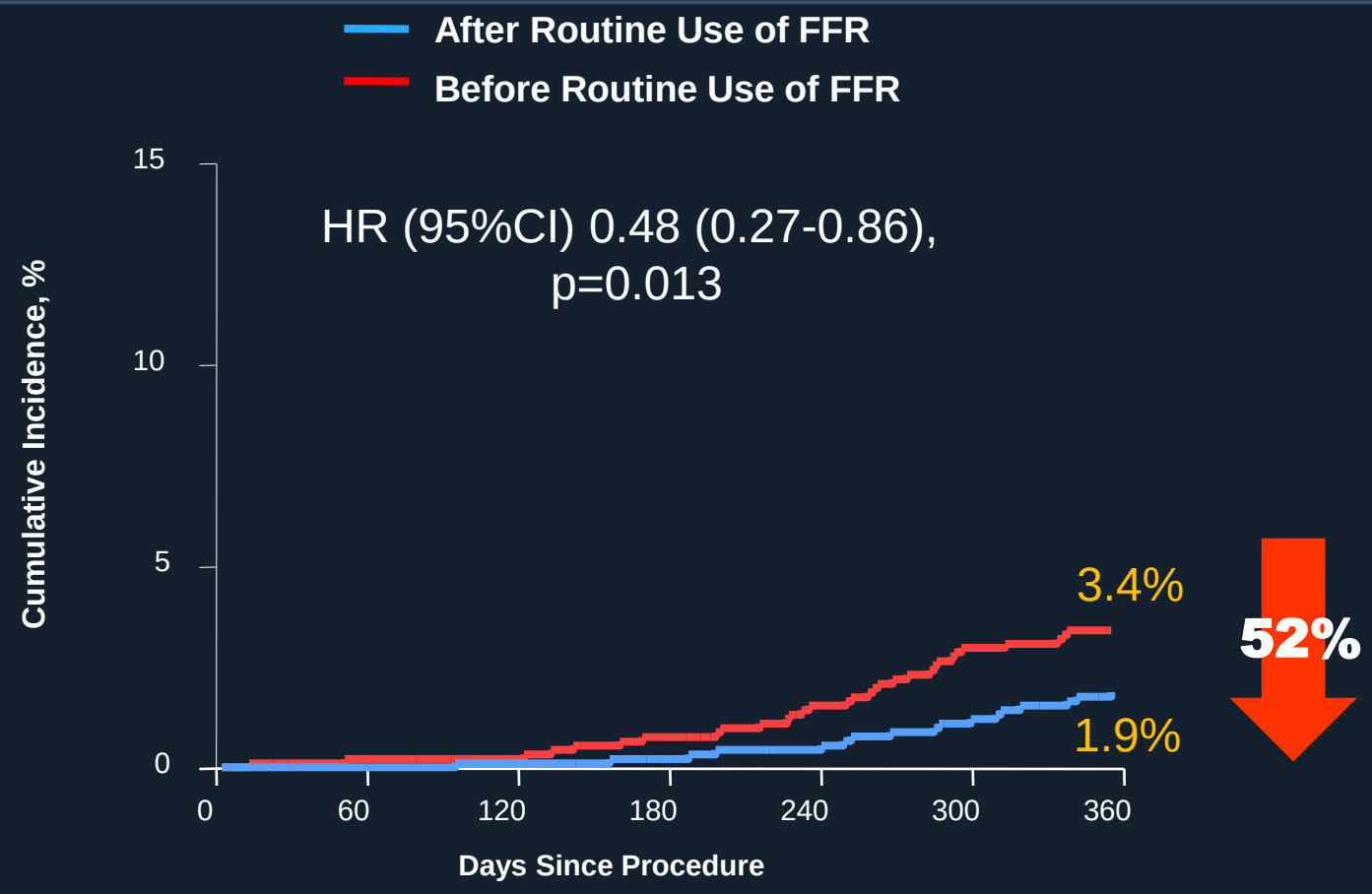
No. at Risk				
Before Routine Use	917	901	883	857
After Routine Use	917	898	886	869

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

Conclusion

1. The routine incorporation of FFR in the decision making for revascularization has extended role of PCI, while it reduced role of CABG as the primary revascularization strategies.

2. PCI with second generation DES, guided by FFR showed similar clinical outcomes with concurrent CABG at 1 year in patients with left main or three vessel disease.

Conclusion

3. The deferral of revascularization in patients without documented ischemia showed excellent clinical outcomes event, even in the angiographic severe coronary artery disease.

4. Overall clinical outcomes in patients with severe coronary artery disease were improved after the routine use of FFR, mainly derived from the improvement of PCI outcomes.