

# How Good FFR Guided In Real Practice, Data from ASAN PCI and Multivessel Registry

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# Impact of Routine Use of FFR for PCI Outcomes.

Data from ASAN PCI Registry (1)

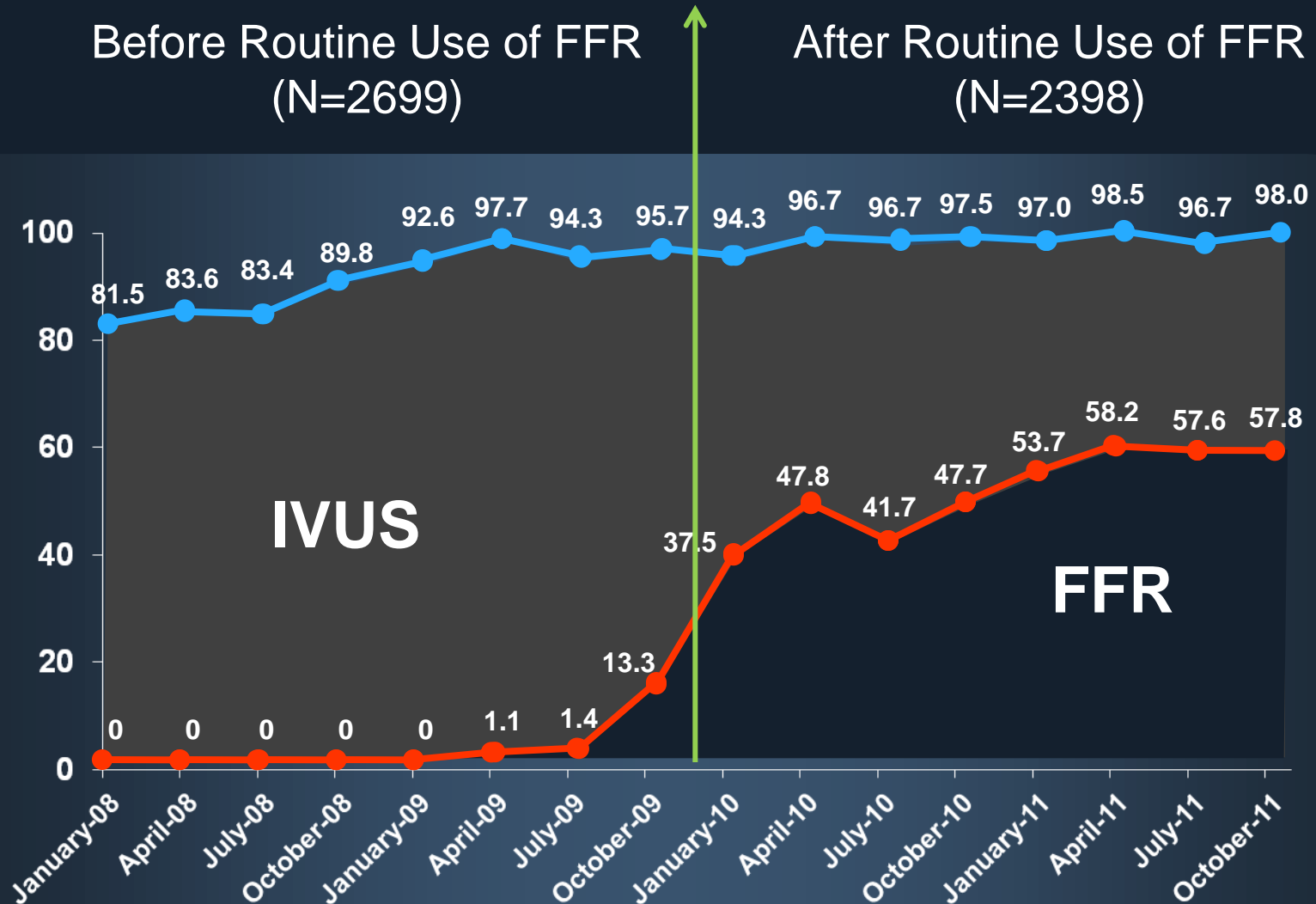
# Study Patients

To evaluate the changes in practice and outcomes of PCI before and after **the routine use of FFR**.

A total of 5097 patients were enrolled between January 2008 and December 2011 from the data of ASAN PCI registry. (*clinicaltrials.gov number NCT 0178859*)

# Integrated Use of FFR and IVUS

(AMC data, n=5097)



# Baseline Clinical 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
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

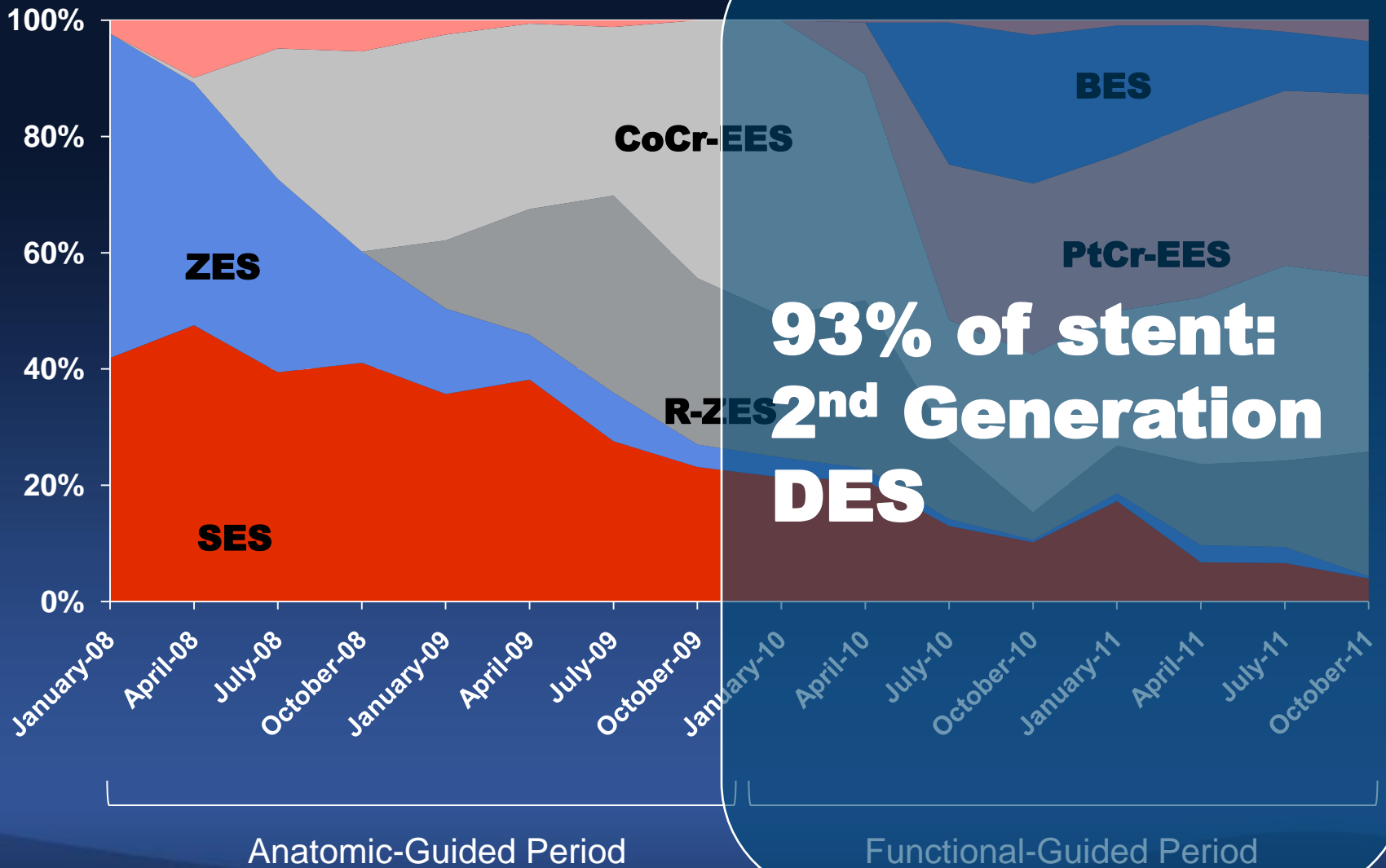
# Baseline Angiographic Characteristics

## 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)	<b>0.001</b>	1742 (80.0)	1748 (80.3)	0.84
CTO	148 (5.5)	177 (7.4)	<b>0.006</b>	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

# Type of DES



**93% of stent:  
2<sup>nd</sup> Generation  
DES**

# Results

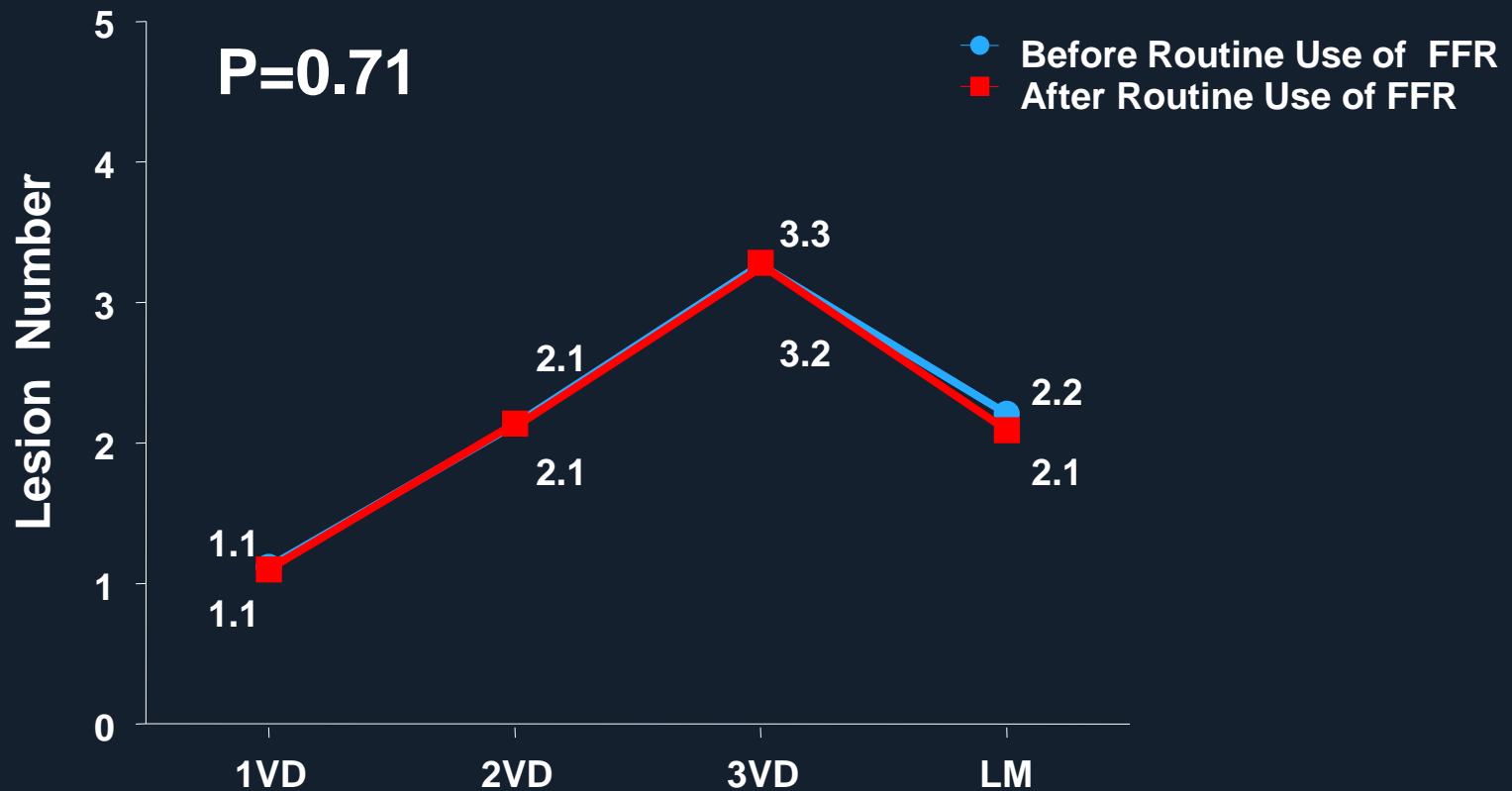


# Procedural Characteristics

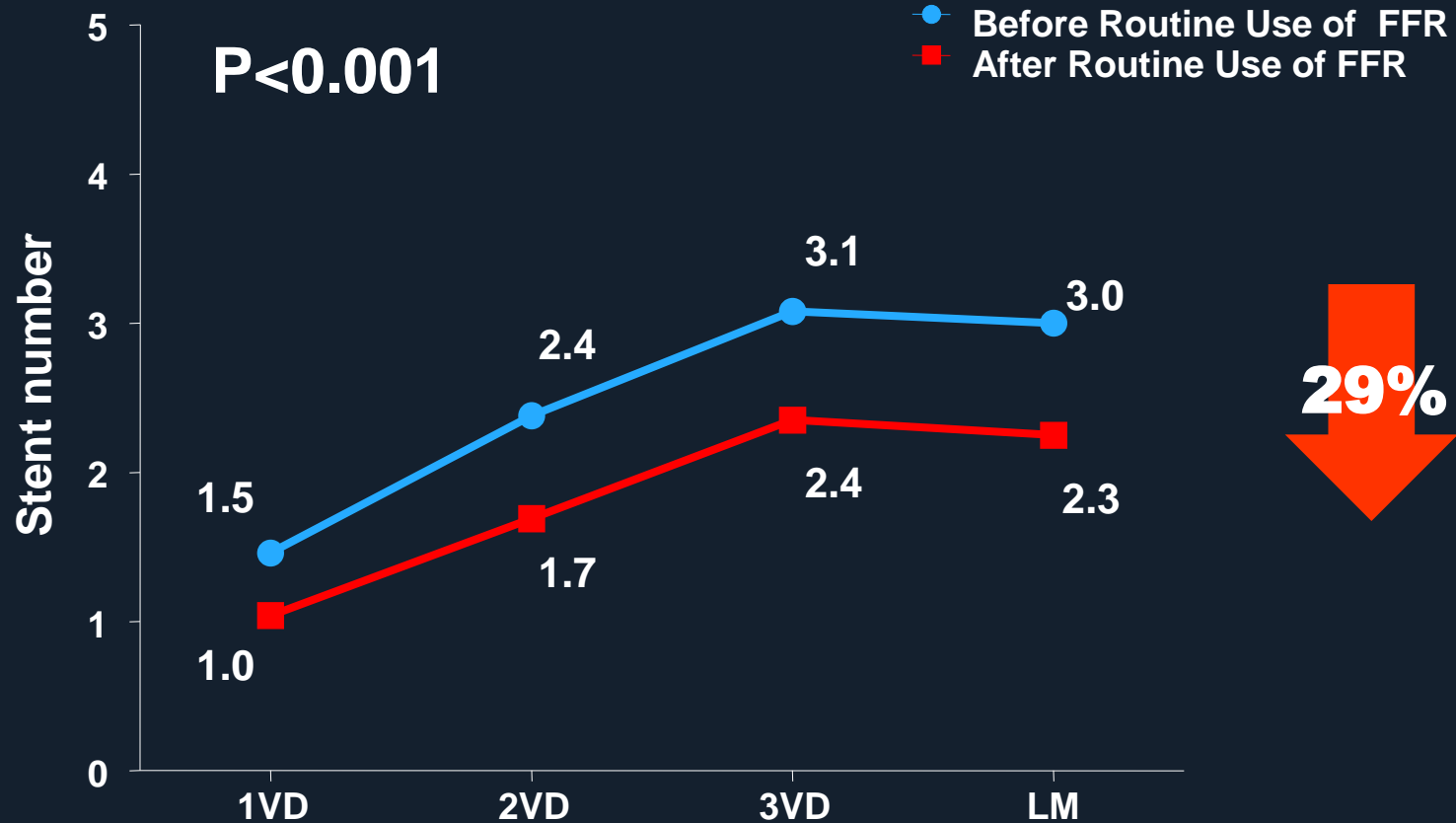
## Propensity Score Matched Population

	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

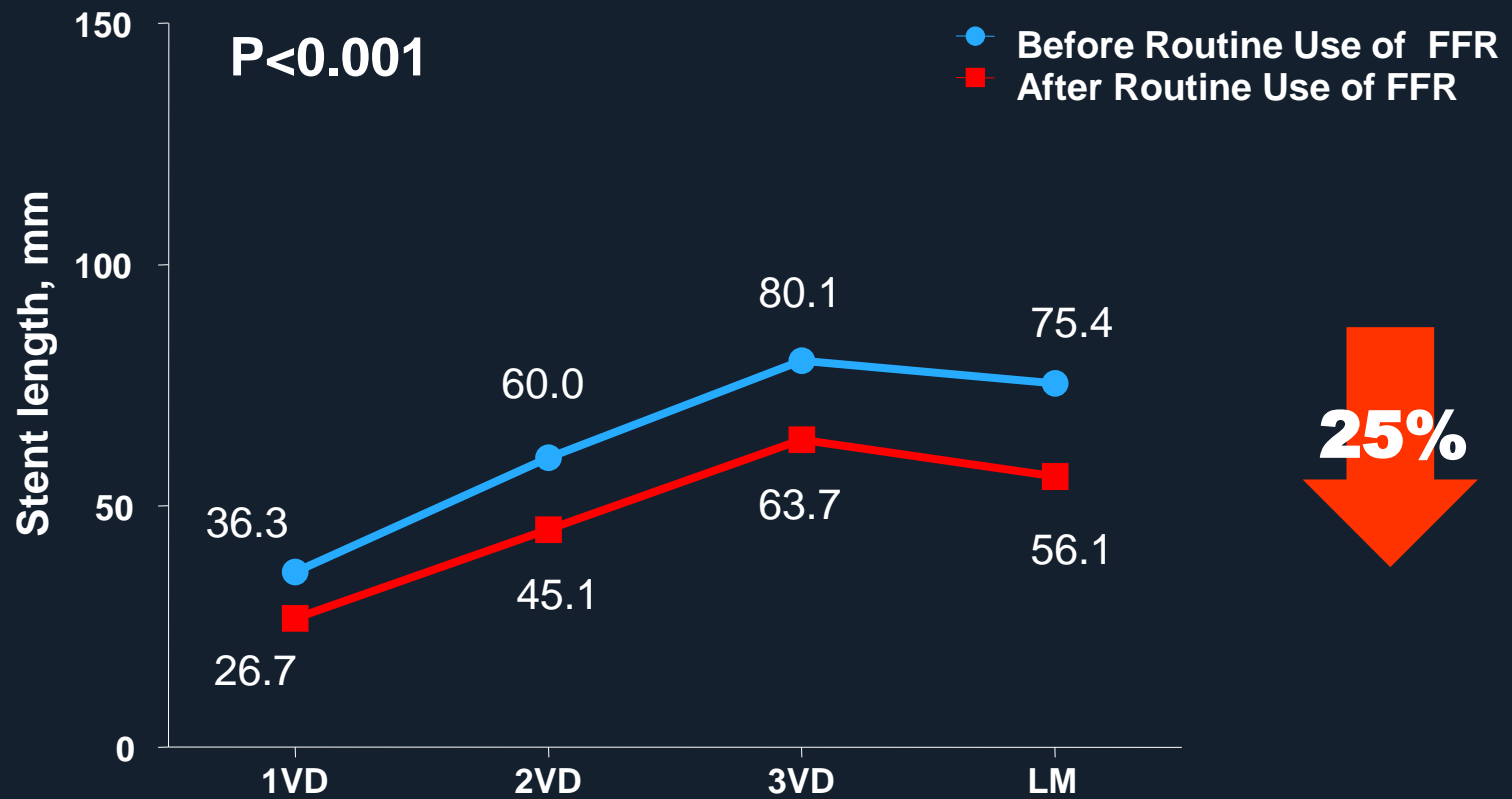
# Angiographic Assessed Lesion Number



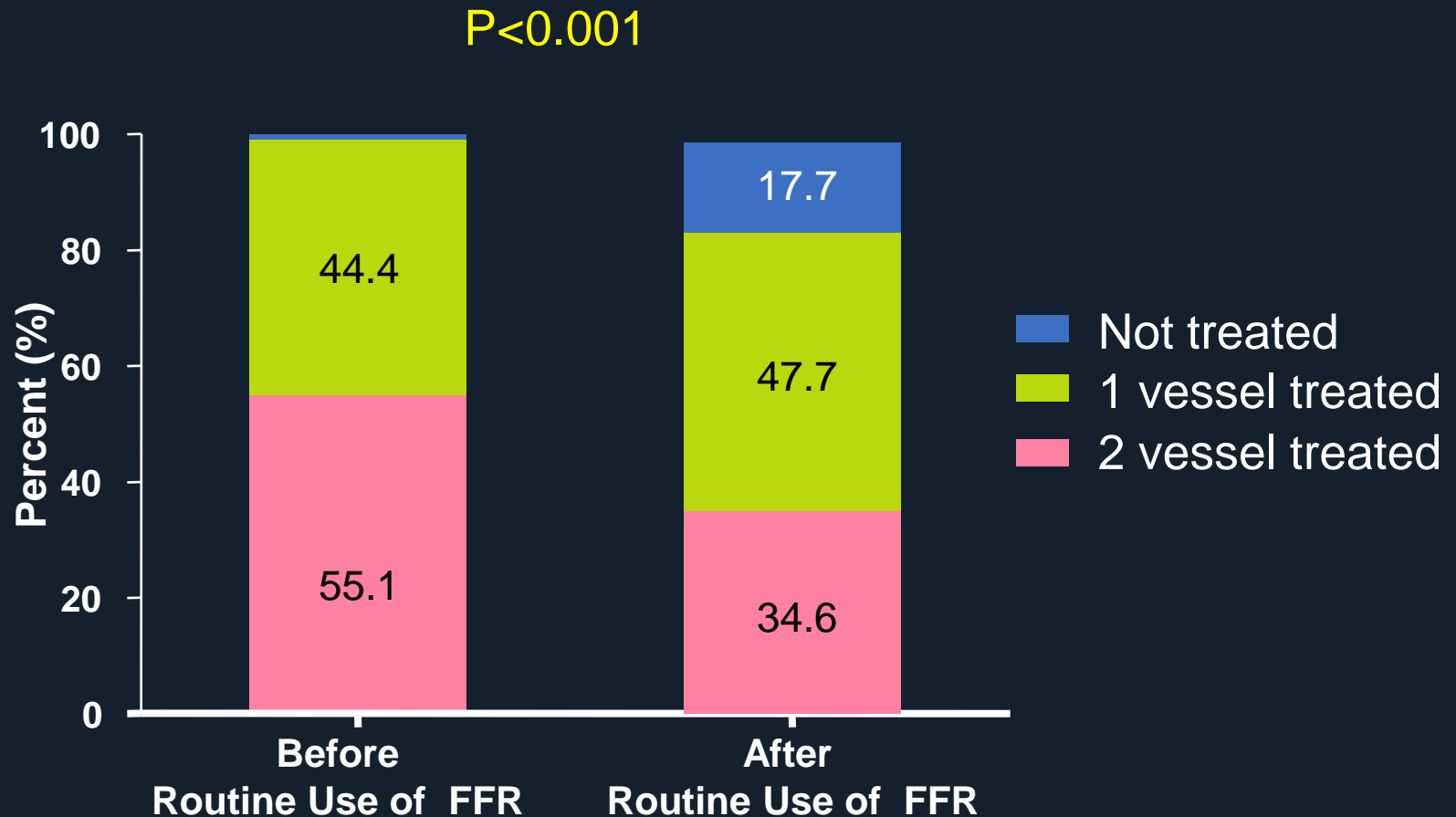
# Stent Number



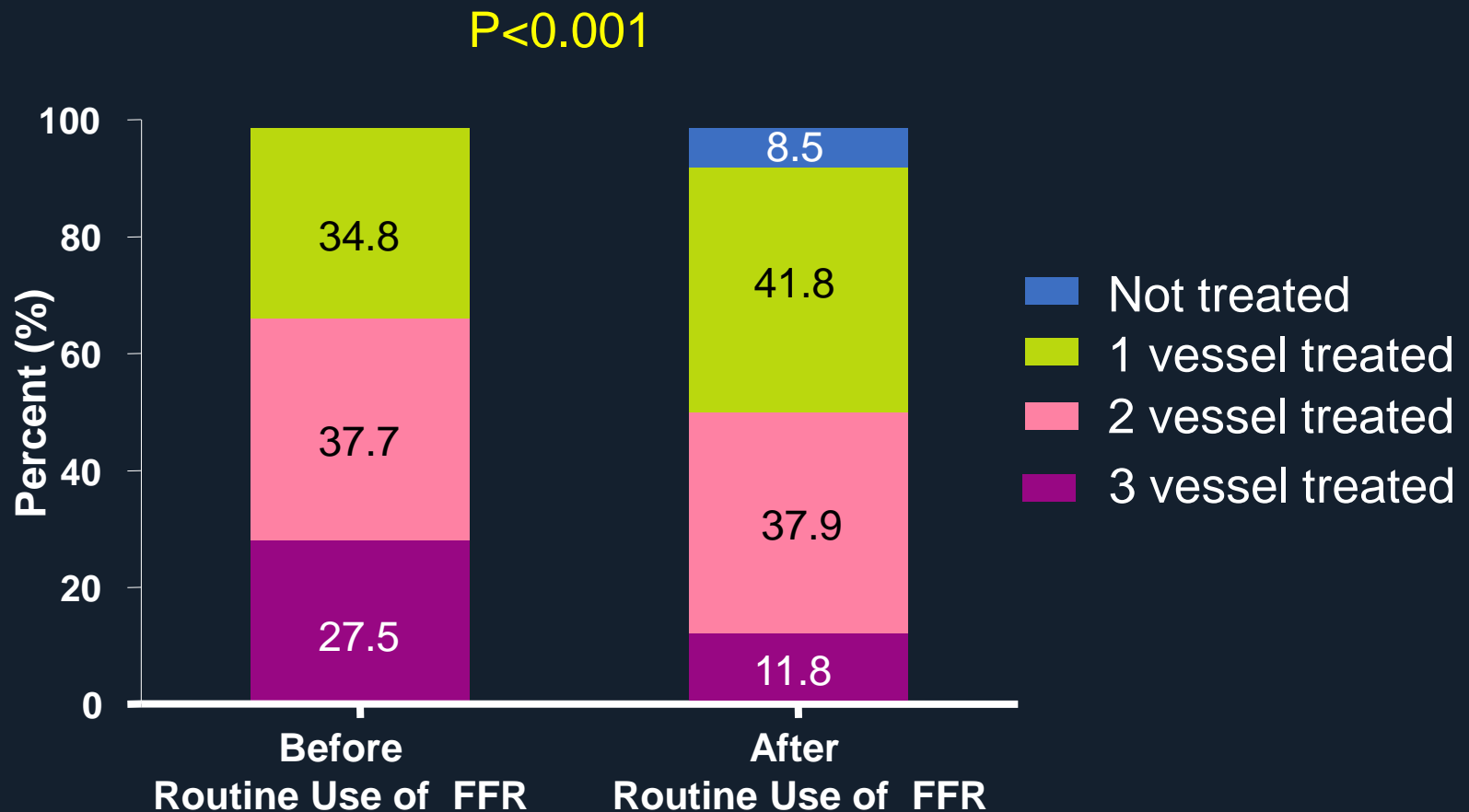
# Stent Length



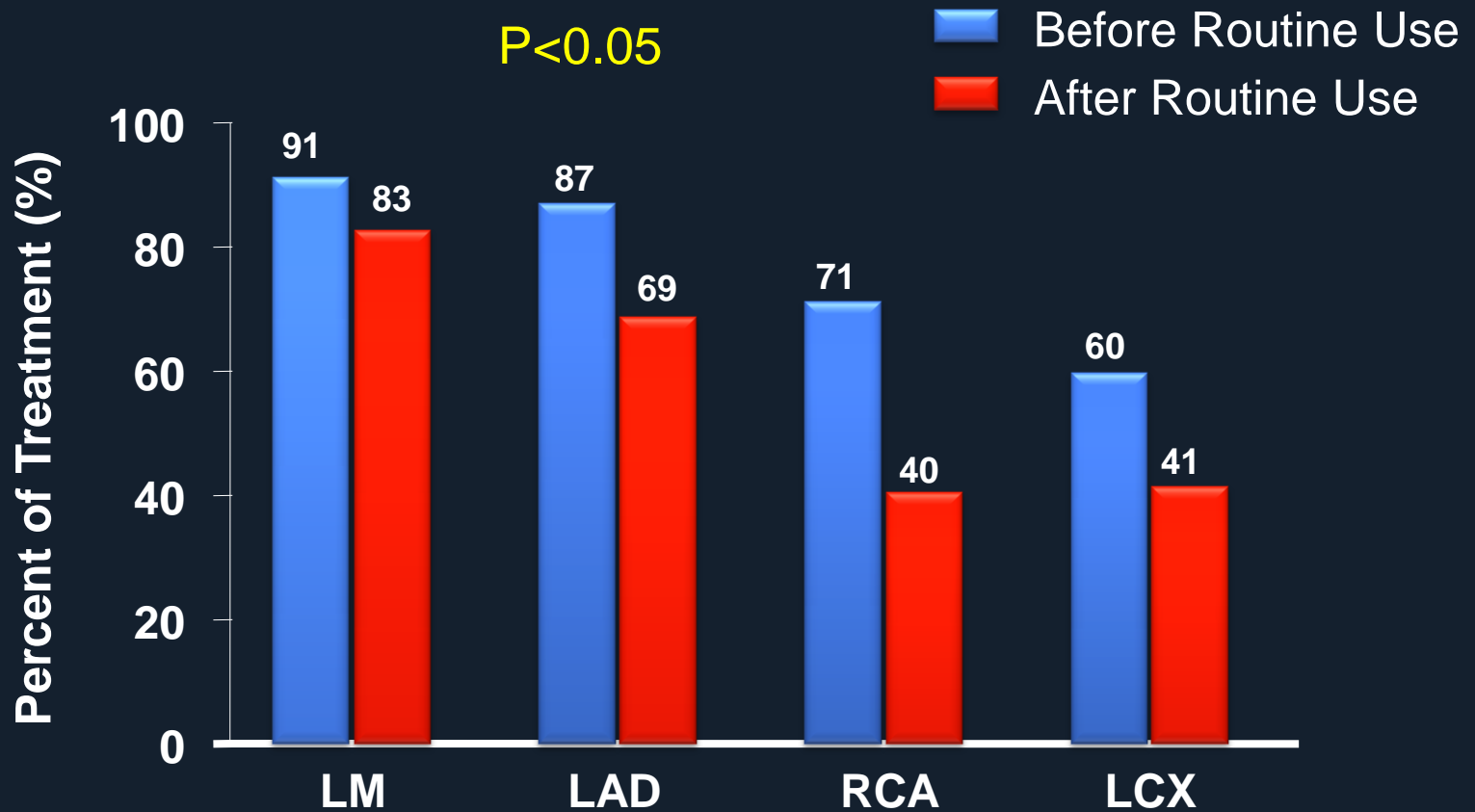
# Angiographic 2 Vessel Disease



# Angiographic 3 Vessel Disease

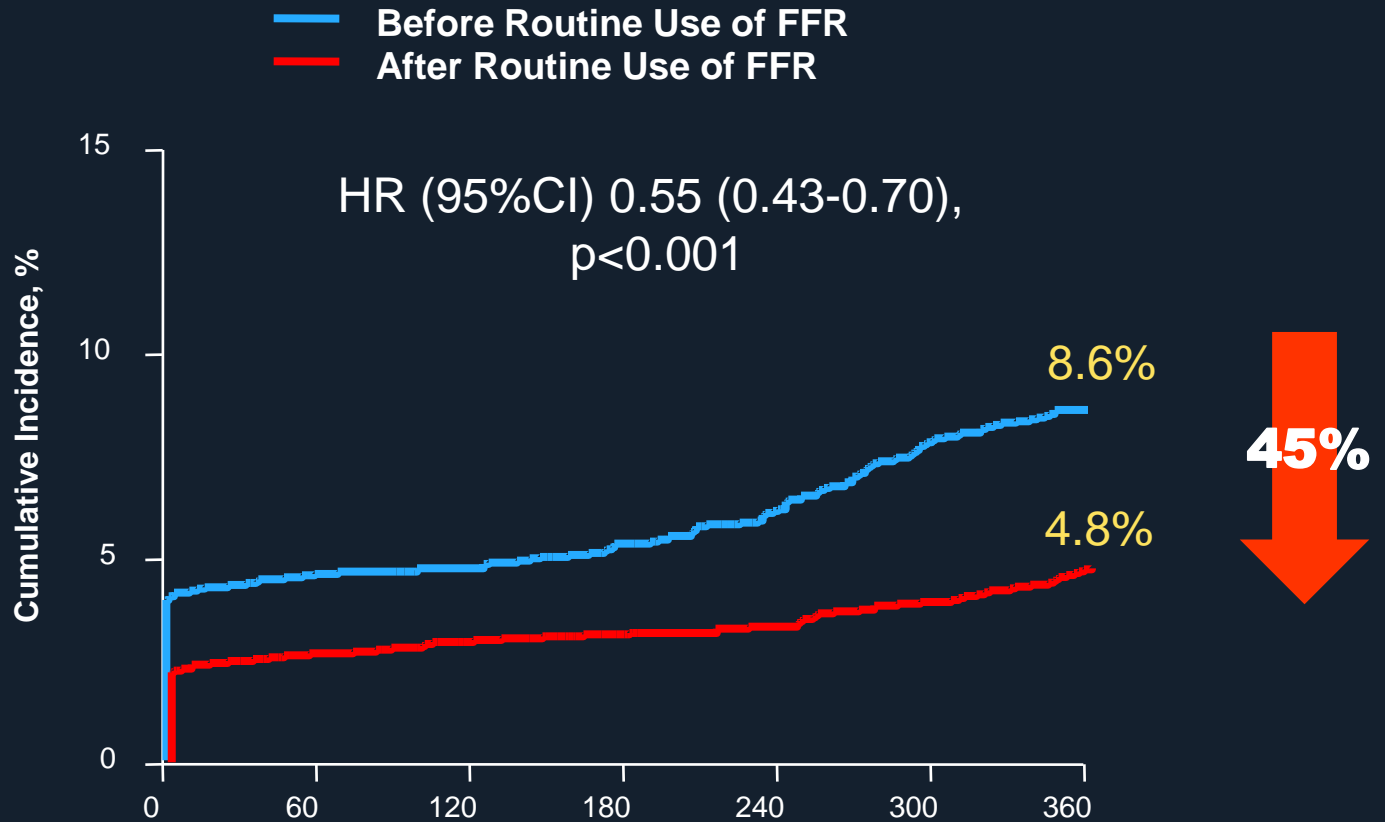


# Treated Vessel Territory



# Primary End Point

(Death, MI, or Repeat Revascularization)



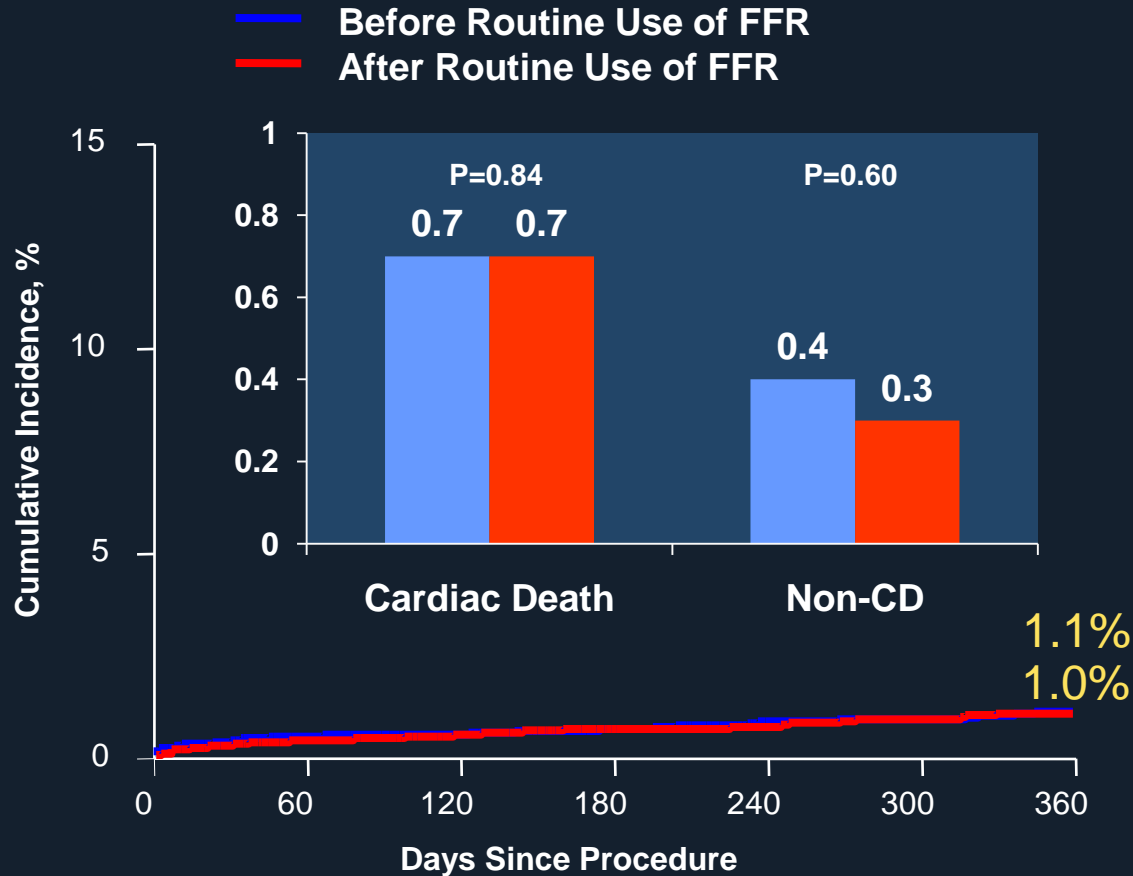
## No. at Risk

	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



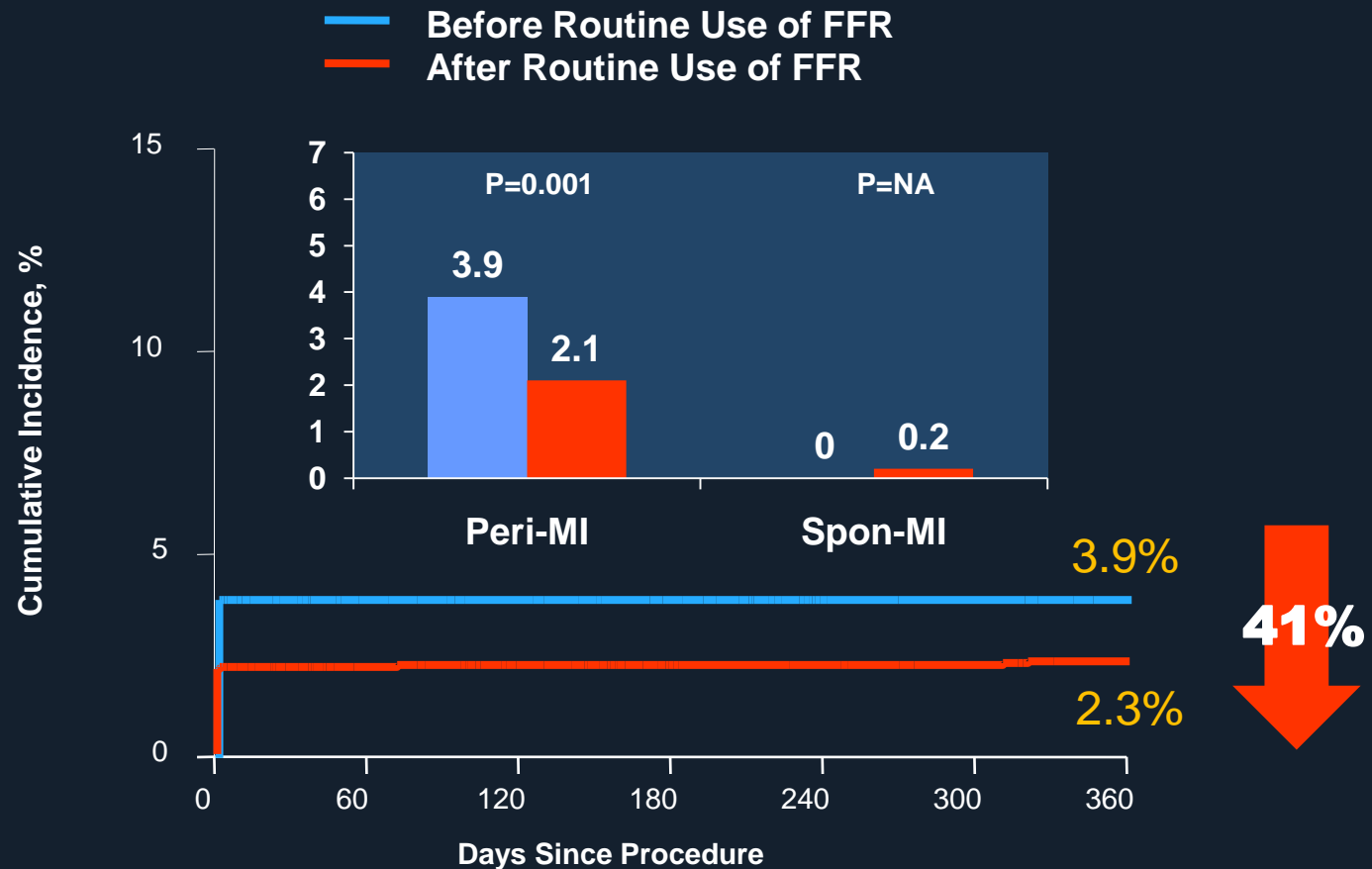
# Death



**No. at Risk**

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

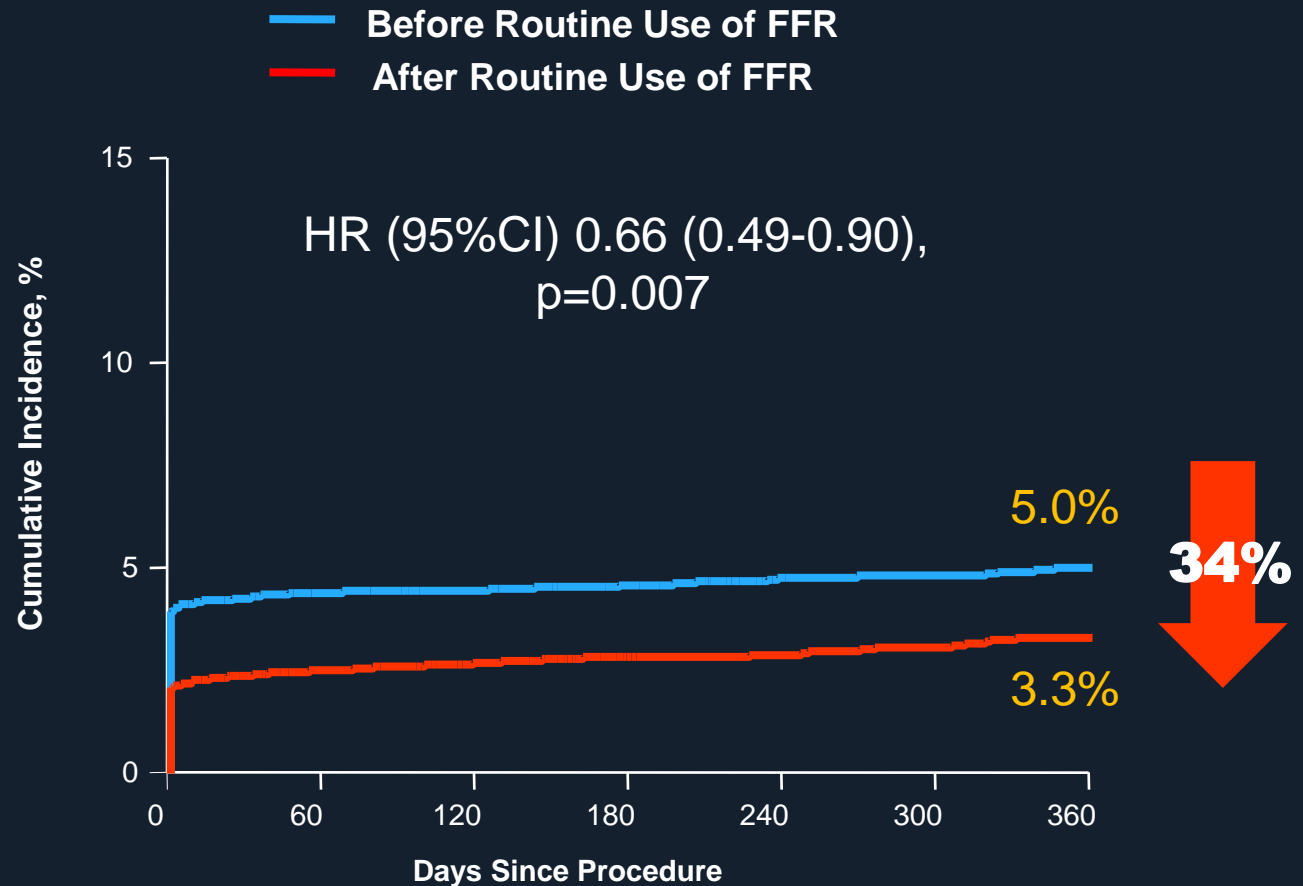
# Myocardial Infarction



## No. at Risk

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

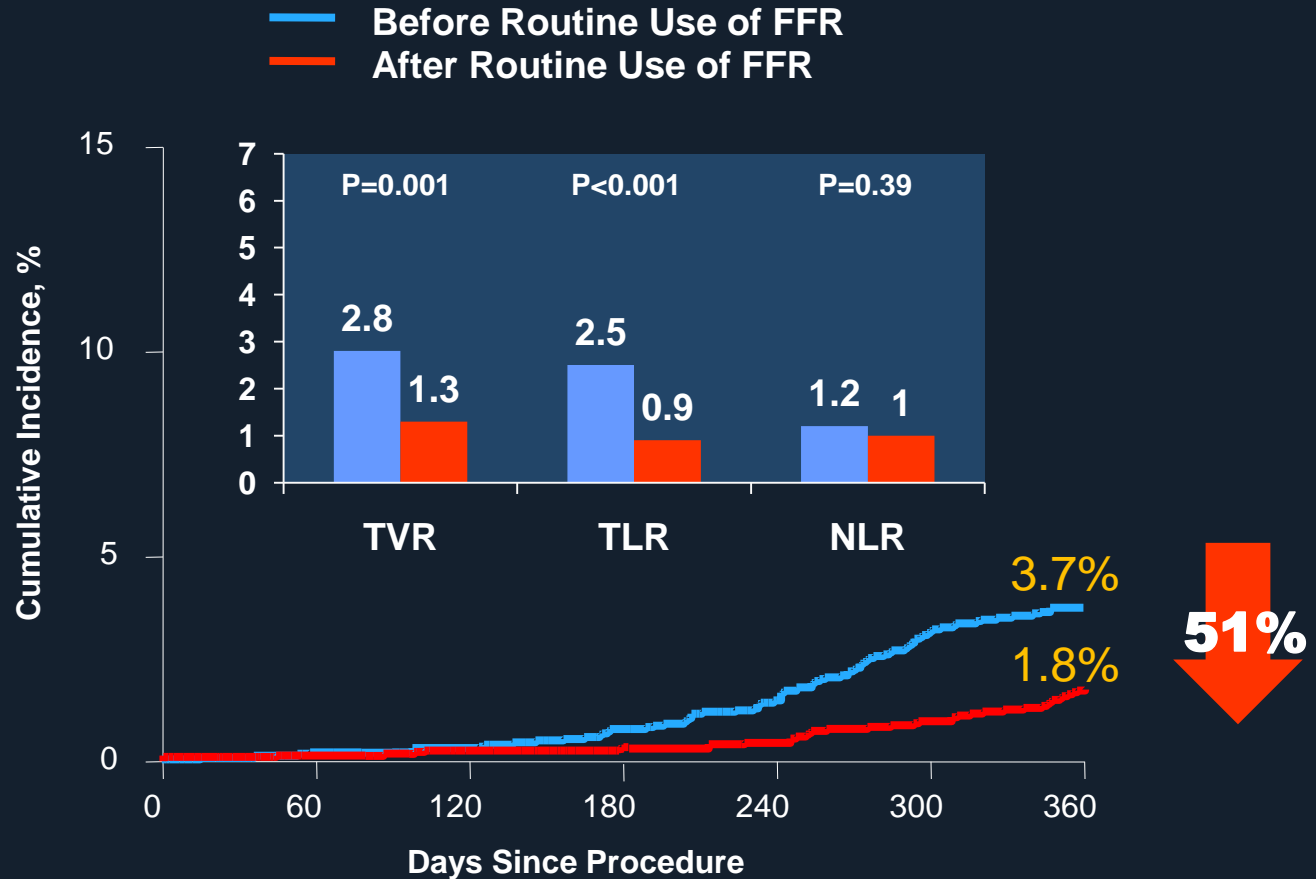
# Death or Myocardial Infarction



## 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	2075	2066	2066	2066

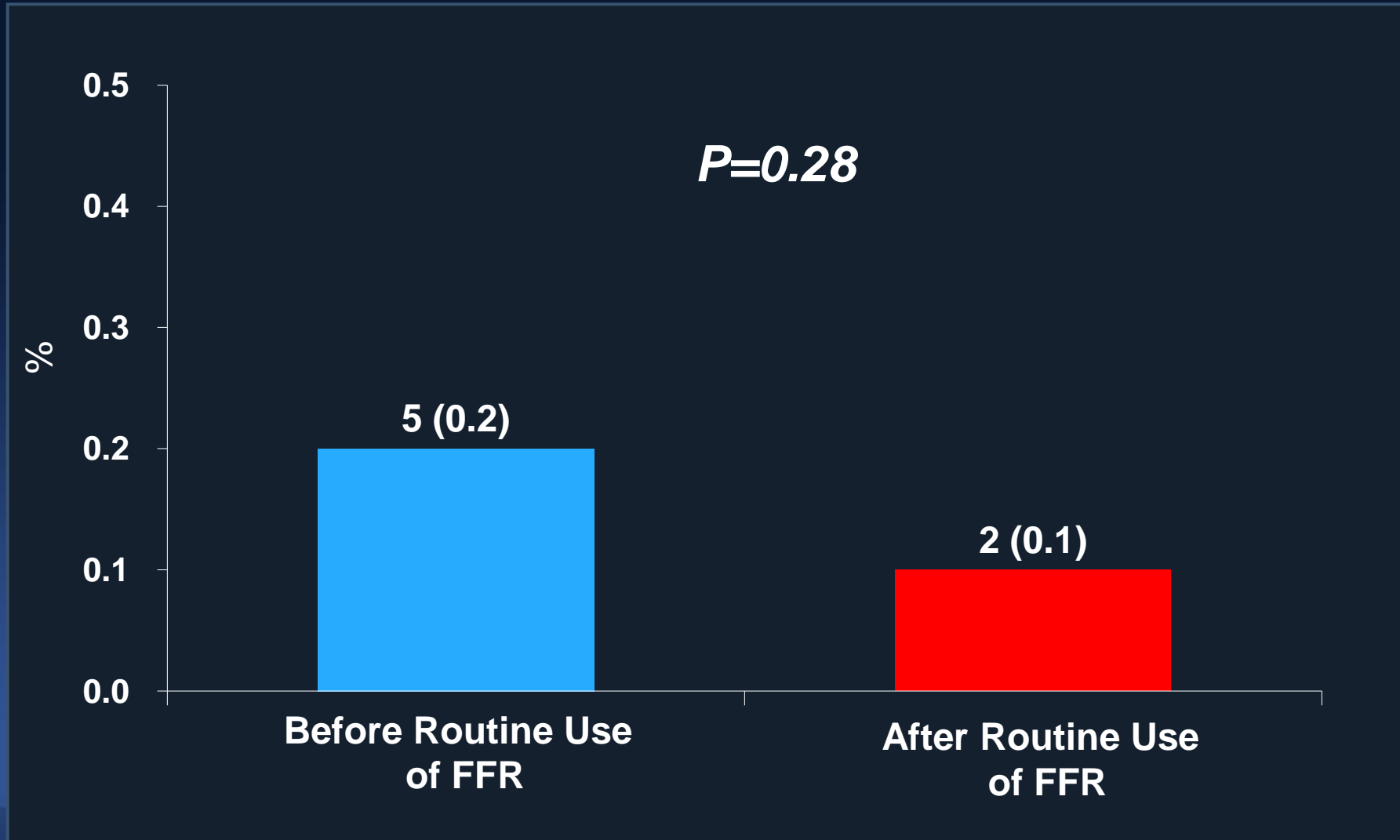
# Repeat Revascularization



**No. at Risk**

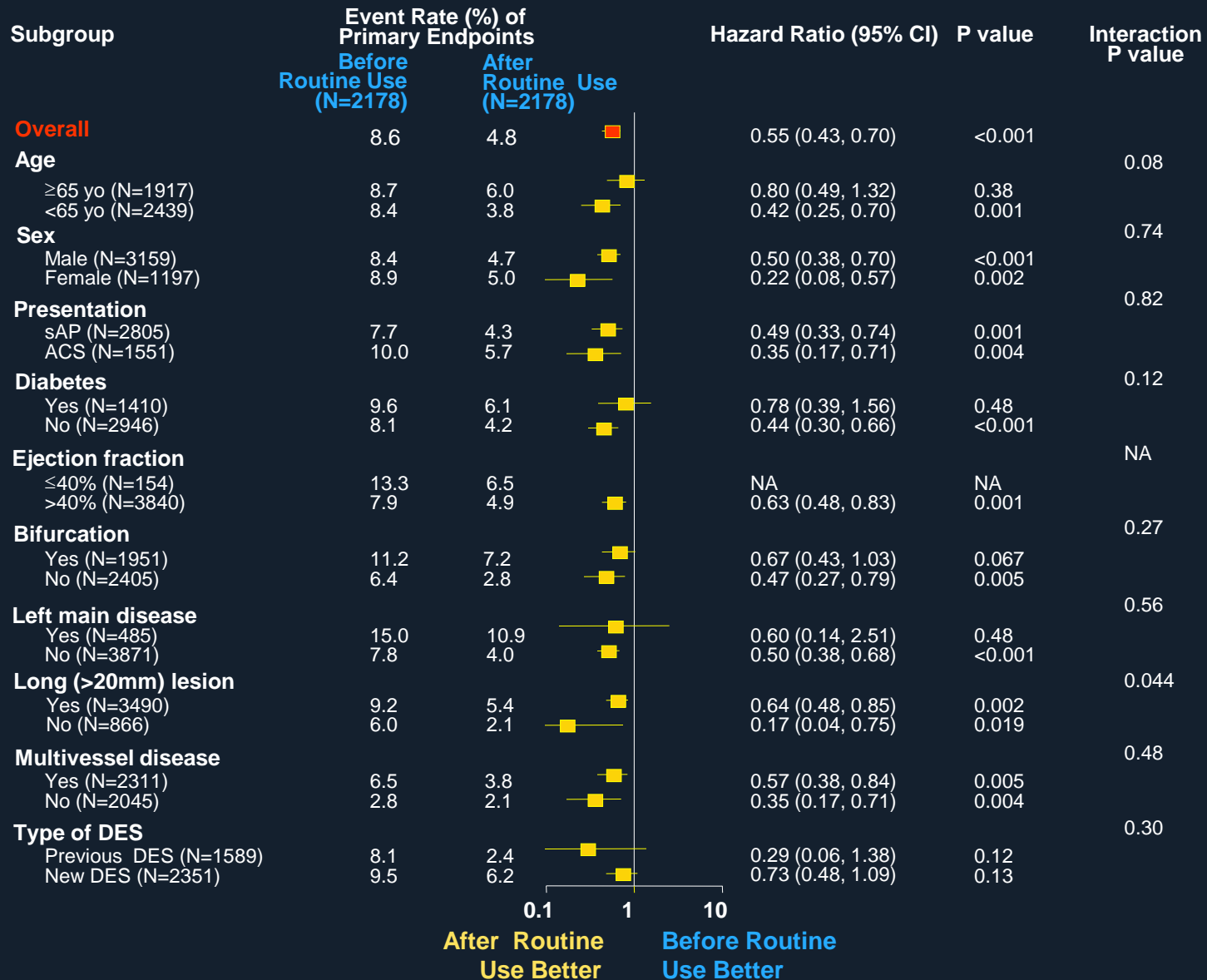
	0	60	120	180	240	300	360
Before Routine Use	2178		2151		2095		2048
After Routine Use	2178		2136		2110		2083

# Stent Thrombosis at 12 Months\*



\* ARC defined definite and probable stent thrombosis

# Subgroup Analysis



# Impact of **FFR** for Multi-vessel Disease

# Impact of FFR on Multi-Vessel Disease



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



# Featured RCT, **FAME 3**

**Patients with Angiographically  
3 Vessel Disease without LM**

**R**

```
graph TD; R((R)) --> A[FFR Guided PCI + OMT]; R --> B[CABG];
```

**FFR Guided PCI + OMT**

**CABG**

**Primary Endpoint at 2 years:  
Death + MI + Repeat R + Stroke**

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

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

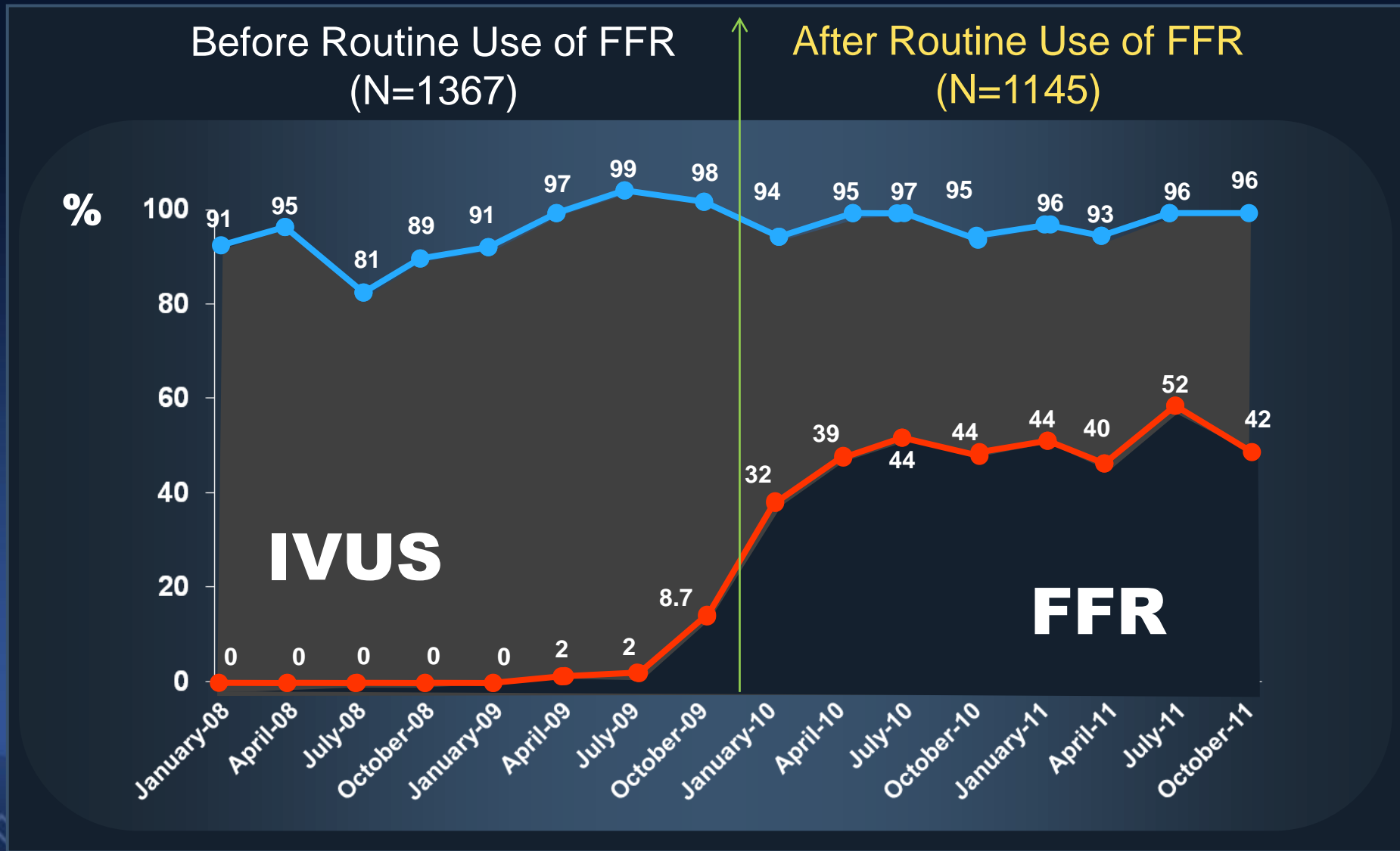
# Study Patients

To evaluate the changes in the treatment strategy, clinical outcomes between PCI and CABG in patients with left main or three vessel disease **after the routine use of FFR.**

A total of 2512 patients were enrolled between January 2008 and December 2011 from the data of ASAN LM and Multivessel registry.  
(*clinicaltrials.gov number NCT 0178859*)

# Integrated Use of FFR and IVUS

(AMC data, n=2512)



# Baseline Clinical Characteristics

Before Routine FFR  
(Year 2008-2009)

After Routine FFR  
(Year 2010-2011)

* p<0.05	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

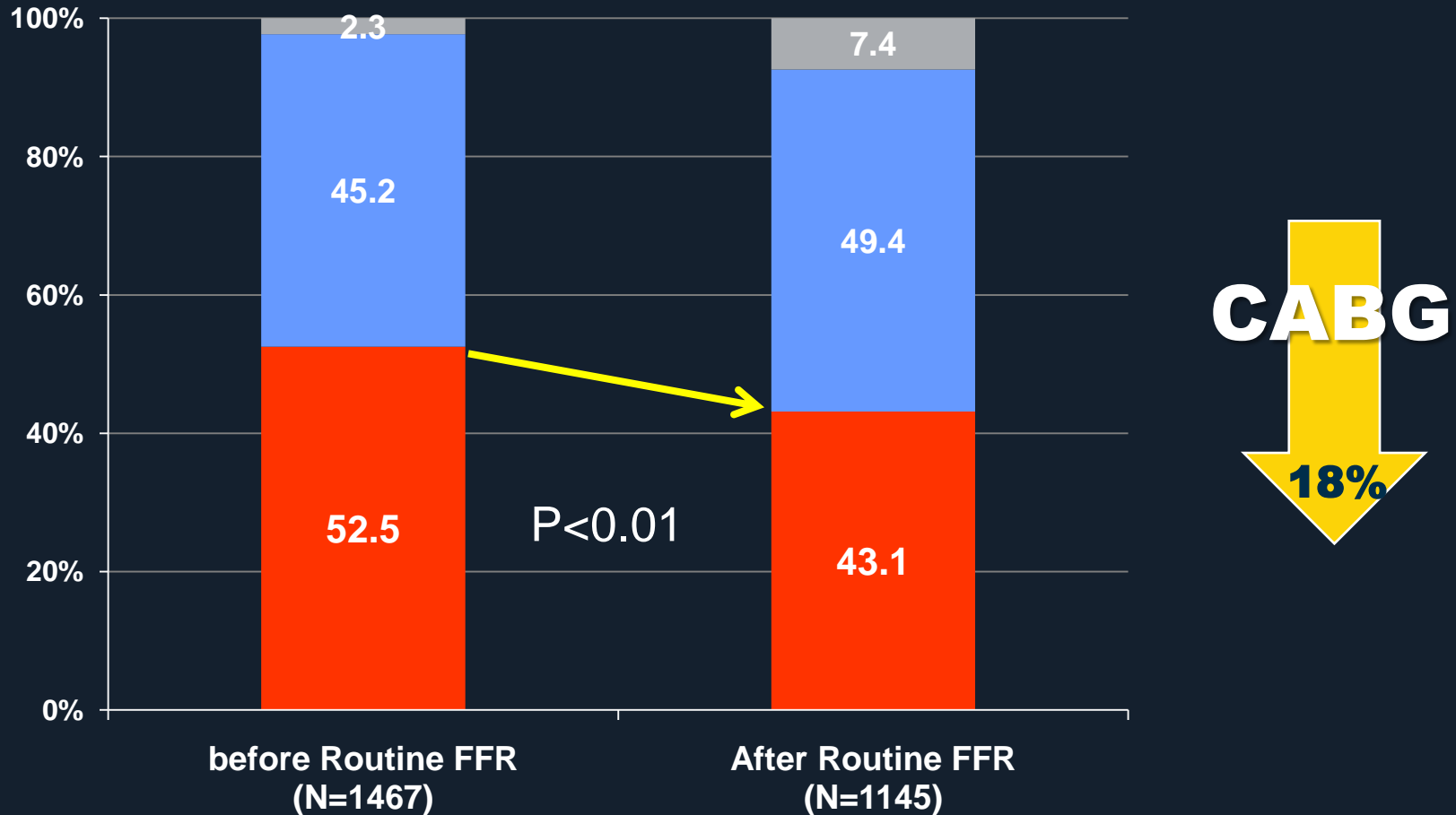
Before Routine FFR  
(Year 2008-2009)

After Routine FFR  
(Year 2010-2011)

* p<0.05	CABG (N=770)	PCI (N=663)	DEFER (N=34)	CABG (N=494)	PCI (N=566)	DEFER (N=85)
Extent						
Three-Vessel Dz	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)

# Treatment Strategy

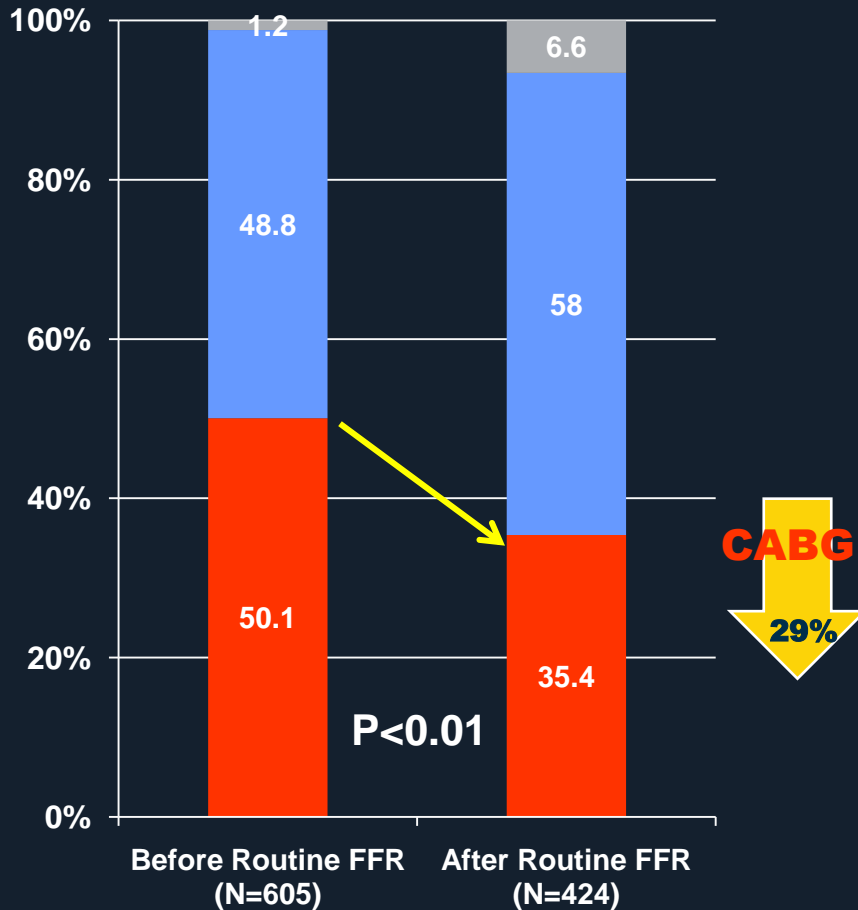
CABG PCI DEFER



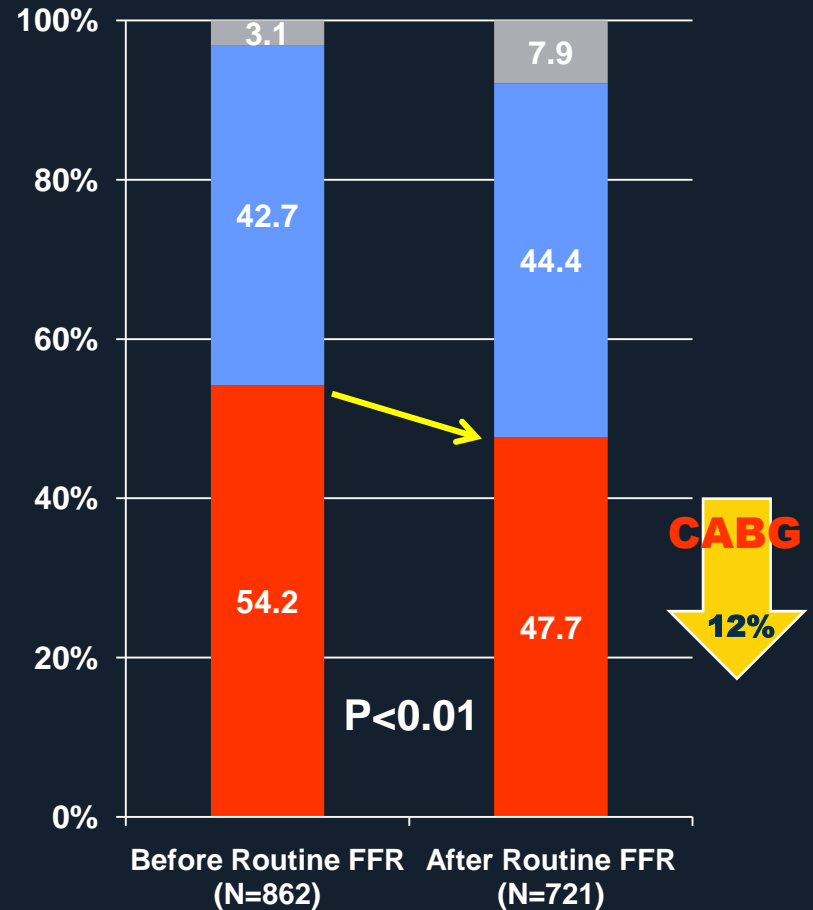
# Treatment Strategy

**CABG**    **PCI**    **DEFER**

## Left Main Disease



## 3-Vessel Disease





# Procedural Characteristics of PCI

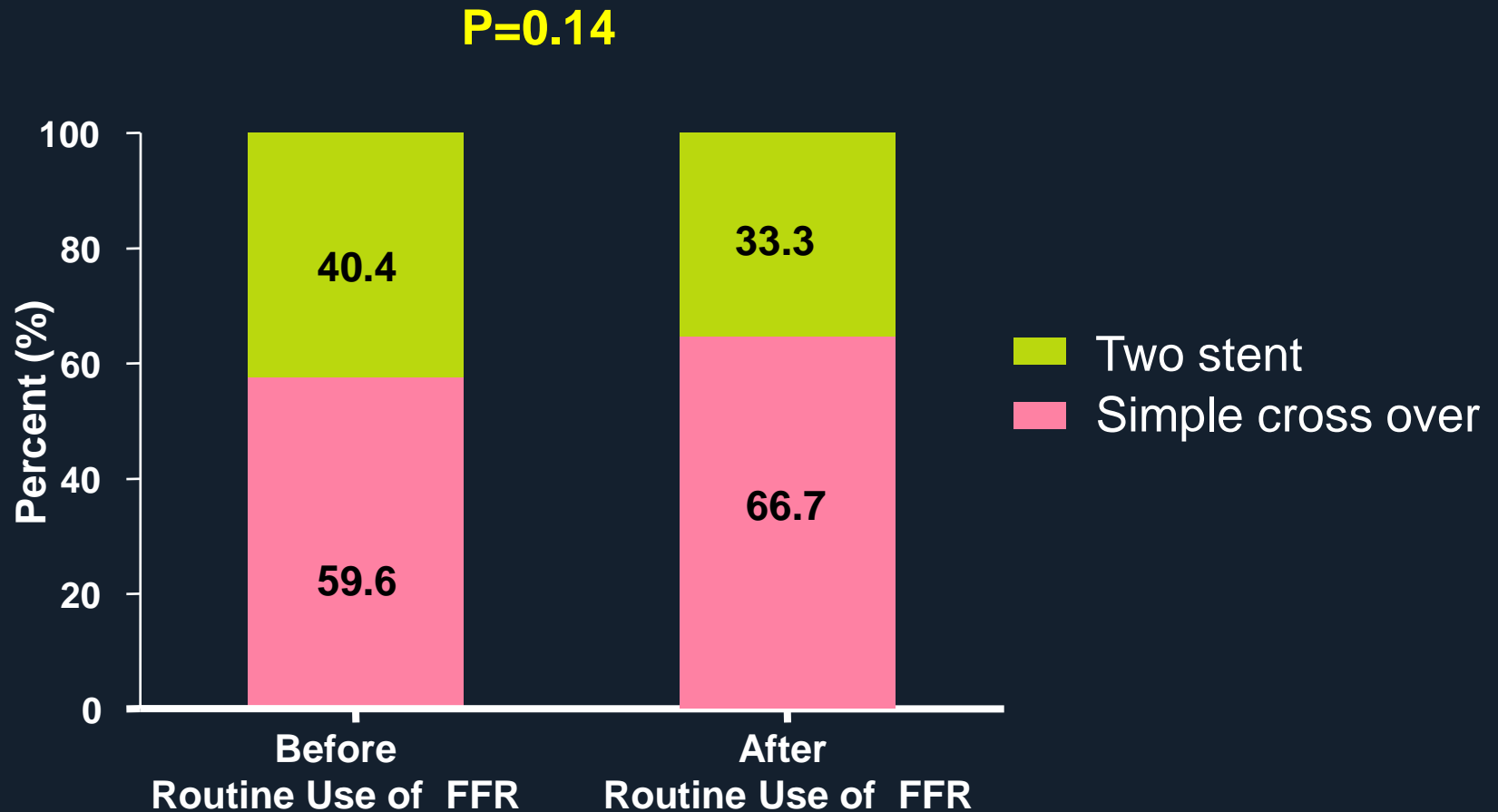
	Before Routine FFR (N=663)	After Routine FFR (N=566)	P value
Fractional flow reserve	13 (2.0)	237 (41.9)	<0.001
Mean	0.87±0.08	0.77±0.12	
>0.80	13 (86.7)	133 (39.8)	
0.75-0.80	0	77 (23.1)	
<0.75	2 (13.3)	124 (37.1)	
N. of Deferred lesions	13 (86.7)	145 (43.4)	
No. of stents	3.04±1.52	2.51±1.39	<0.001
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

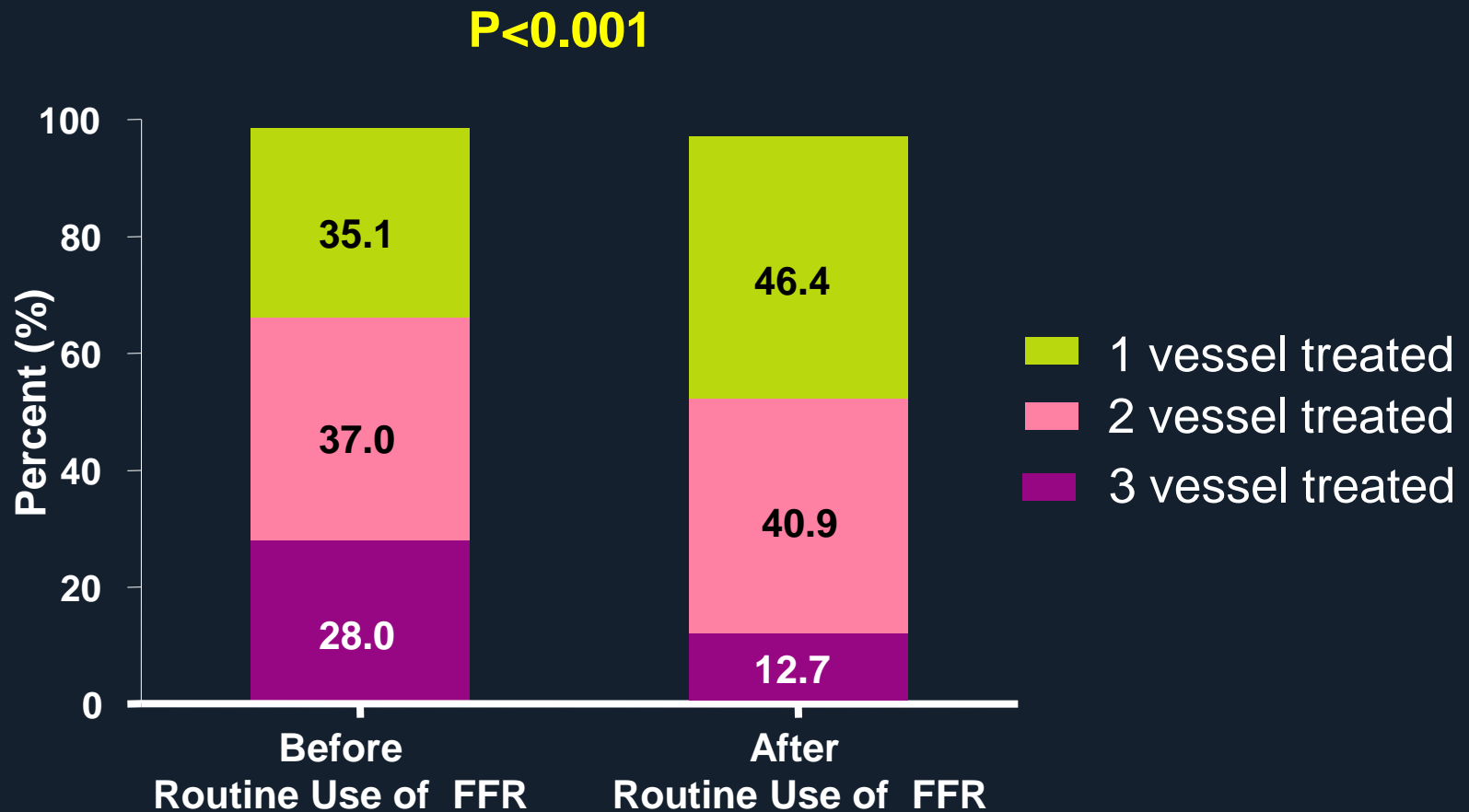
	Before Routine FFR (N=770)	After Routine FFR (N=494)	P value
Number of conduit	2.97 ± 0.94	3.08 ± 0.94	0.038
Number of vein conduit	1.17 ± 0.90	1.30 ± 0.85	0.009
Number of arterial conduit	1.80 ± 0.87	1.78 ± 0.90	0.69
Internal thoracic artery	757 (98.3)	481 (97.4)	0.25
Off-pump	499 (64.8)	433 (87.7)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

# Procedural Change in PCI

## Distal LM Treatment



# Procedural Change in PCI 3 Vessel Disease, Treatment

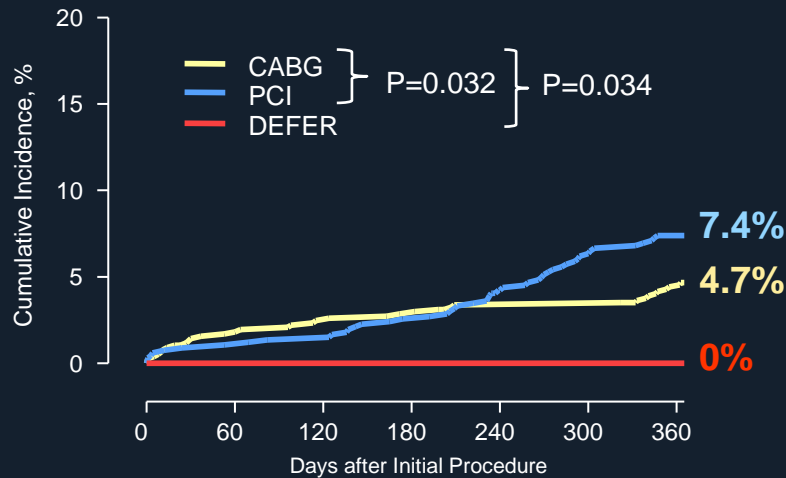


# **Unadjusted K-M Curve Defer vs. PCI vs. CABG**

# Primary End Point

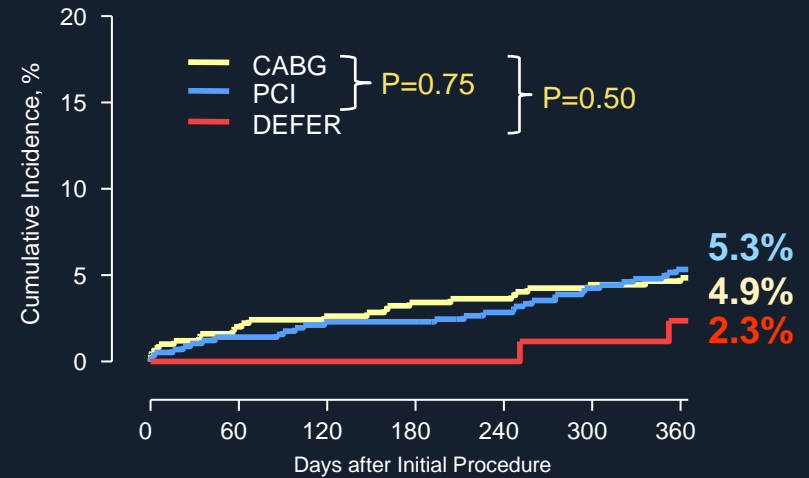
(Death, MI, Stroke or Repeat Revascularization)

## Before Routine FFR (2008-2009)



CABG	770	751	743	734
PCI	663	655	634	612
DEFER	34	34	34	34

## After Routine FFR (2010-2011)



CABG	494	482	477	471
PCI	566	553	545	531
DEFER	85	85	85	84

# Propensity Matched Population

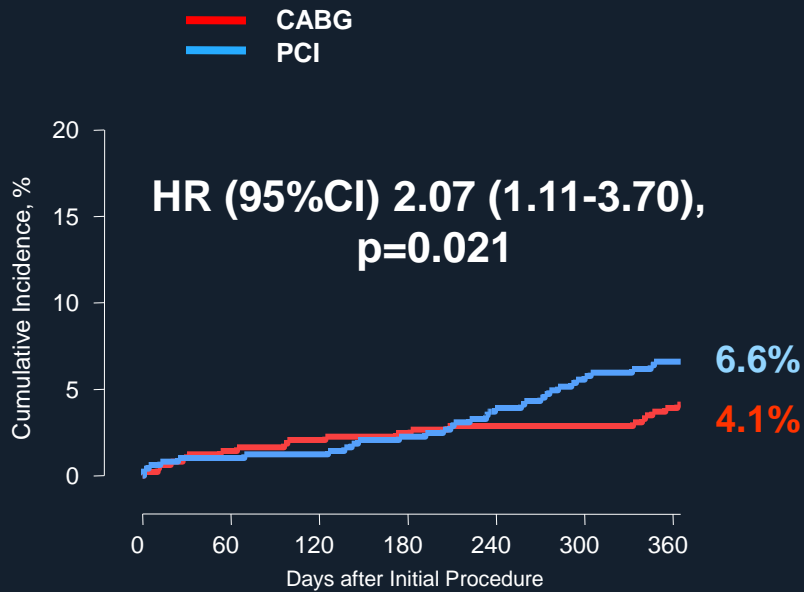
## CABG vs. PCI

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

# Primary End Point

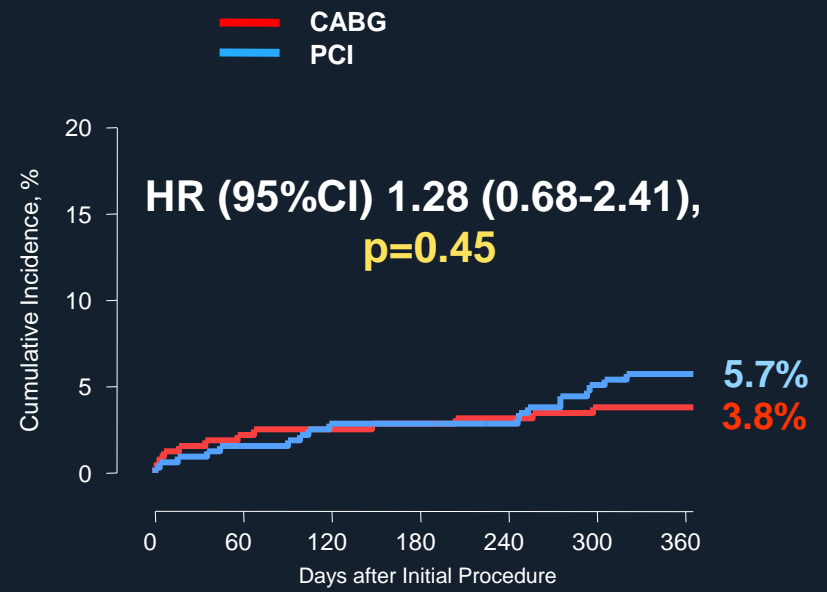
(Death, MI, Stroke or Repeat Revascularization)

## Before Routine FFR (2008-2009)



CABG	486	477	472	467
PCI	486	481	466	453

## After Routine FFR (2010-2011)

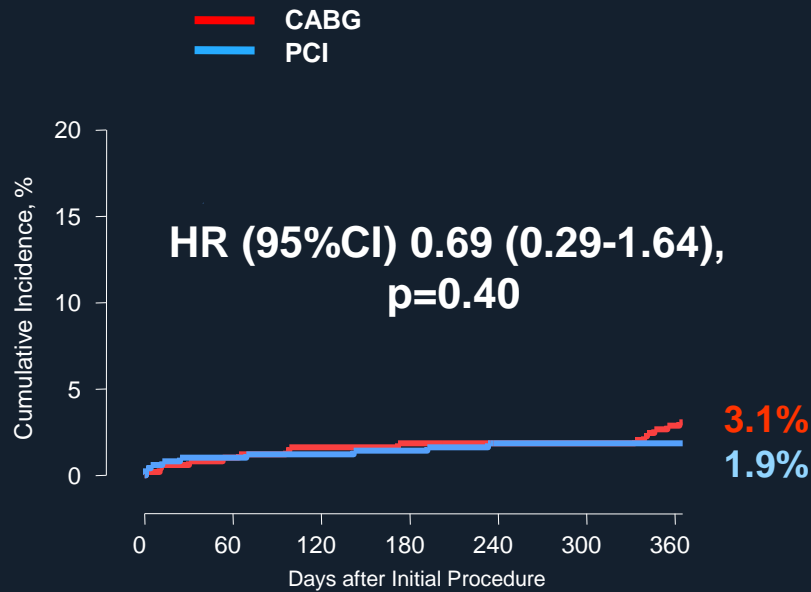


CABG	315	308	306	304
PCI	315	307	304	295



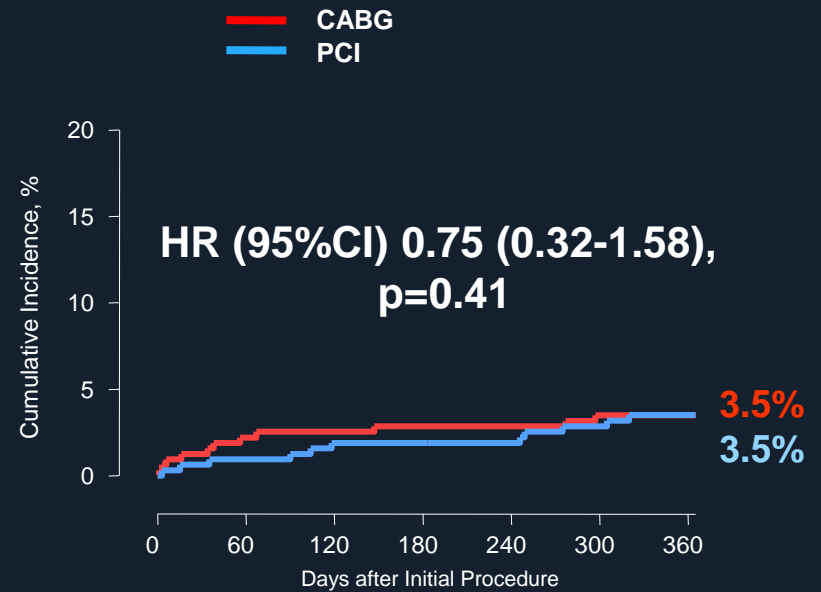
# Death, MI or Stroke

## Before Routine FFR (2008-2009)



CABG	486	479	477	472
PCI	486	481	476	476

## After Routine FFR (2010-2011)

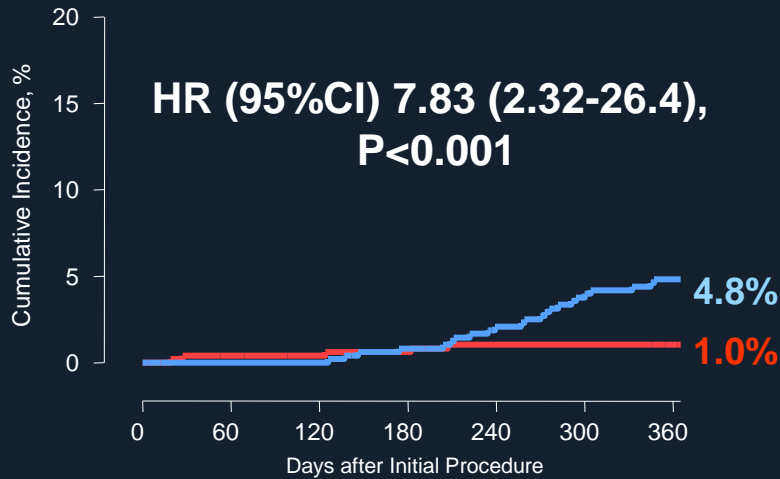


CABG	315	308	307	305
PCI	315	310	307	302

# Repeat Revascularization

## Before Routine FFR (2008-2009)

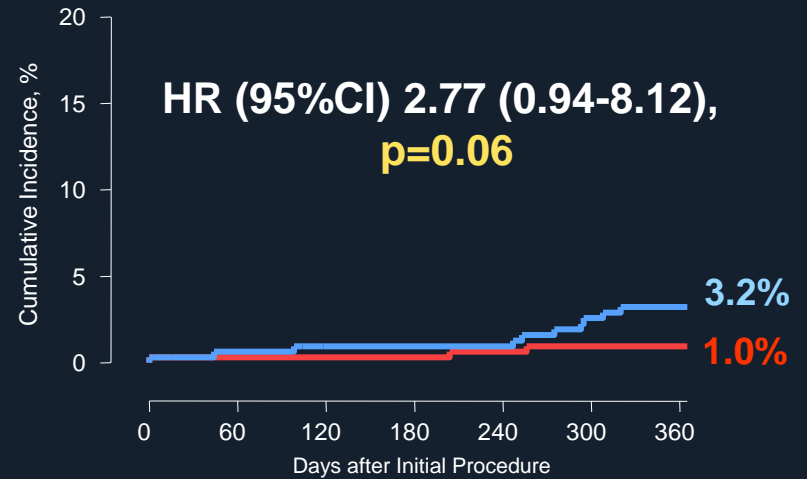
— CABG  
— PCI



CABG	486	479	475	472
PCI	486	482	466	453

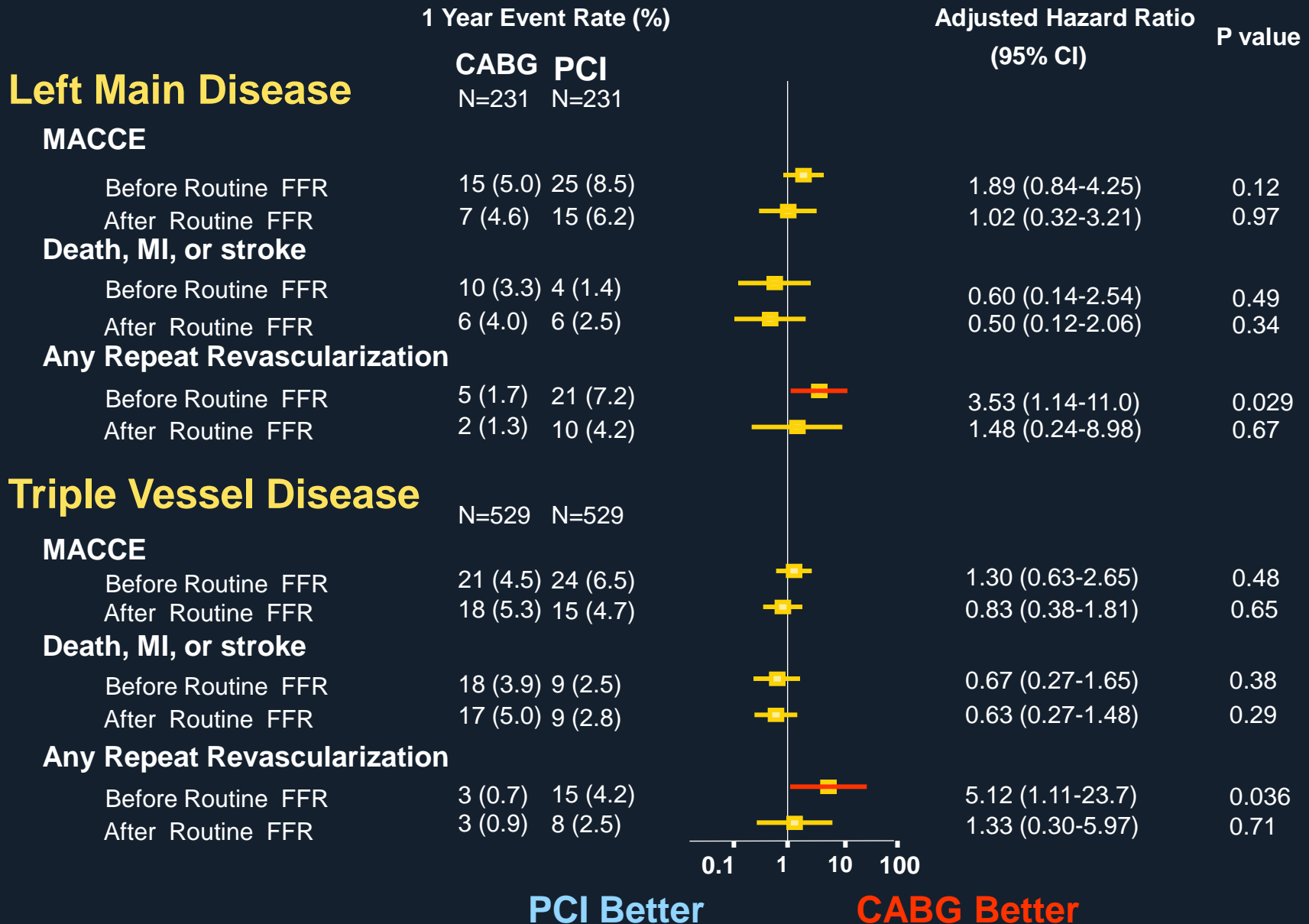
## After Routine FFR (2010-2011)

— CABG  
— PCI



CABG	315	311	309	307
PCI	315	307	307	300

# LM and 3-Vessel, Subgroup Analysis



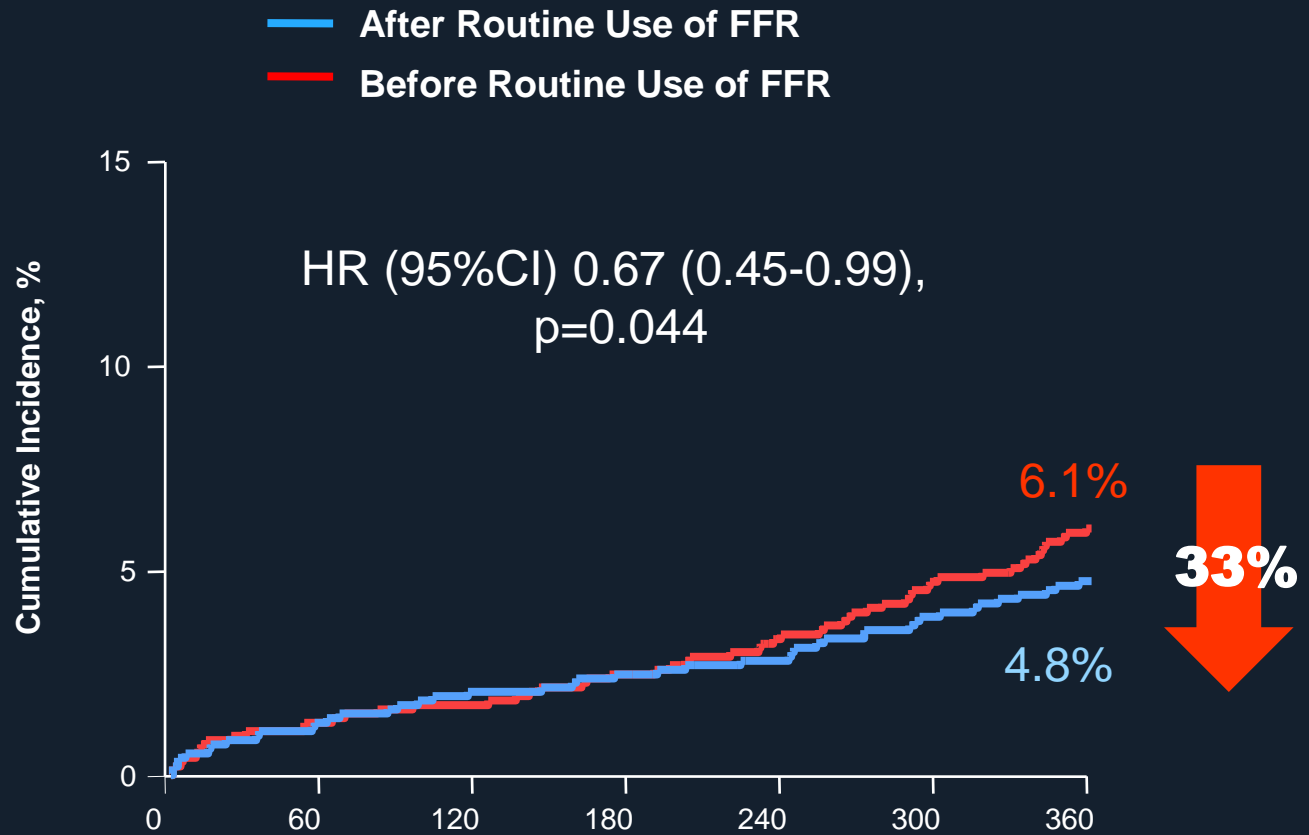
# **Propensity Matched Population**

## **Overall Clinical Outcomes**

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

# Primary End Point

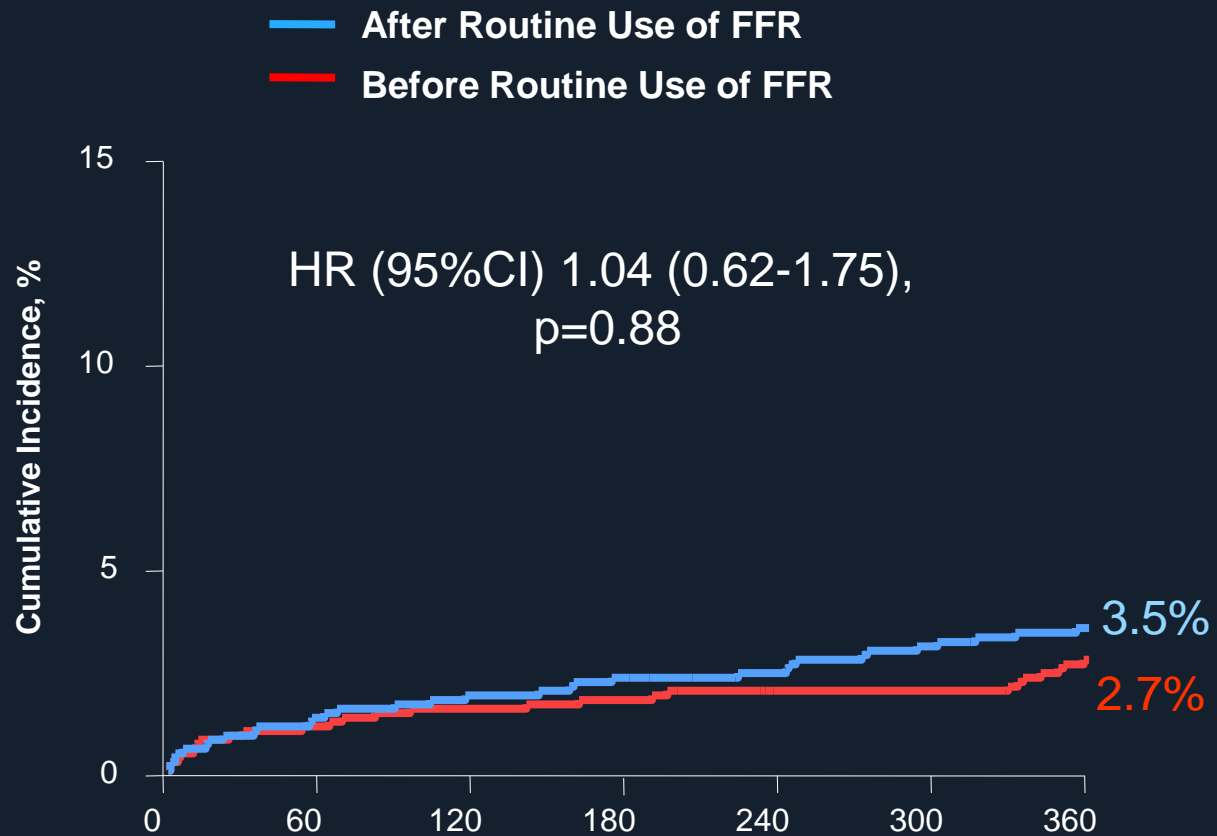
(Death, MI, Stroke or Repeat Revascularization)



**No. at Risk**

	Days Since Procedure						
	0	60	120	180	240	300	360
Before Routine Use	917	901	883	857			
After Routine Use	917	898	886	869			

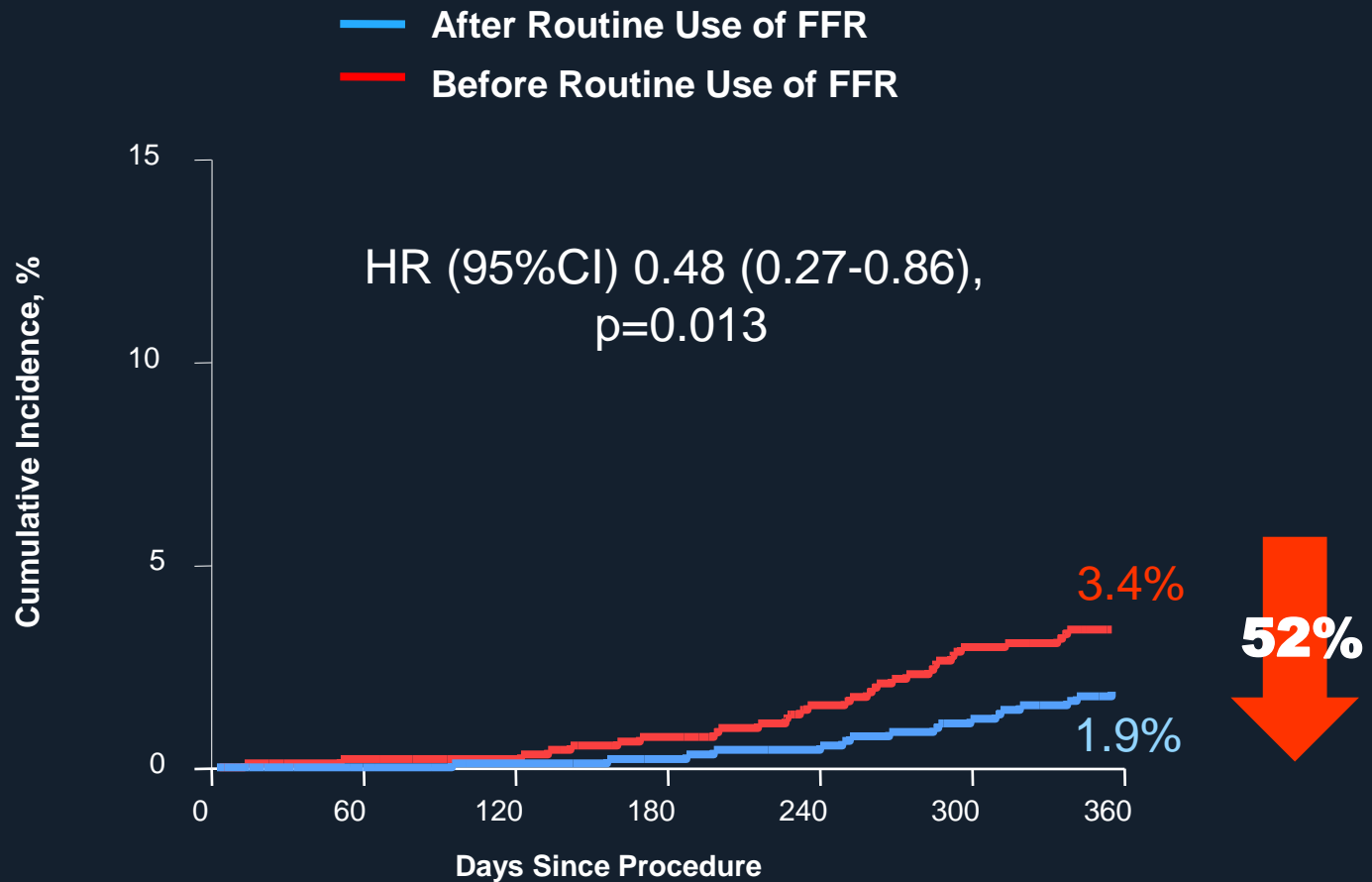
# Death, MI or Stroke



## No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	917	903	896	888			
After Routine Use	917	899	889	879			

# Repeat Revascularization



## No. at Risk

	0	60	120	180	240	300	360
Before Routine Use	917	905	886	863			
After Routine Use	917	904	897	883			

# Conclusion

In patients with left main or 3-vessel disease

1. The routine incorporation of FFR had **reduced death, MI, stroke or repeat** revascularization mainly due to reduced rate of repeat revascularization. .
2. **Overall clinical outcomes were improved** after the routine use of FFR, mainly derived from the improvement of PCI outcomes in patients with severe coronary artery disease.



# Conclusion

In patients with left main or 3-vessel disease

3. 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.
4. The deferral of revascularization showed **excellent clinical outcomes**, even in the angiographic severe coronary artery disease.