

Current Status of PCI vs. CABG in Left Main Disease

Young-Hak Kim, MD, PhD

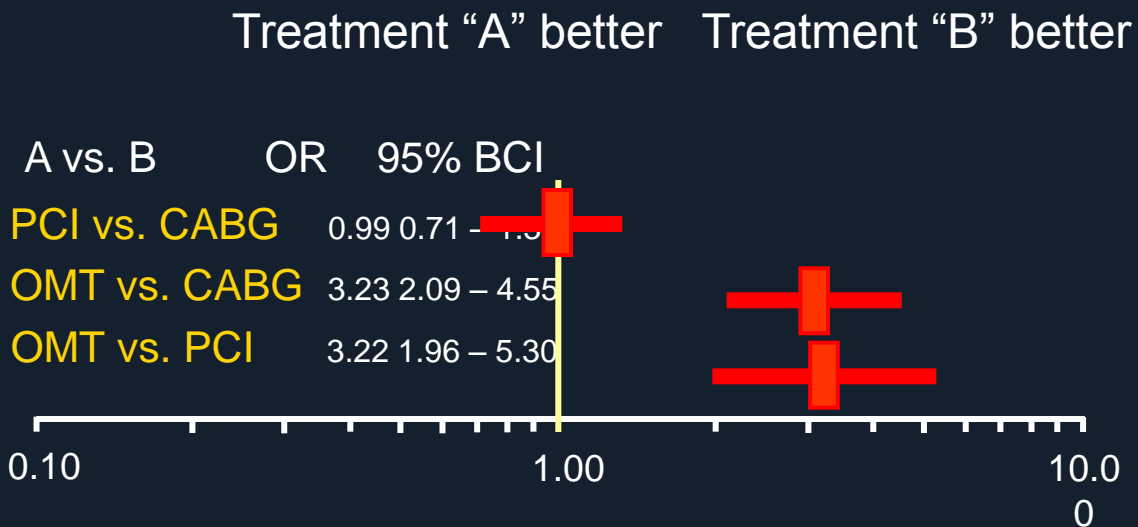
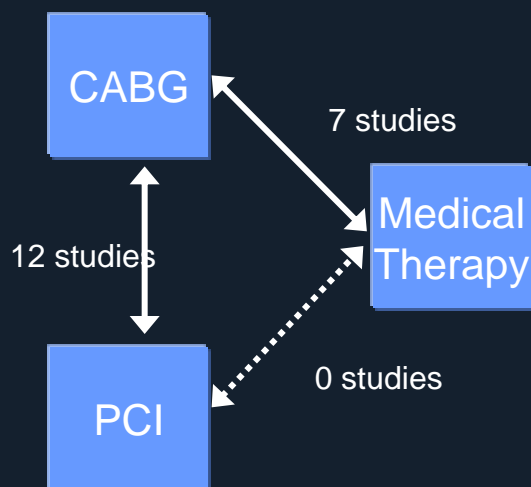
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Disclosure

- Nothing to disclose related with this presentation

Both PCI and CABG saves life for LM disease

Bayesian Net-work Meta-analysis

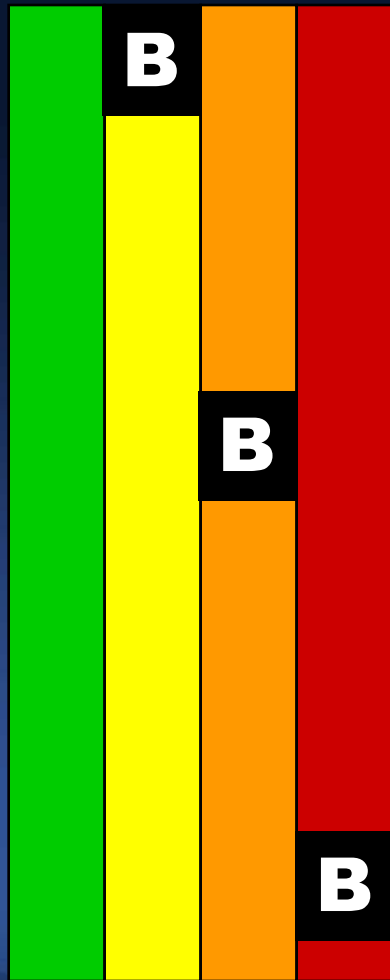


One-Year Mortality
Posterior Median OR
and 95% Bayesian Credible Intervals (BCI)

ACC/AHA Guidelines 2011

Elective PCI for LM Stenosis

I IIa IIb III

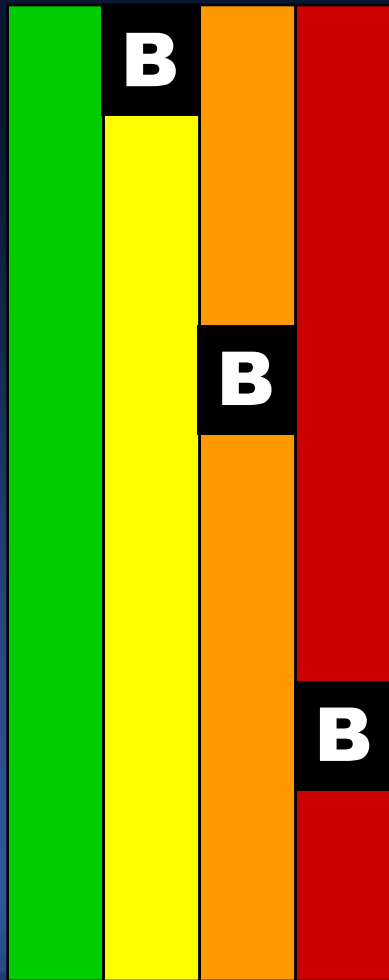


- Low risk PCI
 - SYNTAX score ≤ 22 OR
 - Ostial or shaft LM
- High risk CABG
 - STS risk $\geq 5\%$
- Intermediate-risk PCI
 - SYNTAX score < 33 OR
 - Bifurcation LM
- High risk CABG
 - STS risk $\geq 2\%$ OR
 - COPD, disabled stroke, redo CABG
- Unfavorable anatomy for PCI, but good CABG candidate

ESC Guidelines 2011

Elective PCI for LM Stenosis

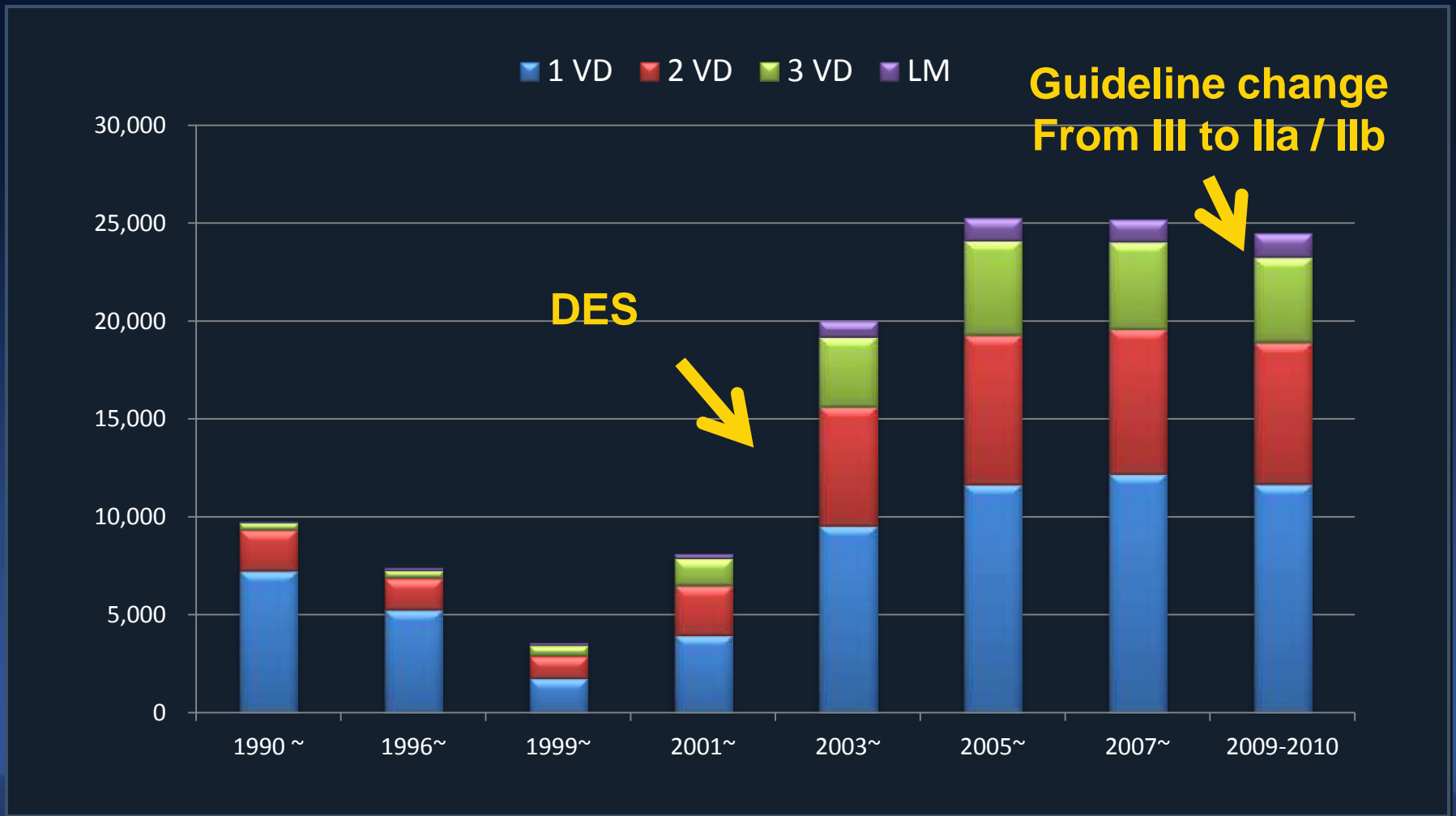
I IIa IIb III



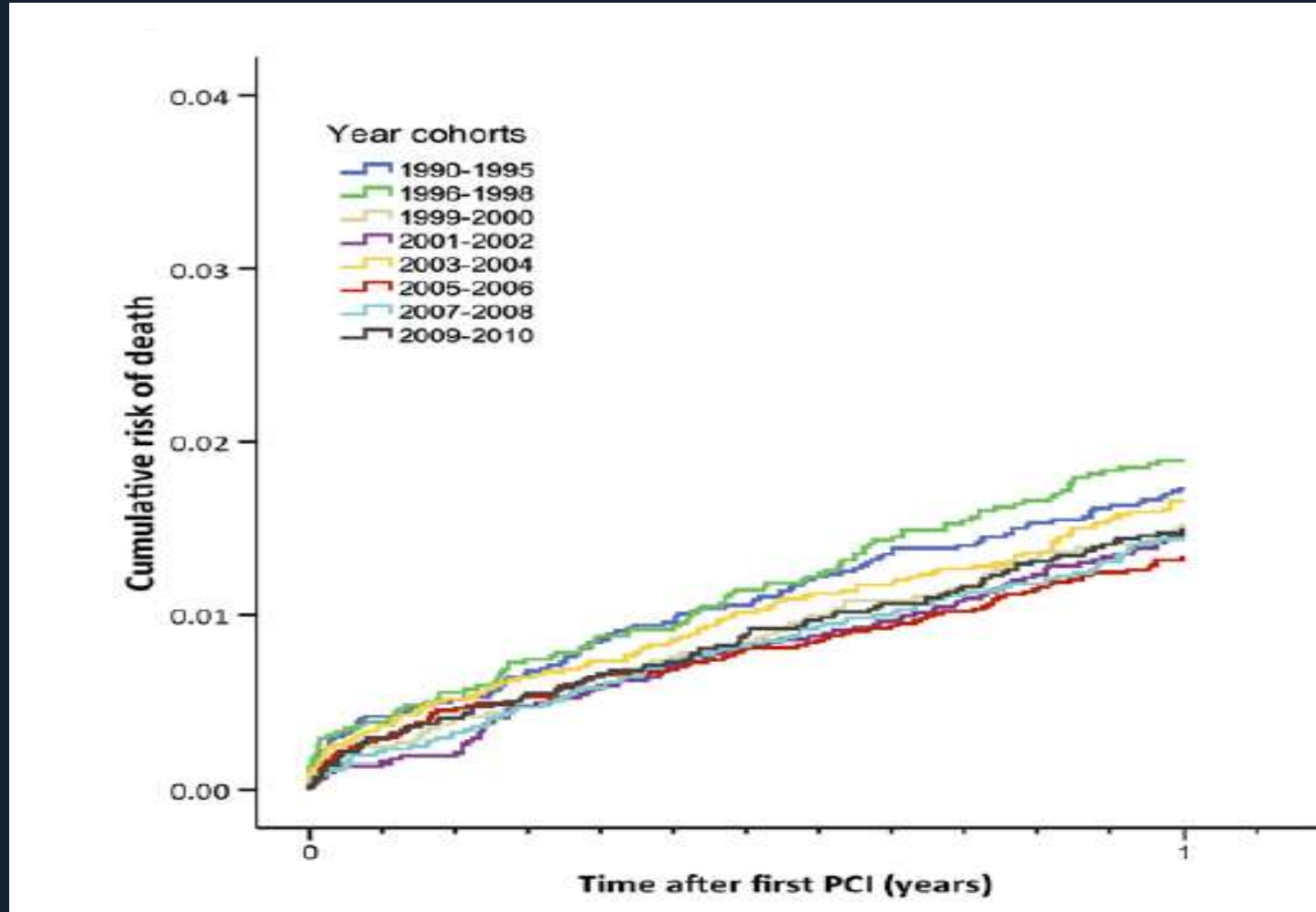
- LM with
- isolated or 1 VD & ostial or shaft LM
- LM with
- isolated or 1 VD & bifurcation LM
- 2 or 3 VD & SYNTAX score ≤ 32
- LM with
- 2 or 3 VD & SYNTAX score ≥ 32

National PCI Trends

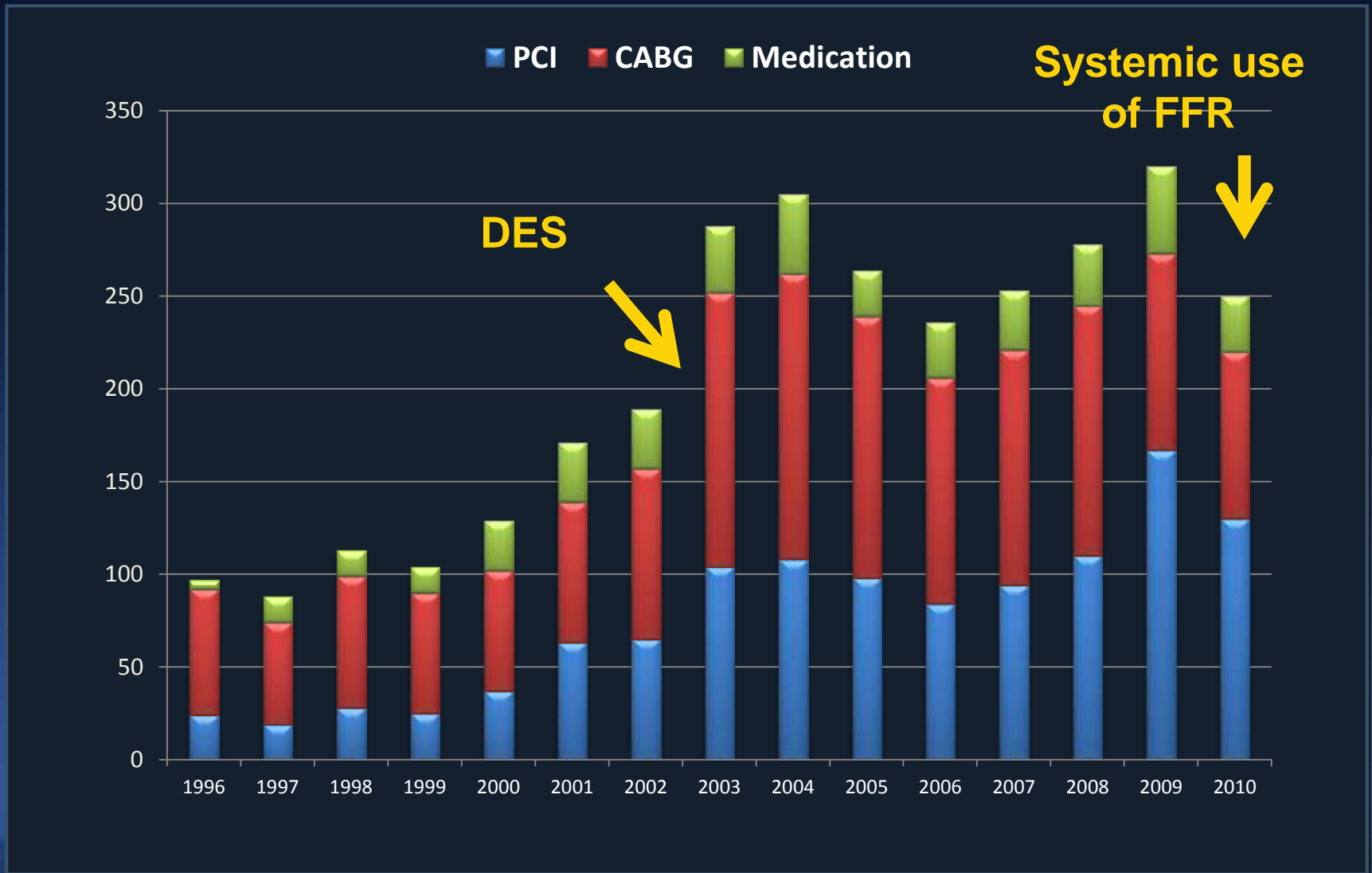
5% in SCCAR Swedish Registry



Gradual Adjusted Mortality Reduction for SA SCCAR Swedish Registry

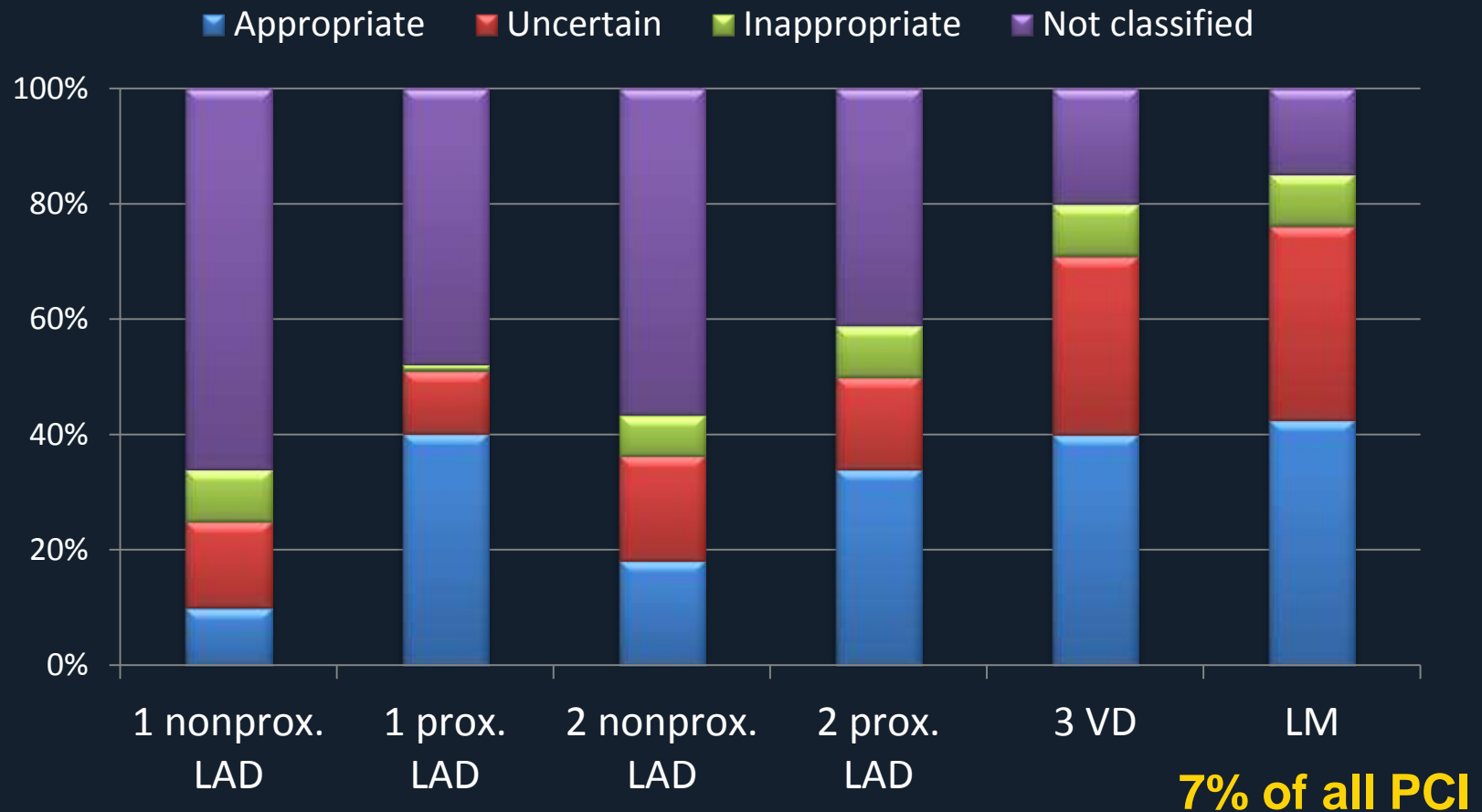


Asan Medical Center



Appropriateness of LM PCI

From 13,291 PCI in 2010 Washington PCI Registry



LM in the Literatures

| First Author/Study | Year | N | DES | CABG | DM | Distal LM | EuroSCORE (PCI) | EuroSCORE (CABG) | SYNTAX (PCI) | SYNTAX (CABG) |
|--------------------|------|-------|-----|------|-----|-----------|-----------------|------------------|--------------|---------------|
| Morice et al. | 2008 | 705 | 357 | 348 | 25% | 56% | 3.9±2.8 | 3.9±2.9 | 29.6±1.35 | 30.2±12.7 |
| Boudript et al. | 2011 | 201 | 100 | 101 | 36% | 74% | 2.4 (1.5-3.7) | 2.6 (1.7-4.9) | 24 (19-29) | 23 (14.8-28) |
| Shimizu et al. | 2010 | 152 | 63 | 89 | 47% | — | 2.7 (1.9-5.1) | 4.9 (2.4-11.5) | — | — |
| Chieffo et al. | 2006 | 249 | 107 | 142 | 21% | 81% | 4.4±3.6 | 4.3±3.4 | 28.8±10.4 | 29.4±5.78 |
| CUSTOMIZE | 2011 | 583 | 222 | 361 | 39% | 52% | 6.3±3.0 | 5.6±2.5 | 26.0±10.8 | 33.6±13.0 |
| Ghenim et al. | | | | | | | | | | — |
| Makikallio et al. | | | | | | | | | | — |
| Rittger et al. | | | | | | | | | | — |
| San Martin et al. | | | | | | | | | | — |
| Kawecki et al. | | | | | | | | | | — |
| Luo et al. | | | | | | | | | | — |
| Palmerini et al. | | | | | | | | | | — |
| PRECOMBAT | | | | | | | | | 9.4 | 25.8±10.5 |
| Zhao et al. | | | | | | | | | | — |
| Yi et al. | | | | | | | | | | — |
| Kang et al. | | | | | | | | | | — |
| CREDO-Kyoto 2 | | | | | | | | | | 30 (22-40) |
| DELTA registry | | | | | | | | | | 38.9±13.2 |
| ASAN | | | | | | | | | | — |
| Wu et al. | 2010 | 376 | 131 | 245 | 28% | 68% | 4.2±2.7 | 4.3±2.4 | — | — |
| Chang et al. | 2012 | 865 | 556 | 309 | 35% | 100% | 3.8±2.5 | 4.2±2.3 | 25.3±10.2 | 34.5±14.1 |
| Qin et al. | 2012 | 515 | 233 | 282 | 26% | 68% | 3.7±2.3 | 4.5±2.6 | 24.1±10.5 | 34.5±12.0 |
| Park registry | 2011 | 810 | 475 | 335 | 38% | 65% | 3.1±2.2 | 3.7±2.1 | 22.5±9.9 | 37.8±11.9 |
| MAIN-COMPARE | 2008 | 1,474 | 784 | 690 | 34% | 57% | — | — | 24.8±10.9 | 38.7±13.3 |
| Capodanno et al. | 2011 | 556 | 285 | 271 | 28% | 52% | — | — | 20.1±6.3 | 22.8±6.1 |

Distal LM

~ > 60%

EuroSCORE

~ 3 in PCI

~ 5 in CABG

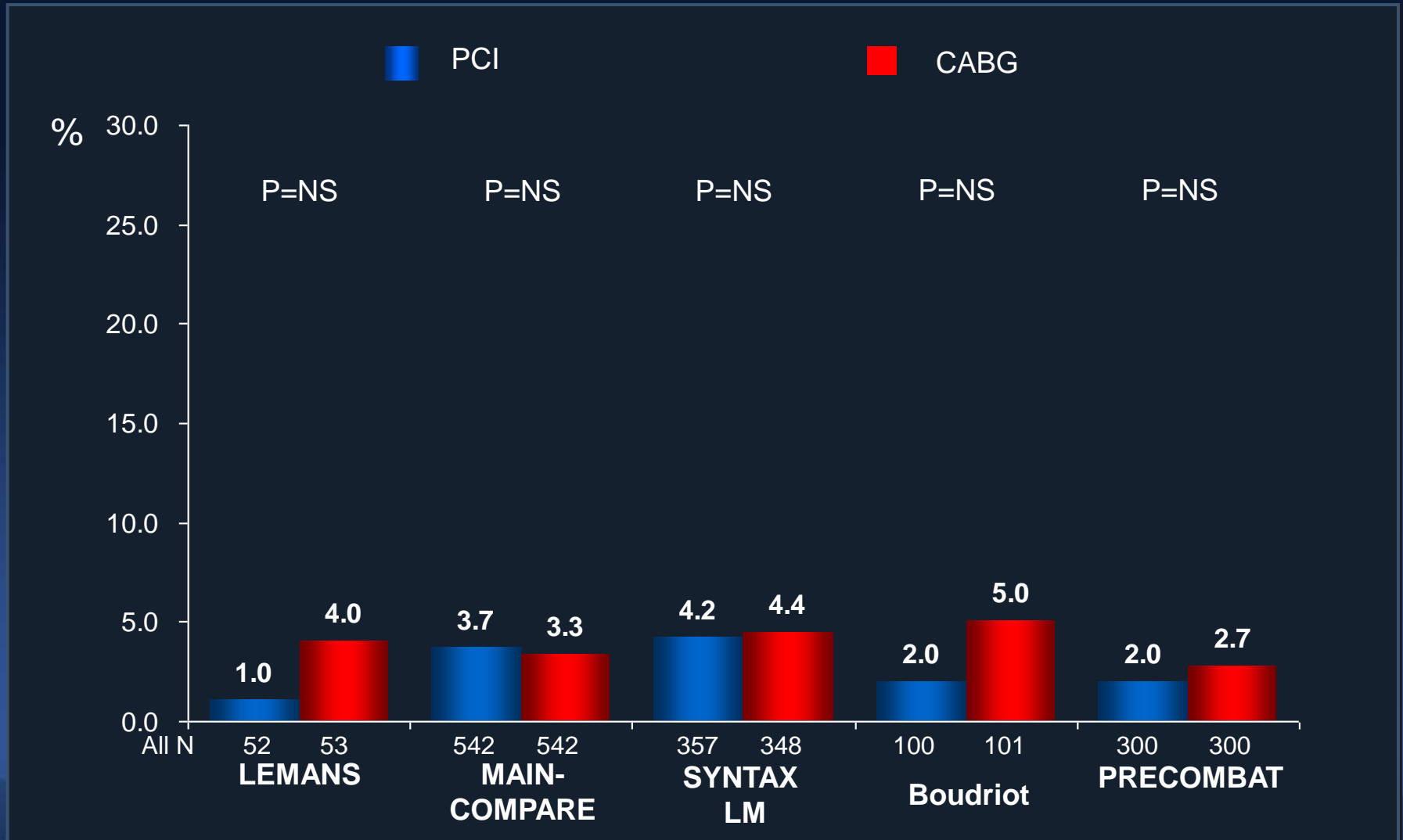
SYNTAX score ~ 24 in PCI

~ 30 in CABG

1-Year Event Rates between PCI vs. CABG

Matched or Randomized Patients

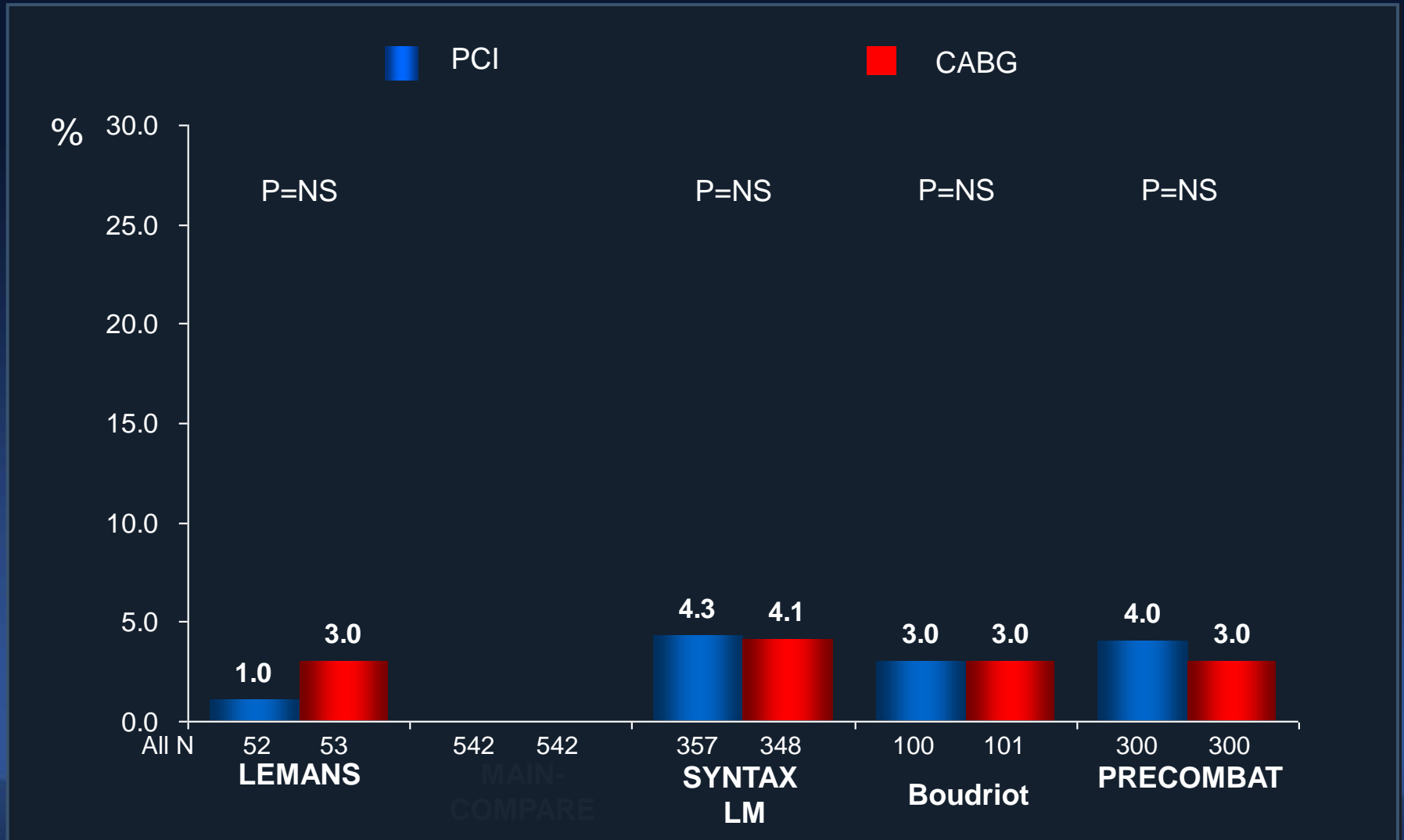
1-Year Mortality



Cumulative KM Event Rate; log-rank P value; *Binary rates

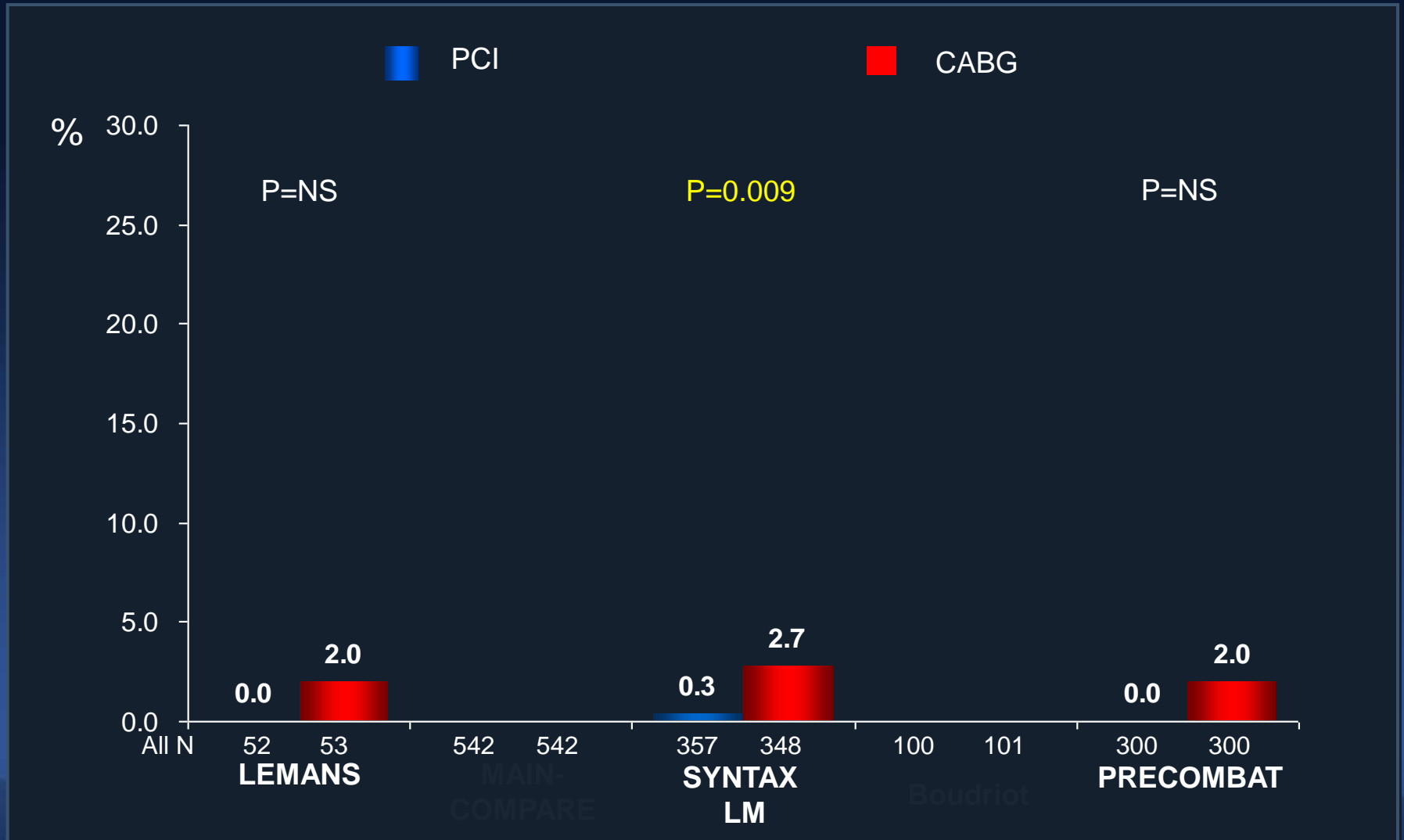
Matched or Randomized Patients

1-Year MI



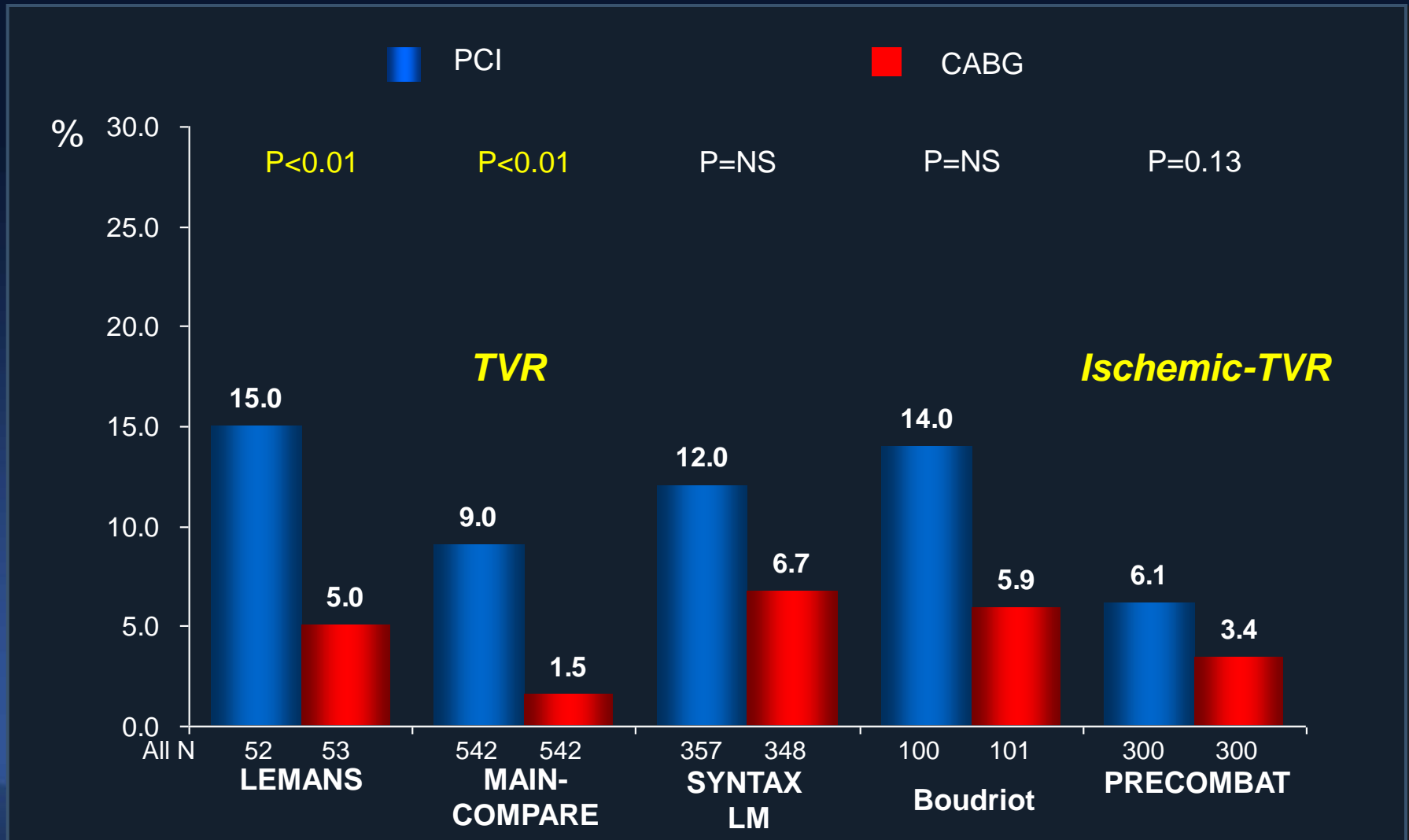
Matched or Randomized Patients

1-Year Stroke



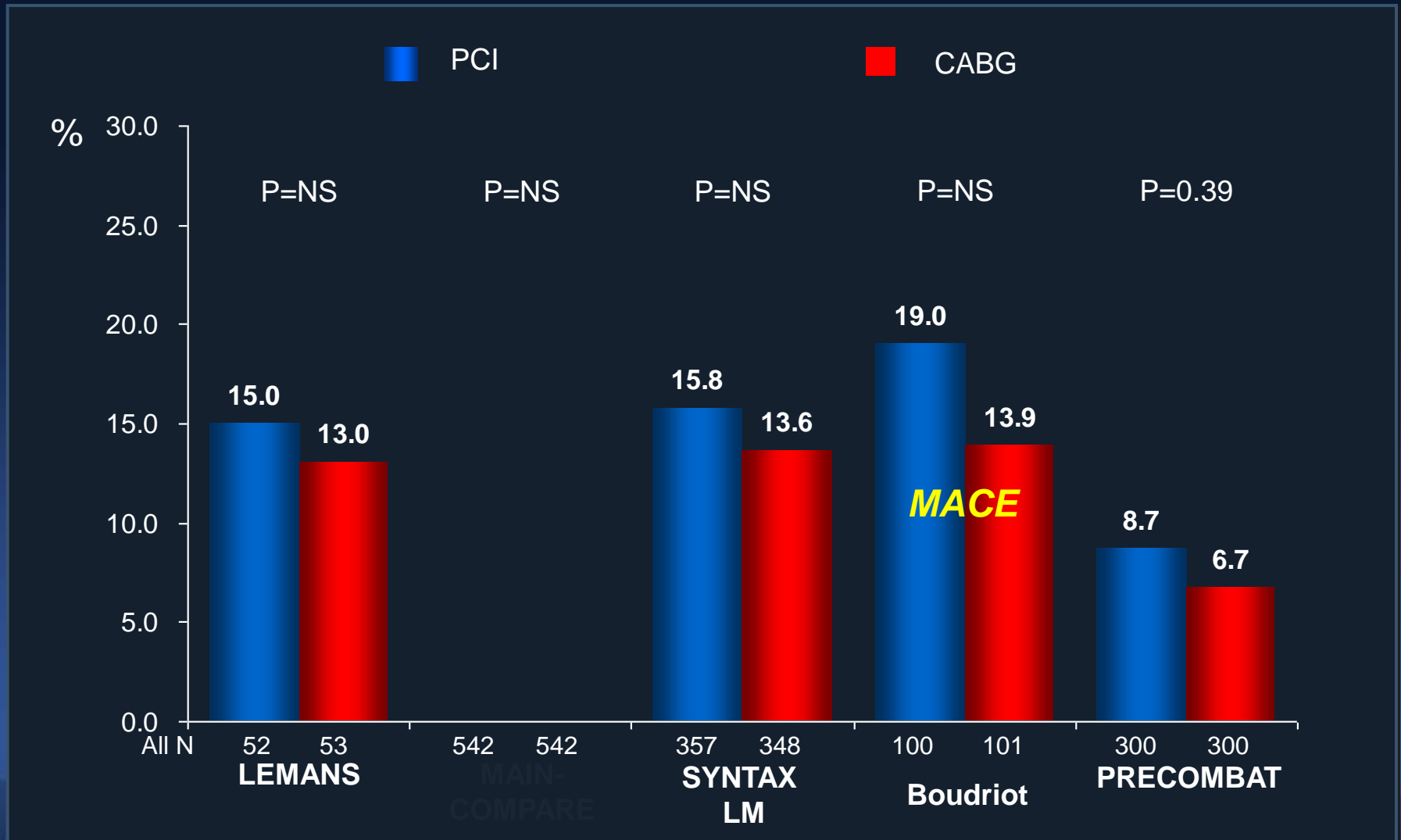
Matched or Randomized Patients

1-Year Repeat Revascularization



Matched or Randomized Patients

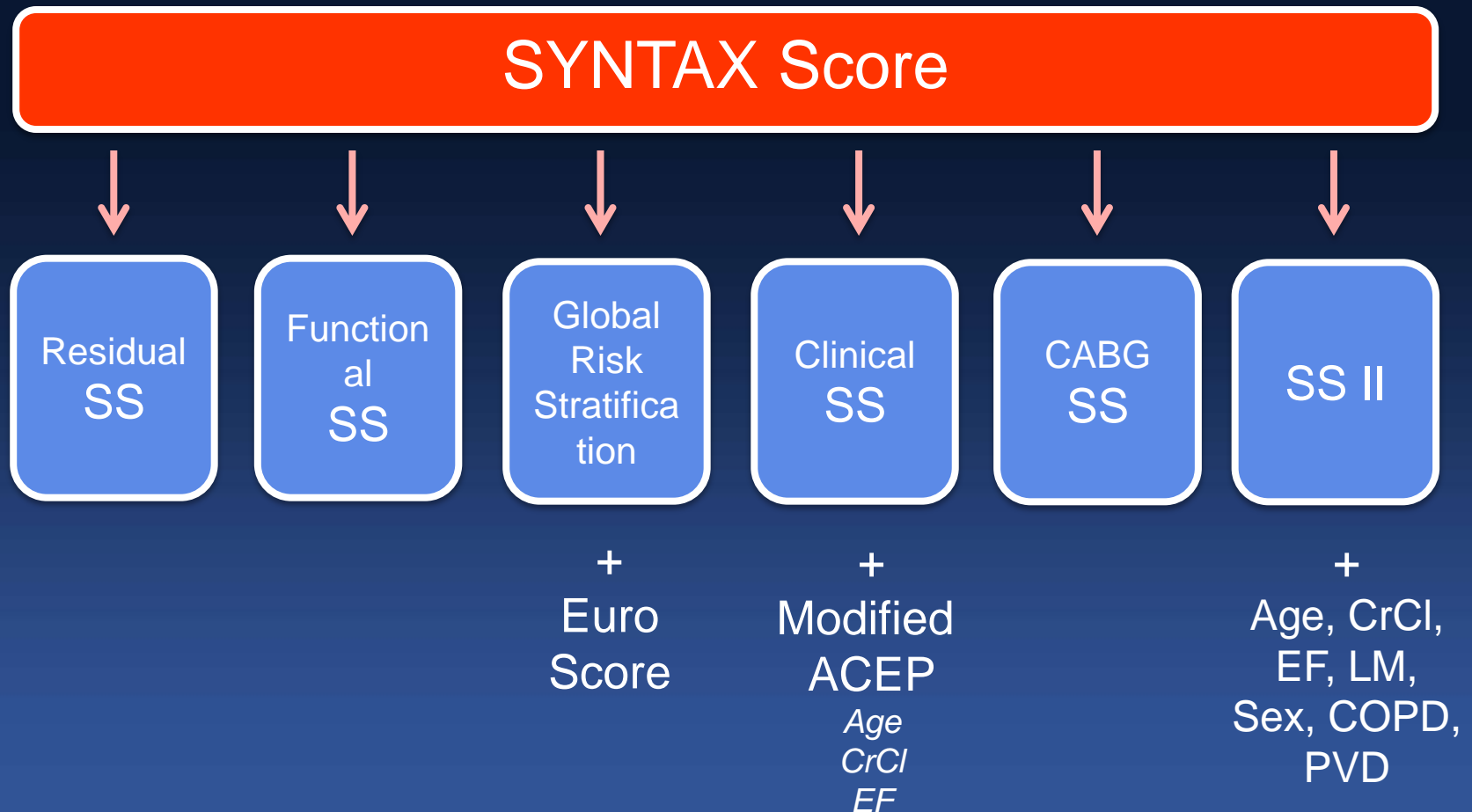
1-Year MACCE



Risk Stratification

SYNTAX Score and Modifiers

In Risk Prediction and Treatment Selection




CT-SYNTAX Score

JACC Cardiovasc Imaging. 2013 Mar;6(3):413-5.

A Feasibility and Reproducibility Study

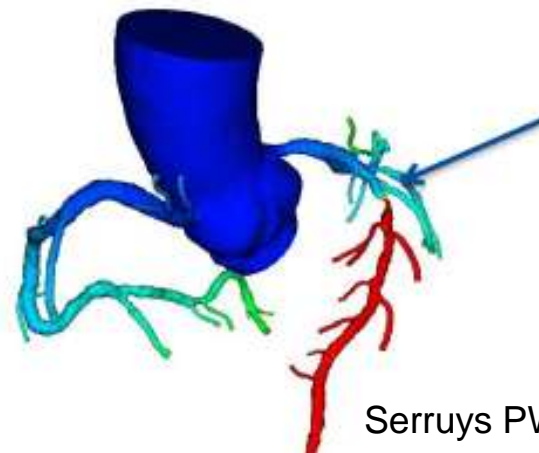
Segments with disease

3. Specify which segments are diseased for lesion 1. 
Click on the coronary tree image to select or unselect segments.

| | | Lesion: | 1 |
|------------|----------------------------|---------|--------------------------|
| | Segments: | | |
| RCA | RCA proximal | 1 | <input type="checkbox"/> |
| | RCA mid | 2 | <input type="checkbox"/> |
| | RCA distal | 3 | <input type="checkbox"/> |
| LM | Left main | 5 | <input type="checkbox"/> |
| LAD | LAD proximal | 6 | <input type="checkbox"/> |
| | LAD mid | 7 | <input type="checkbox"/> |
| | LAD apical | 8 | <input type="checkbox"/> |
| | First diagonal | 9 | <input type="checkbox"/> |
| | Add. first diagonal | 9a | <input type="checkbox"/> |
| | Second diagonal | 10 | <input type="checkbox"/> |
| | Add. second diagonal | 10a | <input type="checkbox"/> |
| LCX | Proximal circumflex | 11 | <input type="checkbox"/> |
| | Intermediate/anterolateral | 12 | <input type="checkbox"/> |
| | Obtuse marginal | 12a | <input type="checkbox"/> |
| | Obtuse marginal | 12b | <input type="checkbox"/> |
| | Distal circumflex | 13 | <input type="checkbox"/> |
| | Left posterolateral | 14 | <input type="checkbox"/> |
| | Left posterolateral | 14a | <input type="checkbox"/> |
| | Left posterolateral | 14b | <input type="checkbox"/> |
| | Posterior descending | 15 | <input type="checkbox"/> |



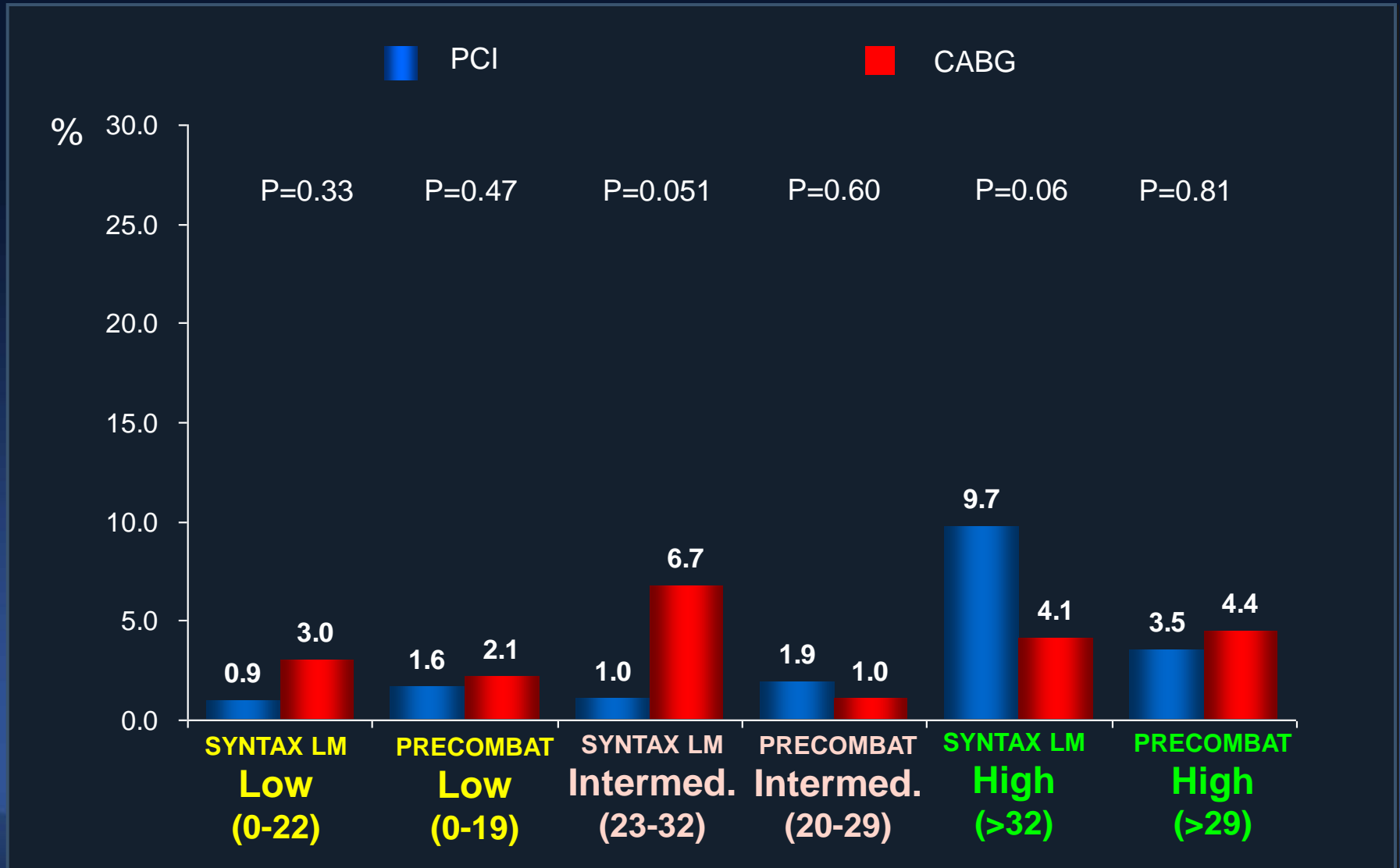
Anatomic calculation of >50% stenosis



Functional calculation stenosis with <0.80 FFR

Death at 1 Year

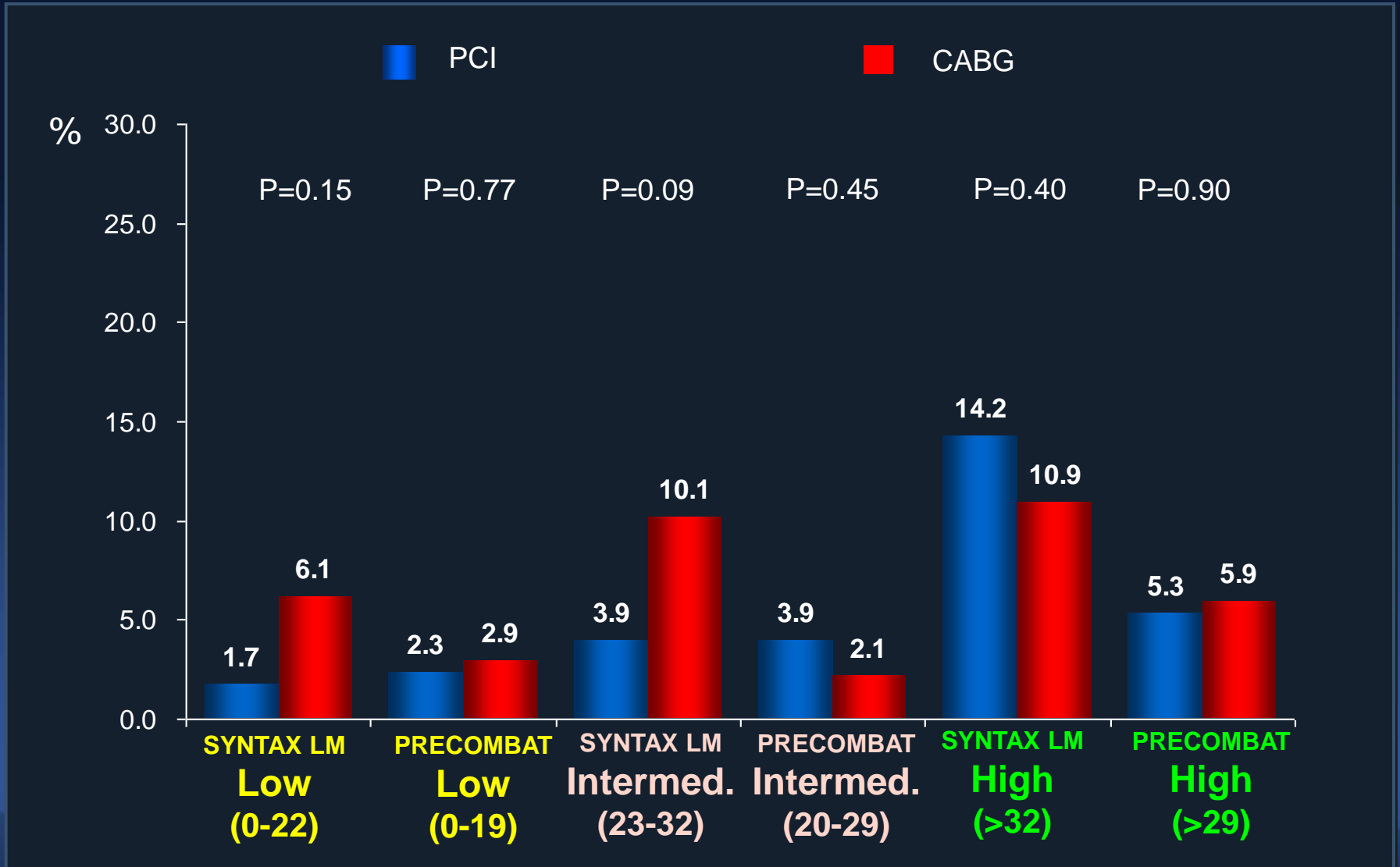
Classified by SYNTAX Tertiles



Cumulative KM Event Rate; log-rank P value; *Binary rates

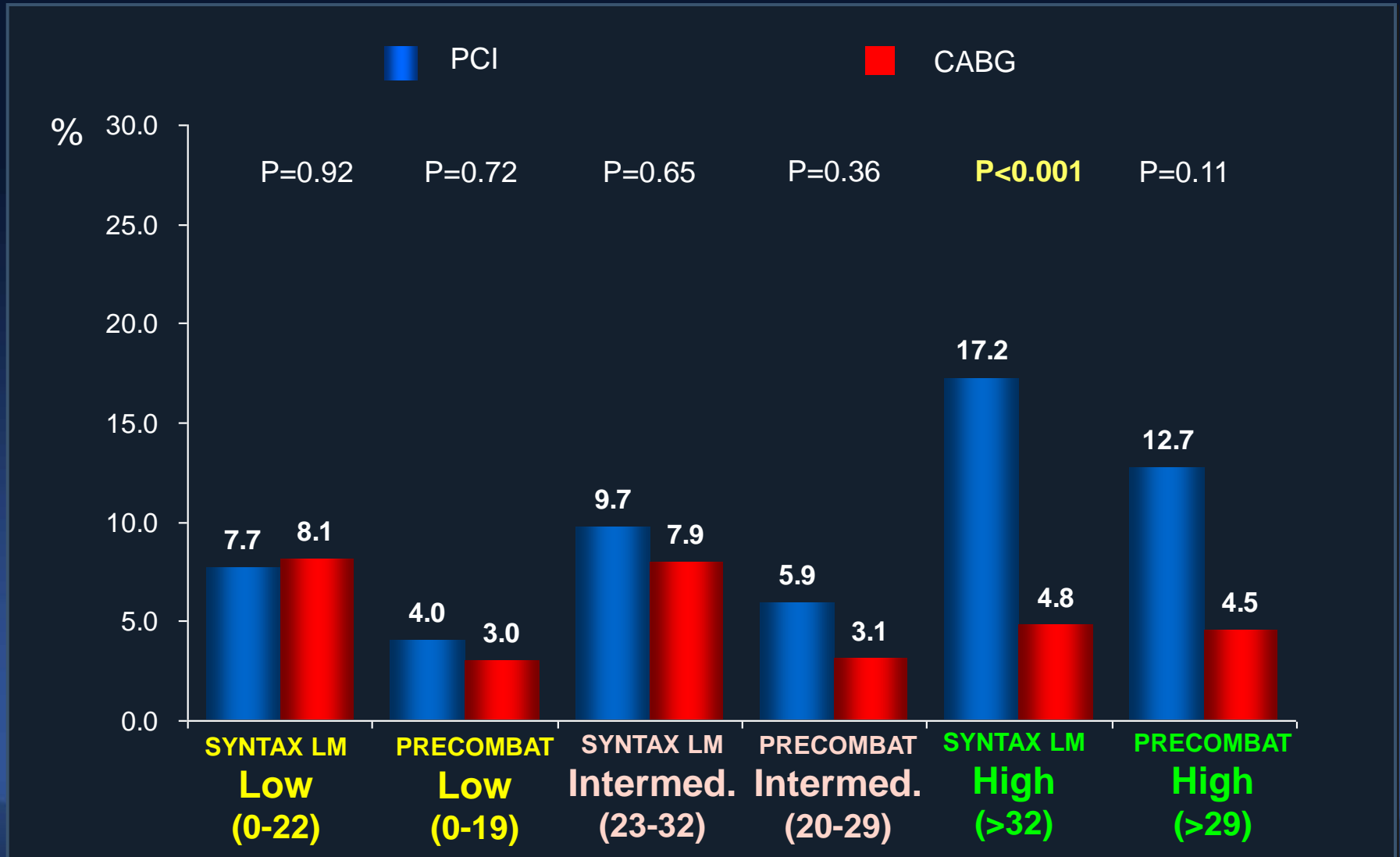
Death, MI, or Stroke at 1 Year

Classified by SYNTAX Tertiles



Cumulative KM Event Rate; log-rank P value; *Binary rates

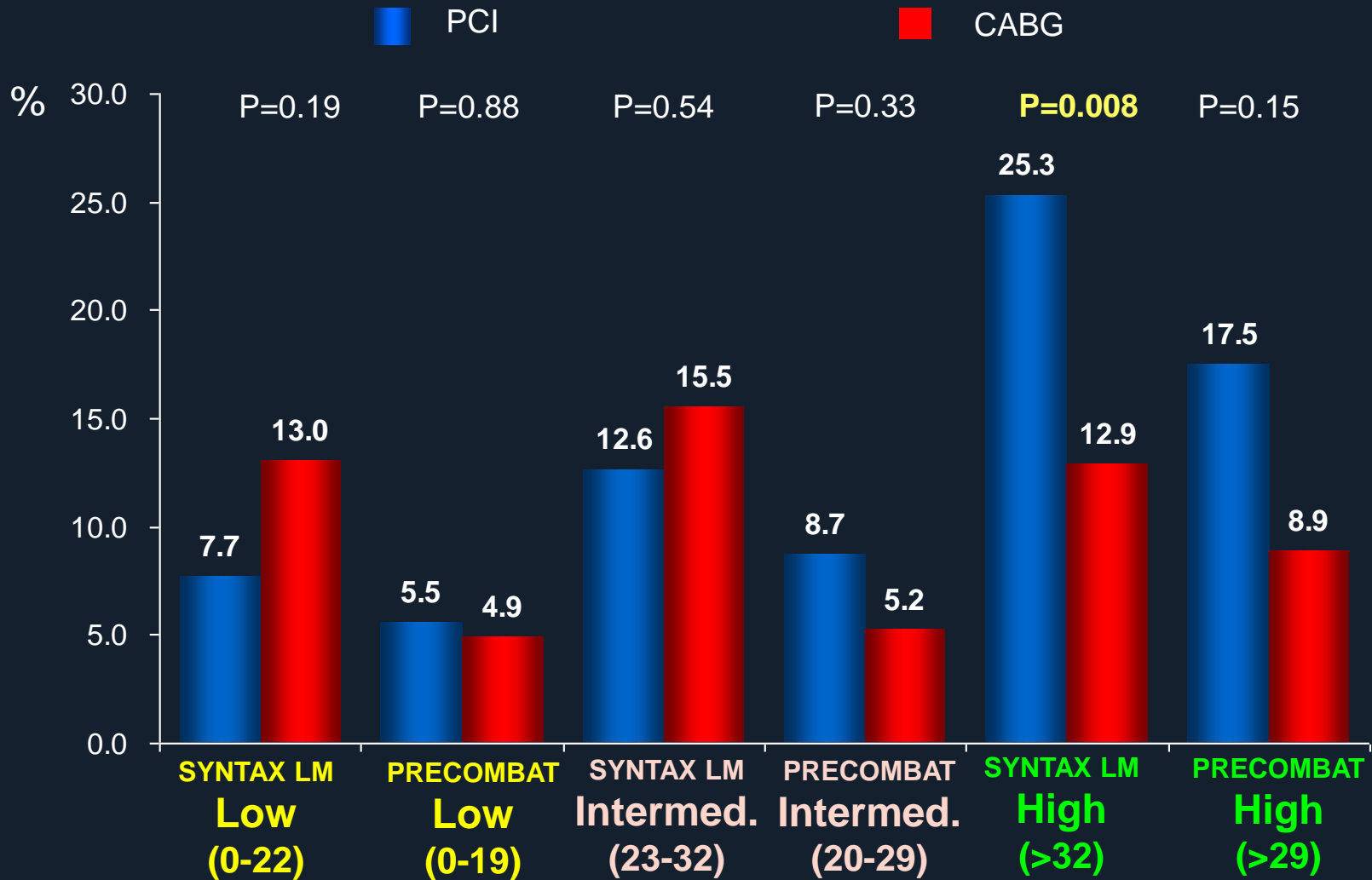
Repeat Revascularization at 1 Year Classified by SYNTAX Tertiles



Cumulative KM Event Rate; log-rank P value; *Binary rates

MACCE at 1 Year

Classified by SYNTAX Tertiles



Cumulative KM Event Rate; log-rank P value; * Binary rates

Predictors of 1-Year MACCE

SYNTAX LM Study

| | PCI | | CABG | |
|----------------------------|--------------------|-------|--------------------|-------|
| | OR (95% CI) | p | OR (95% CI) | p |
| Prior TIA | 3.19 (1.03, 9.86) | 0.04 | - | |
| SYNTAX score | 1.03 (1.01, 1.05) | 0.01 | - | |
| CRF | 6.17 (0.92, 41.54) | 0.06 | - | |
| EuroSCORE | 1.12 (1.00, 1.25) | 0.045 | 1.19 (1.04, 1.35) | 0.009 |
| Emergent revascularization | - | | 6.27 (1.62, 24.22) | 0.008 |
| COPD | - | | 2.52 (0.94, 6.73) | 0.07 |
| DM | - | | 2.05 (0.91, 4.62) | 0.08 |

Predictors for 3-Y MACCE PRECOMBAT

| | HR | 95% CI | P value |
|-------------------------|------|-------------|---------|
| All patients | | | |
| DM requiring insulin | 4.00 | 1.72 – 9.28 | 0.001 |
| Multivessel involvement | 3.62 | 1.56 – 8.41 | 0.003 |
| PCI patients | | | |
| DM requiring insulin | 3.13 | 1.10 – 8.89 | 0.032 |
| Total stent number | 1.34 | 1.06 – 1.70 | 0.017 |

The SYNTAX score is useful to stratify the risk of patients, but, I am not very much convinced about the existence of a unique risk score to be generalized in all areas, patients,

Durable Safety and Efficacy

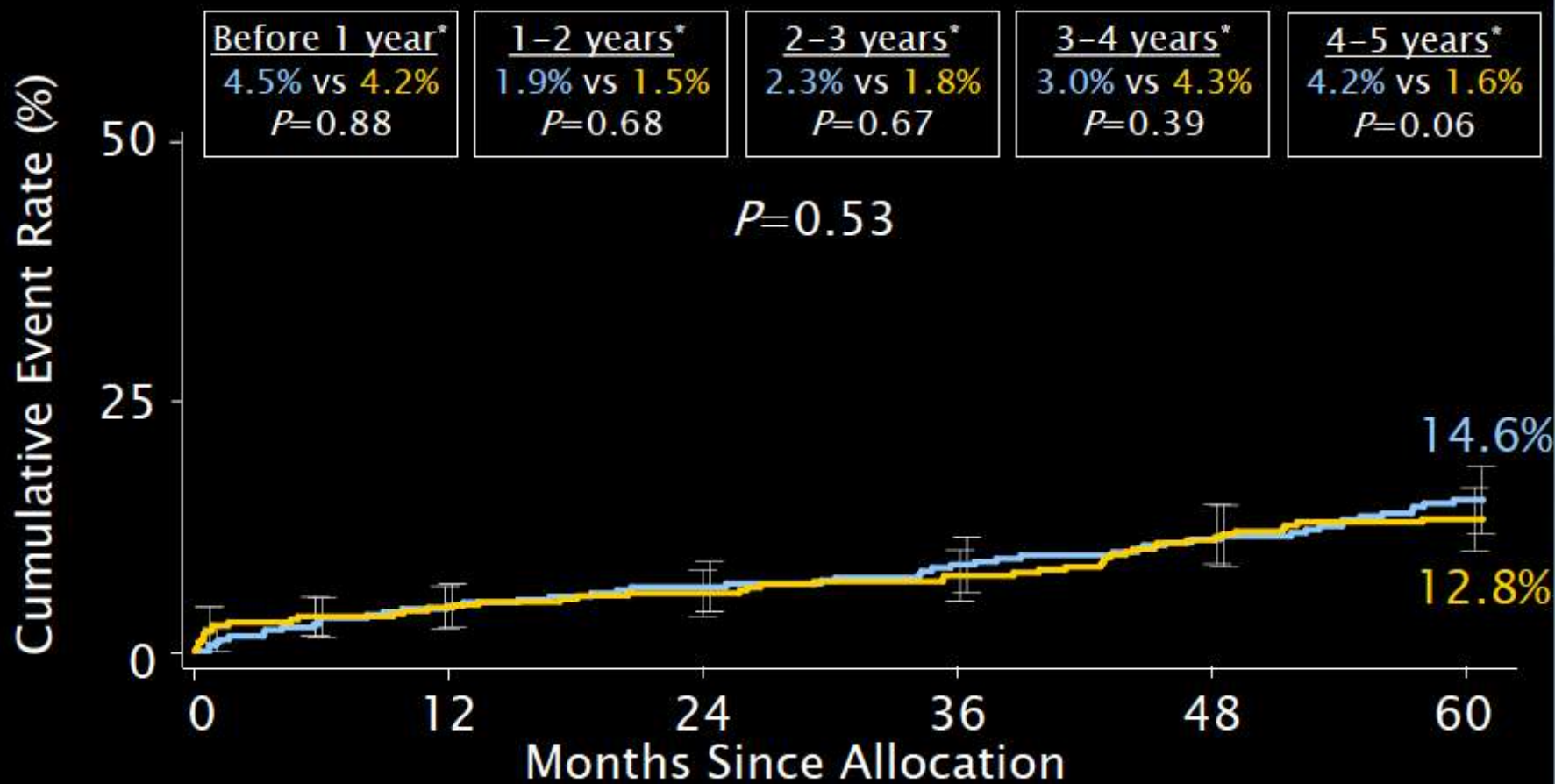
All-Cause Death to 5 Years

Left Main Subset



■ CABG (N=348)

■ TAXUS (N=357)



Cumulative KM Event Rate \pm 1.5 SE; log-rank P value; *Binary rates

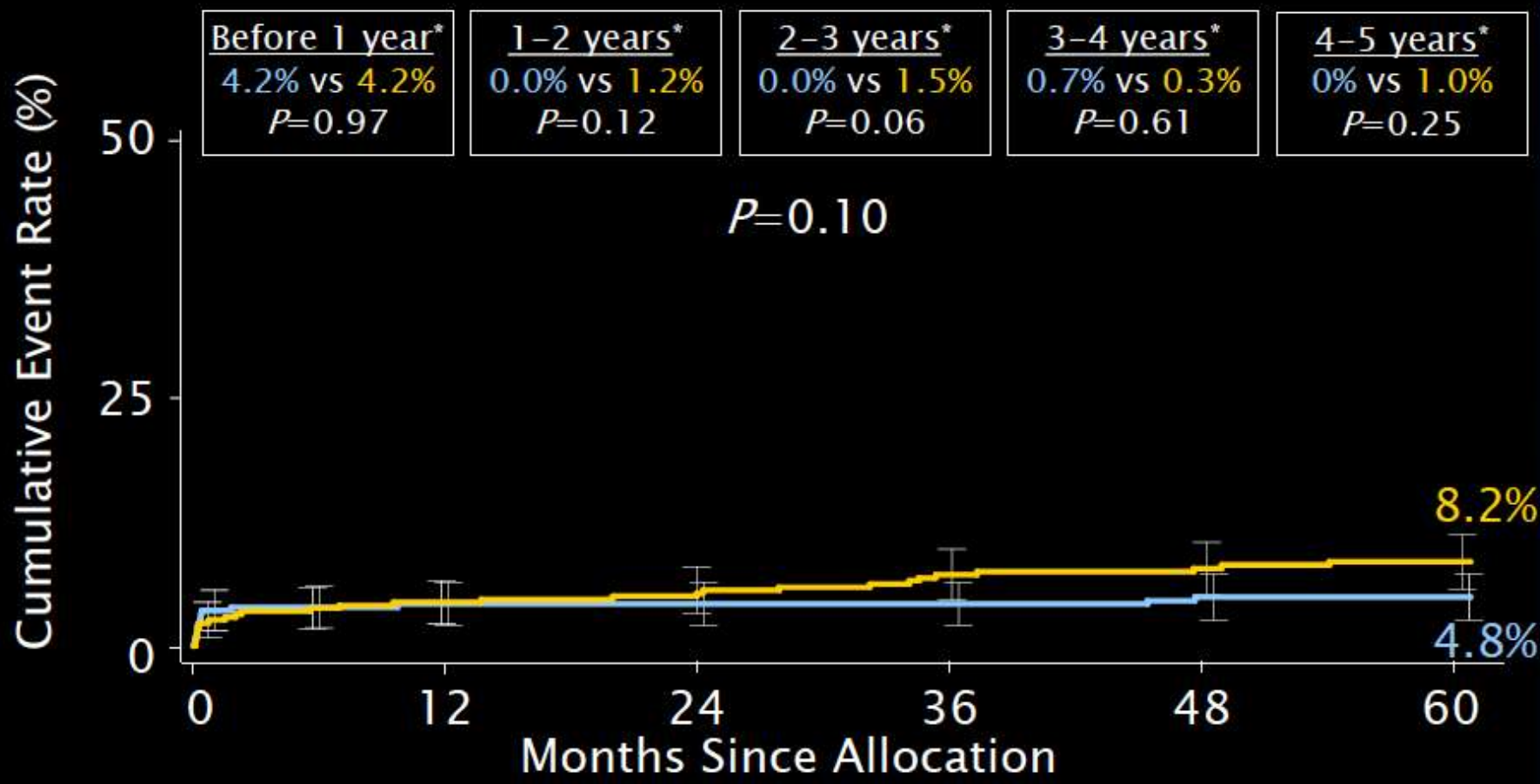
ITT population

Myocardial Infarction to 5 Years *Left Main Subset*



■ CABG (N=348)

■ TAXUS (N=357)



Cumulative KM Event Rate \pm 1.5 SE; log-rank P value; *Binary rates

ITT population

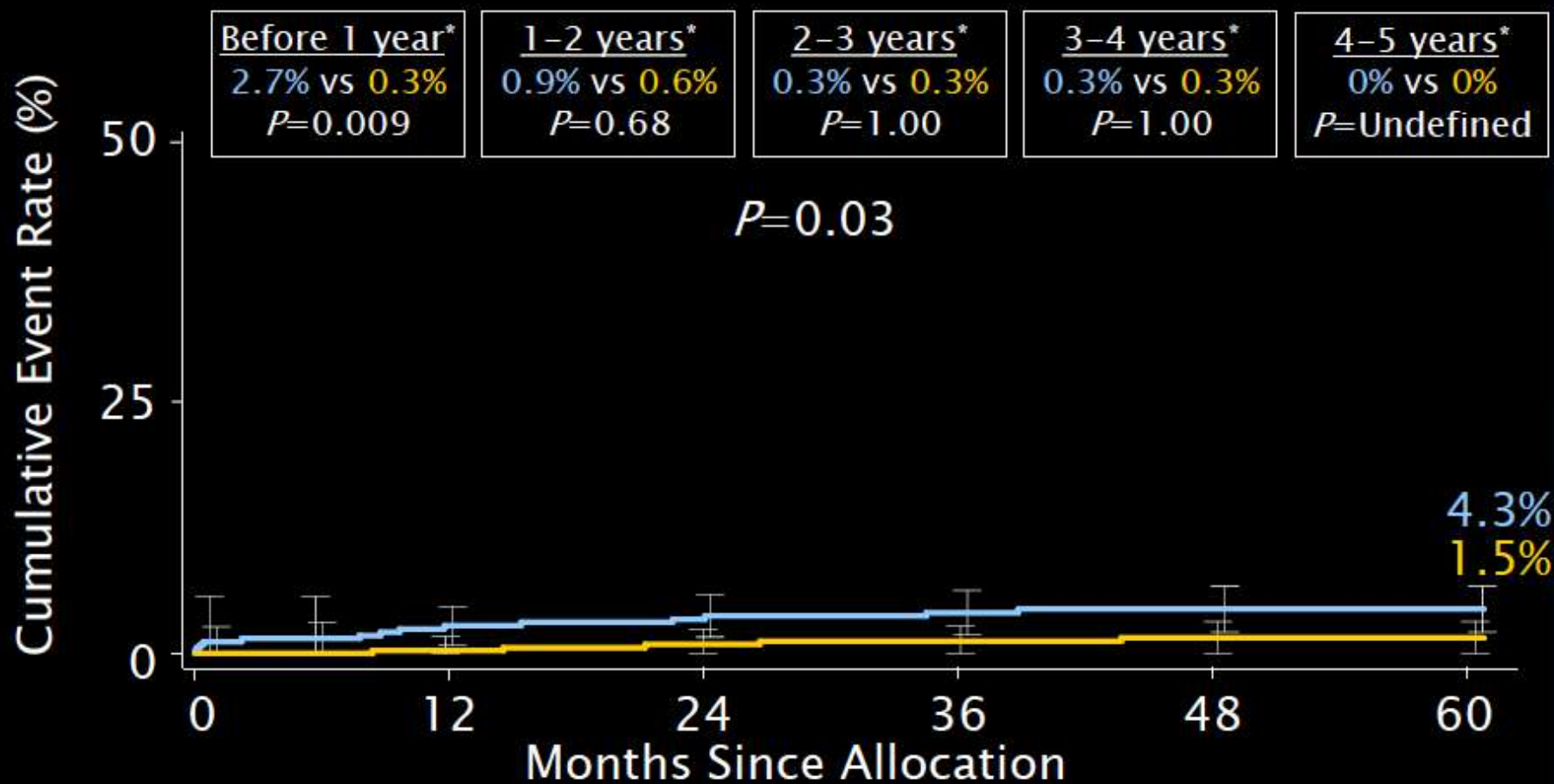
CVA to 5 Years

Left Main Subset



■ CABG (N=348)

■ TAXUS (N=357)



Cumulative KM Event Rate \pm 1.5 SE; log-rank P value; *Binary rates

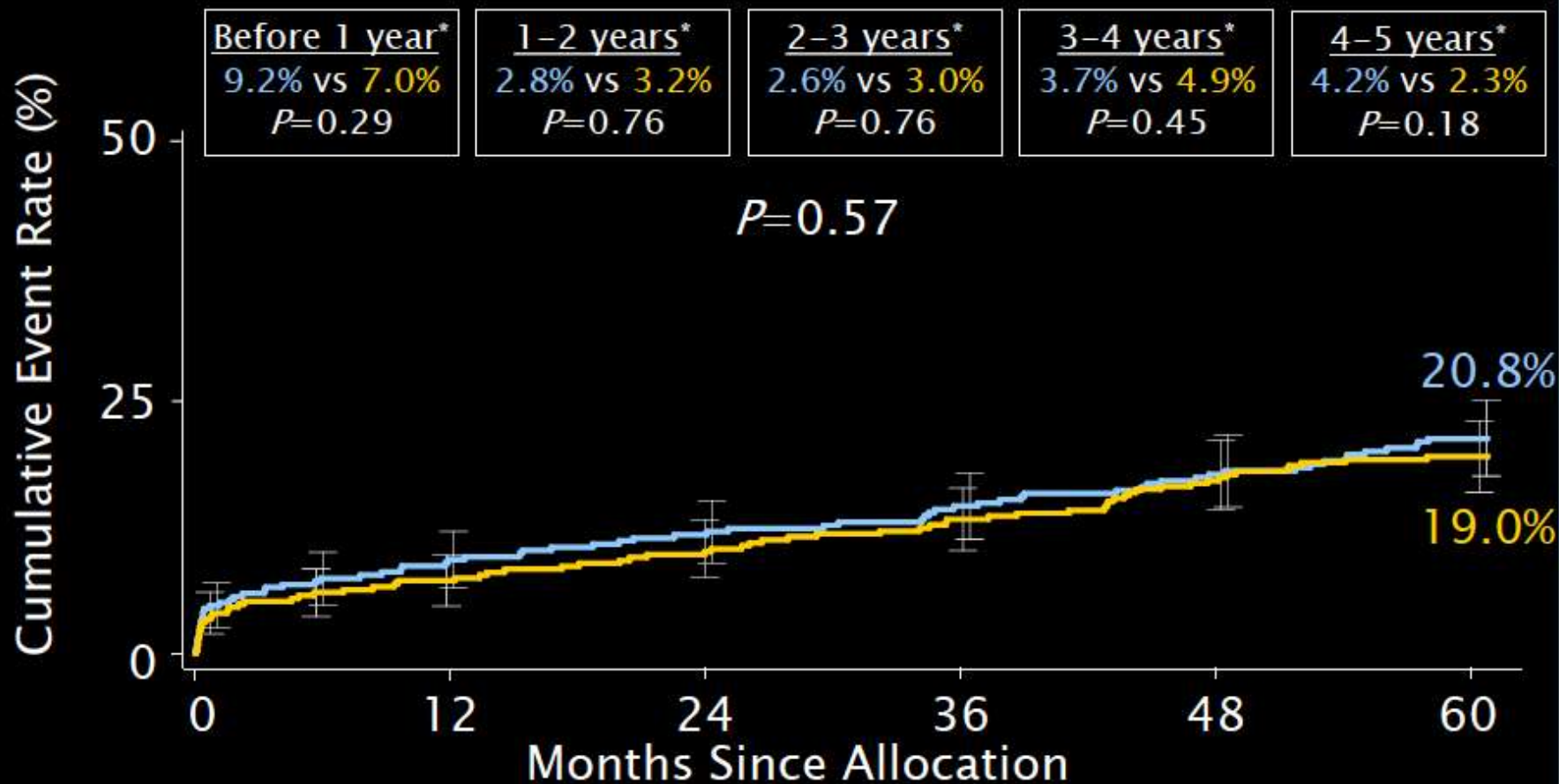
ITT population

All-Cause Death/CVA/MI to 5 Years Left Main Subset



■ CABG (N=348)

■ TAXUS (N=357)



Cumulative KM Event Rate \pm 1.5 SE; log-rank P value; *Binary rates

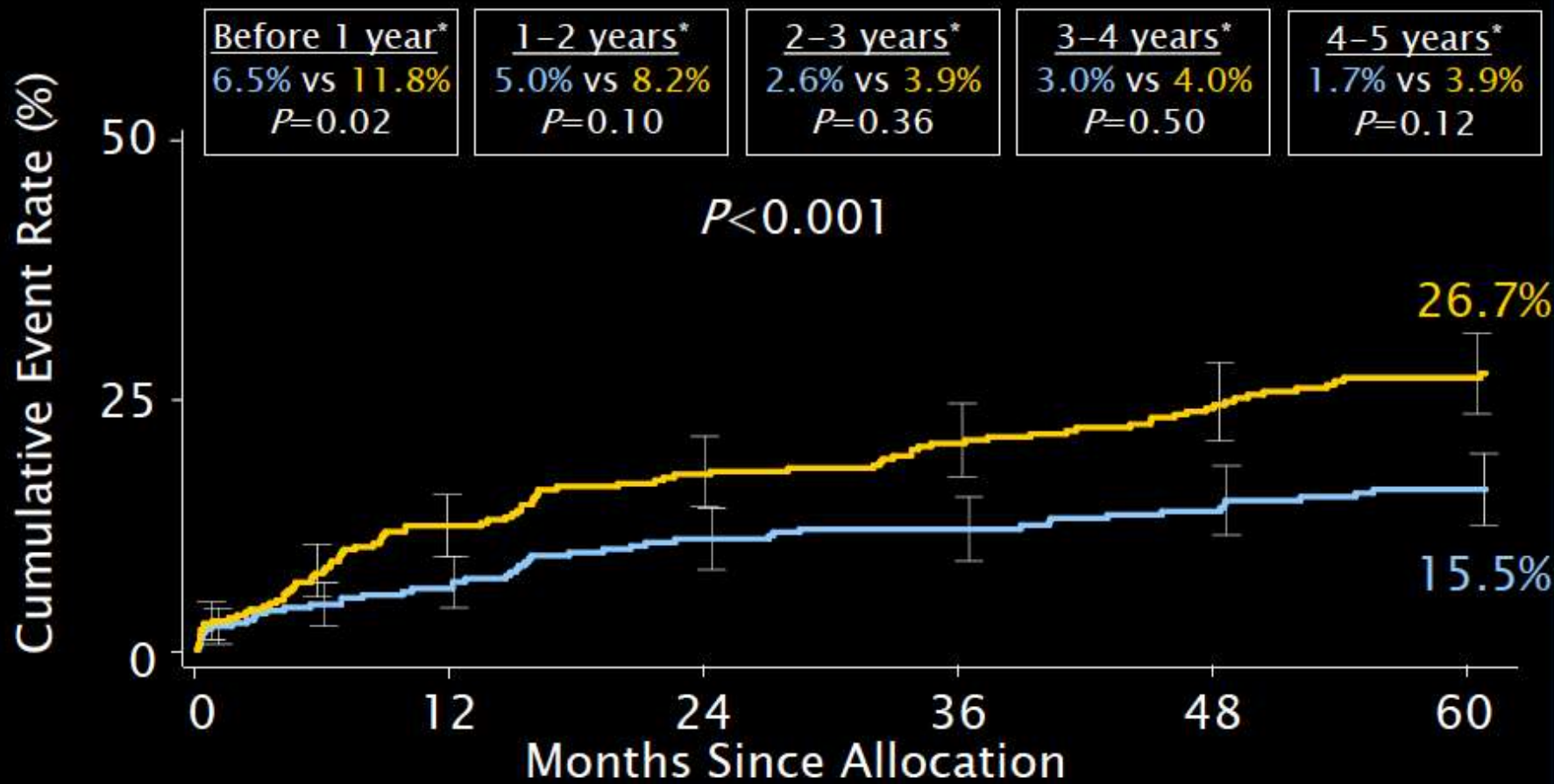
ITT population

Repeat Revascularization to 5 Years *Left Main Subset*



■ CABG (N=348)

■ TAXUS (N=357)



Cumulative KM Event Rate \pm 1.5 SE; log-rank Pvalue; *Binary rates

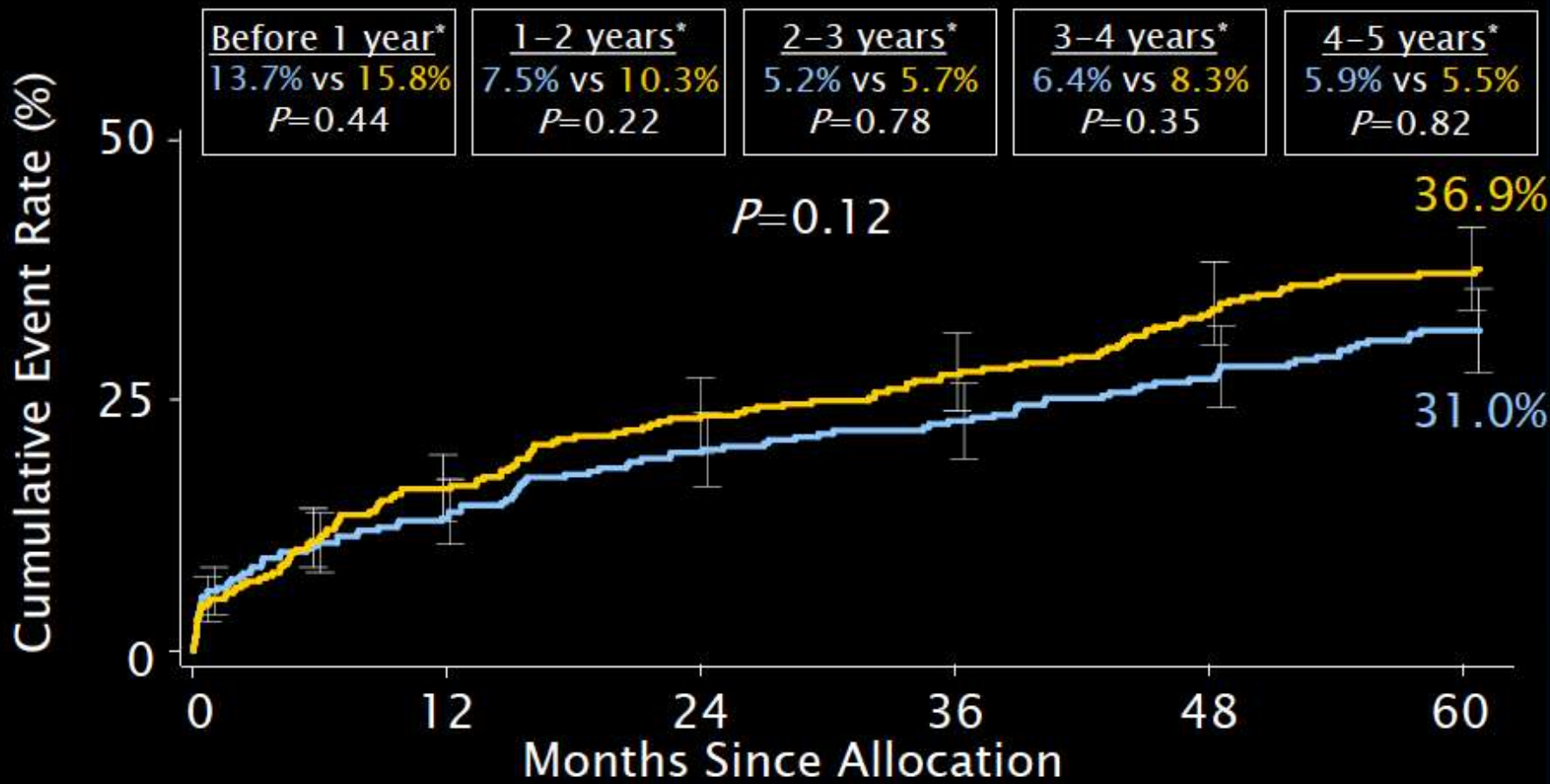
ITT population

MACCE to 5 Years *Left Main Subset*



■ CABG (N=348)

■ TAXUS (N=357)



Cumulative KM Event Rate \pm 1.5 SE; log-rank Pvalue; *Binary rates

ITT population

3-Year Follow-up of PRECOMBAT

Enrolled Patients (N=1454)

Randomized Cohort
N=600

Assigned CABG
N=300

Treated CABG
N=248
Treated PCI
N=51
Treated medical
N=1

1-year FU
N=296 (98.7%)

2-year FU
N=285 (95.0%)

3-year FU
N=269 (89.7%)

Assigned PCI
N=300

Treated CABG
N=24
Treated PCI
N=276
Treated medical
N=0

1-year FU
N=296 (98.7%)

2-year FU
N=282 (94.0%)

3-year FU
N=260 (86.7%)

CABG registry N=335
PCI registry N=475
Medication registry N=44

1-Year

CABG 97.1%, PCI 94.8%
Medication 90.4%

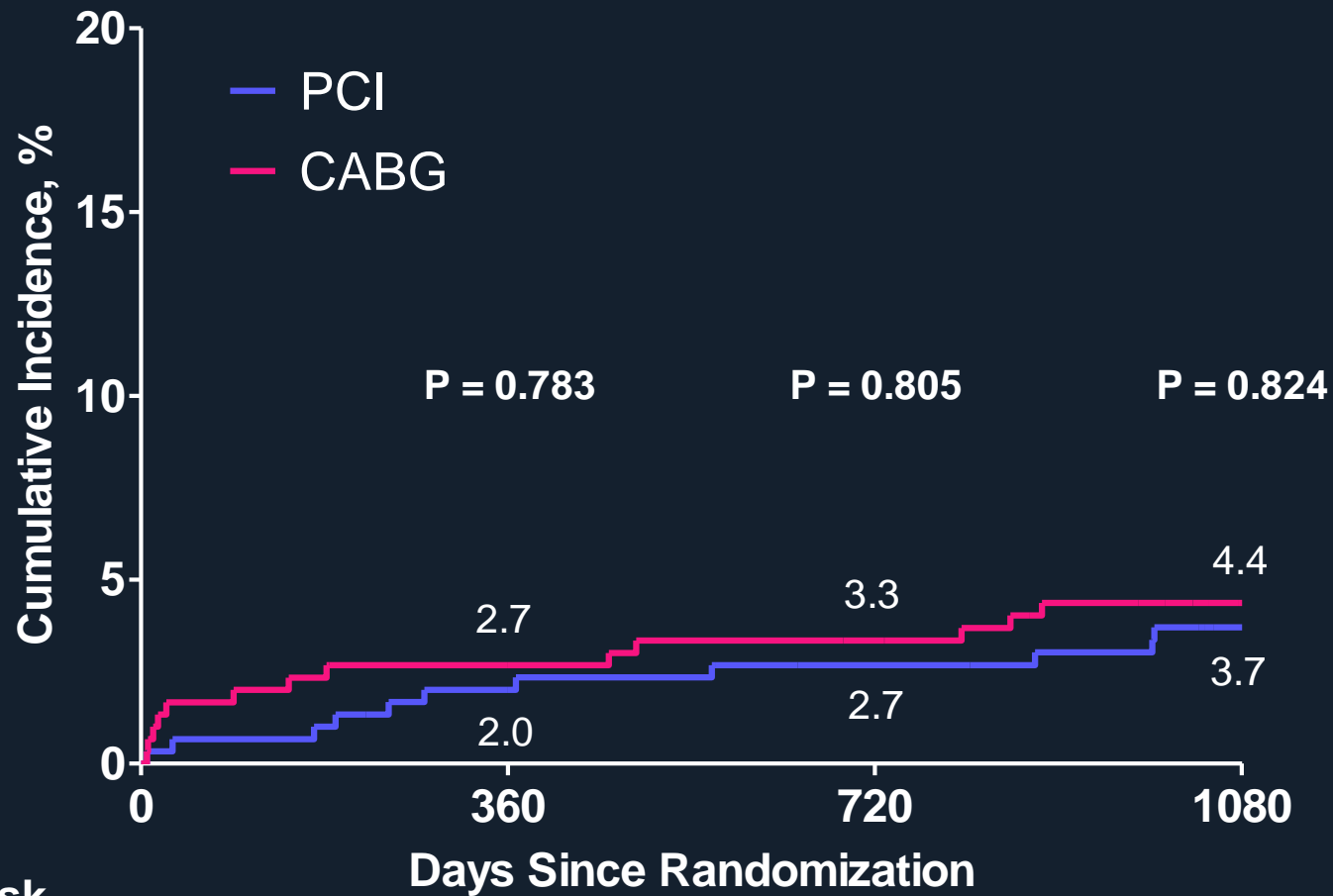
3-Year

CABG 95.8%, PCI 93.3%
Medication 90.4%

3-Year

CABG 89.3%, PCI 90.2%
Medication 84.6%

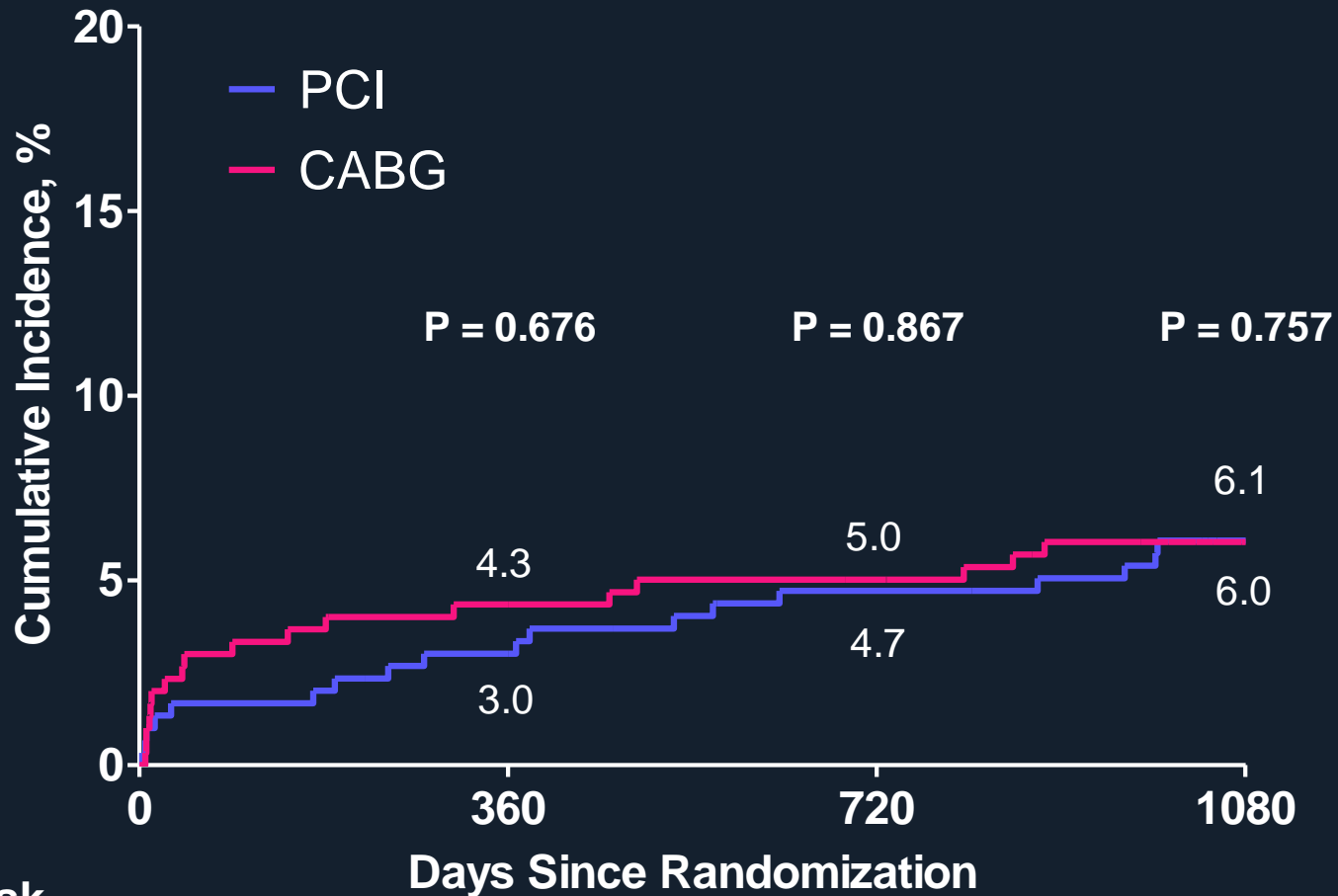
Death



No. at Risk

| | | | | |
|------|-----|-----|-----|-----|
| PCI | 300 | 292 | 287 | 279 |
| CABG | 300 | 290 | 287 | 275 |

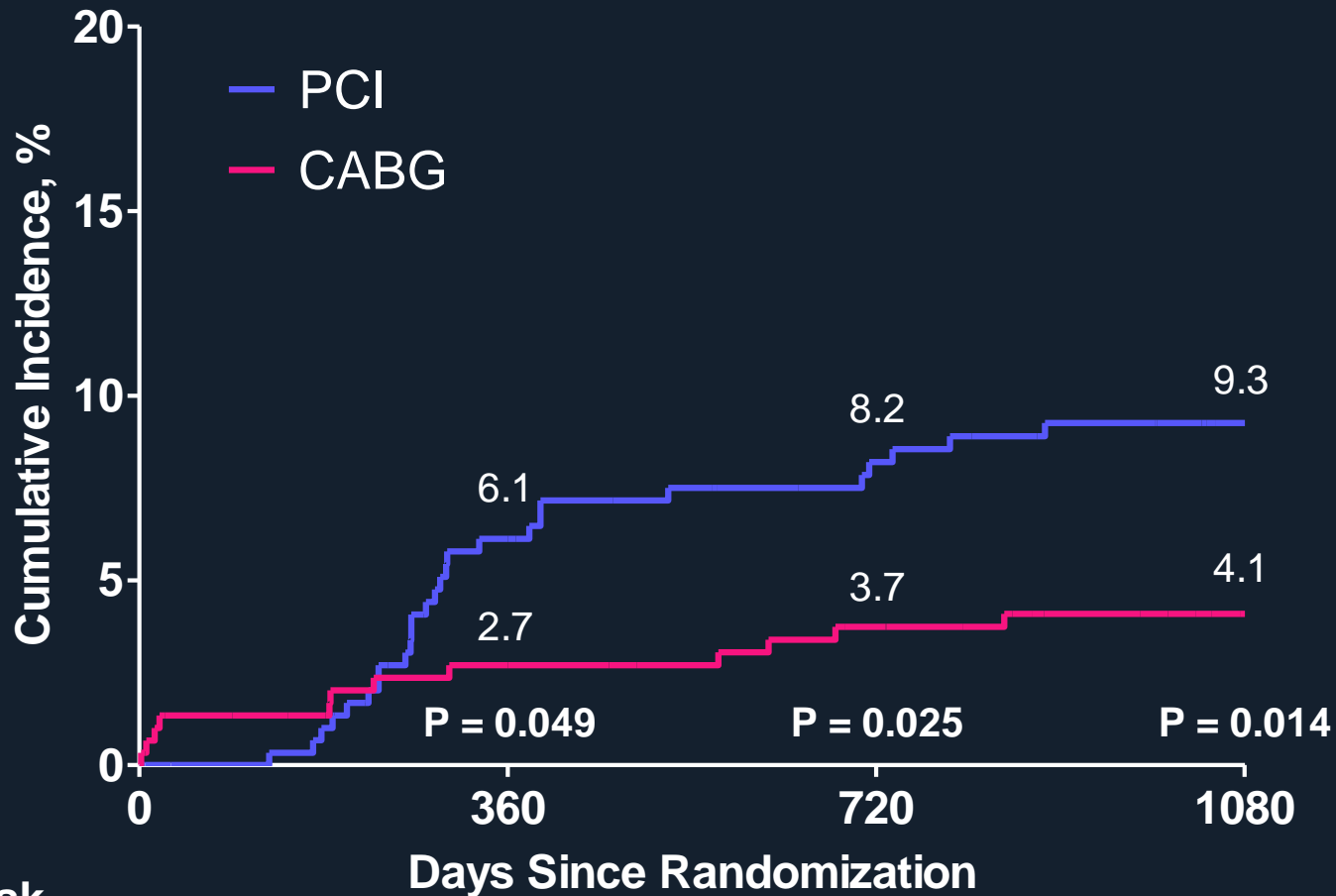
Death, MI or Stroke



No. at Risk

| | | | | |
|------|-----|-----|-----|-----|
| PCI | 300 | 288 | 281 | 272 |
| CABG | 300 | 285 | 282 | 270 |

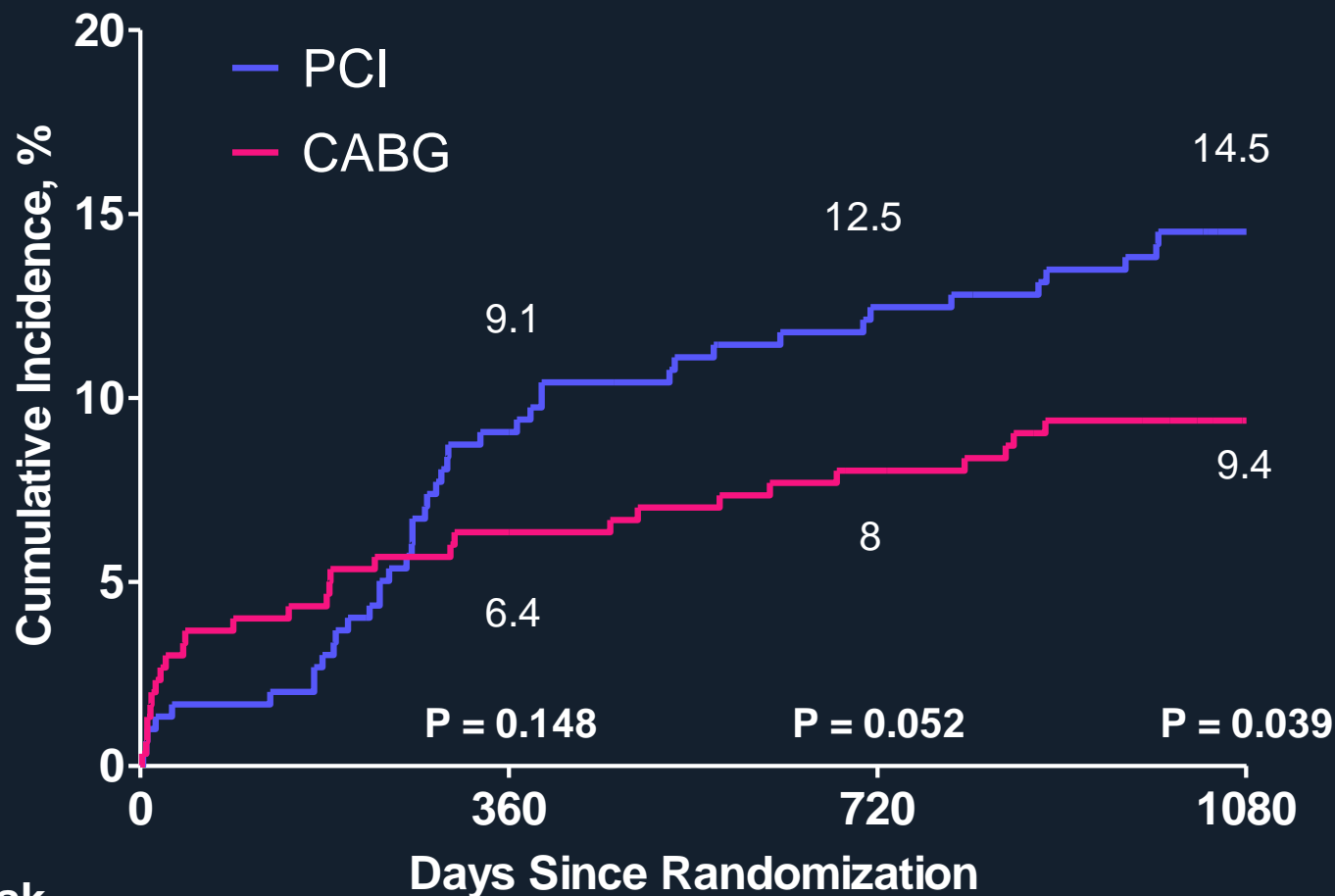
Ischemia-Driven TVR



No. at Risk

| | | | | |
|------|-----|-----|-----|-----|
| PCI | 300 | 274 | 263 | 252 |
| CABG | 300 | 285 | 279 | 266 |

Primary End Point of MACCE



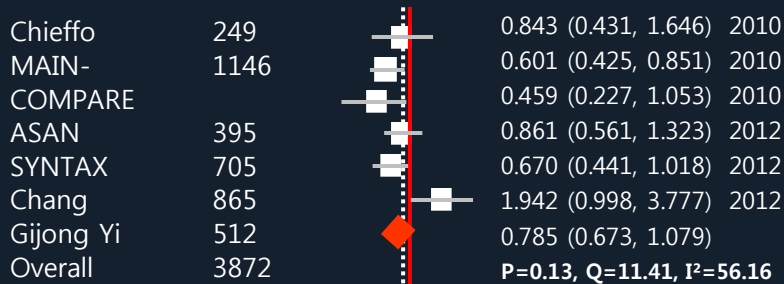
No. at Risk

| | | | | |
|------|-----|-----|-----|-----|
| PCI | 300 | 270 | 258 | 247 |
| CABG | 300 | 280 | 274 | 261 |

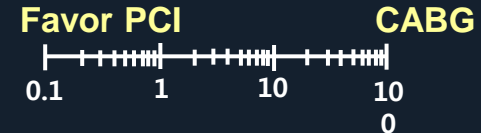
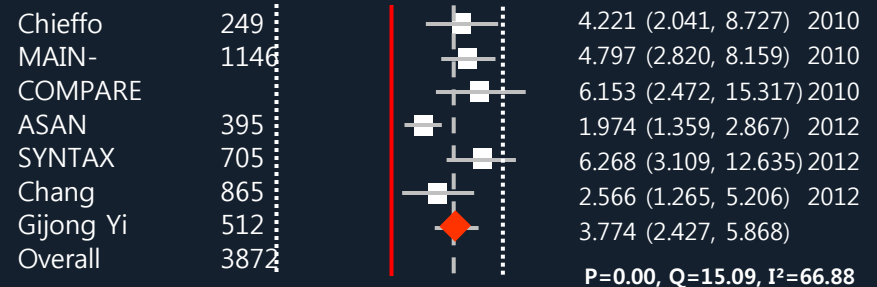
PCI VS. CABG

5-year Meta-analysis

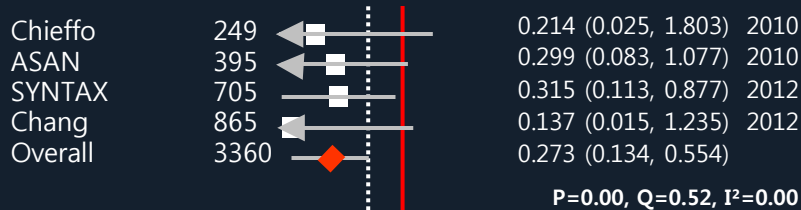
Mortality



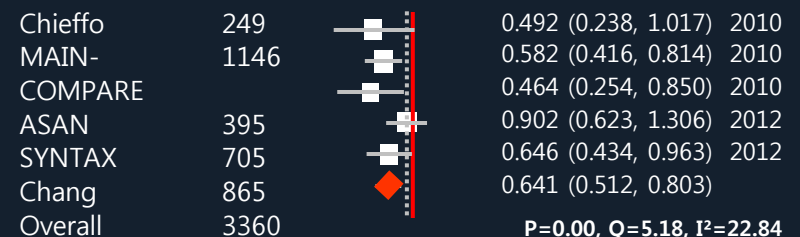
TVR



Stroke



MACCE



New DES

1st vs. 2nd DES for LM *EXCELLENT registry*

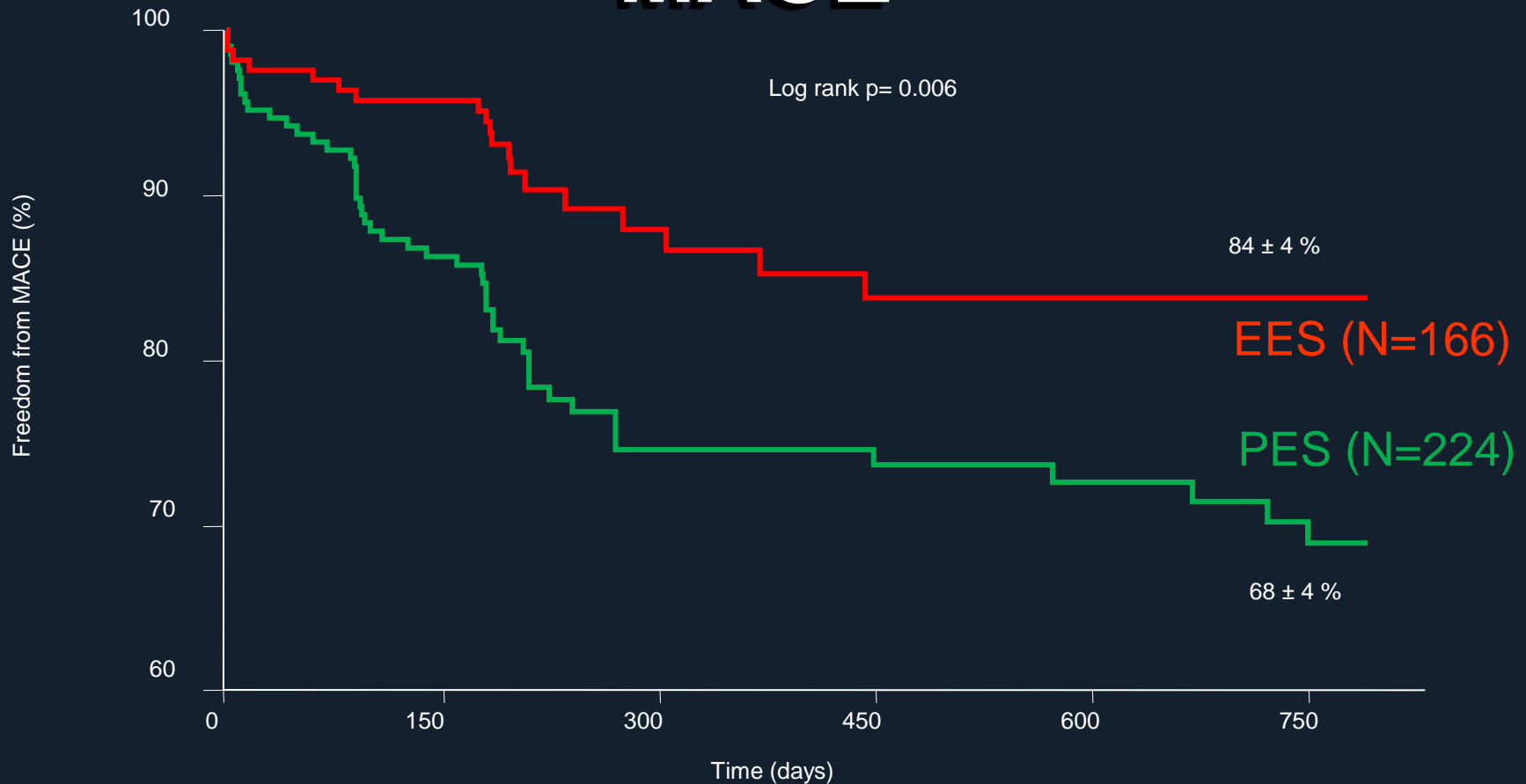
1 Year Outcome

| | Events | | | Propensity Score Adjustment | |
|--------------|----------------|----------------|---------|-----------------------------|--------------|
| | EES (N=160) | SES (N=115) | P value | HR (95% CI) | P value |
| Death/MI/TVR | 12 (7.5%) | 16 (13.9%) | 0.117 | 0.43 (0.20-0.95) | 0.037 |
| Death | 7 (4.4%) | 8 (7.0%) | 0.383 | 0.52 (0.18-0.51) | 0.23 |
| Death/MI | 8 (5.0%) | 8 (7.0%) | 0.529 | 0.60 (0.21-0.67) | 0.323 |
| TVR | 4 (2.5%) | 8 (7.0%) | 0.096 | 0.28 (0.08-0.98) | 0.046 |

1st vs. 2nd DES for LM

PCI Florence Registry

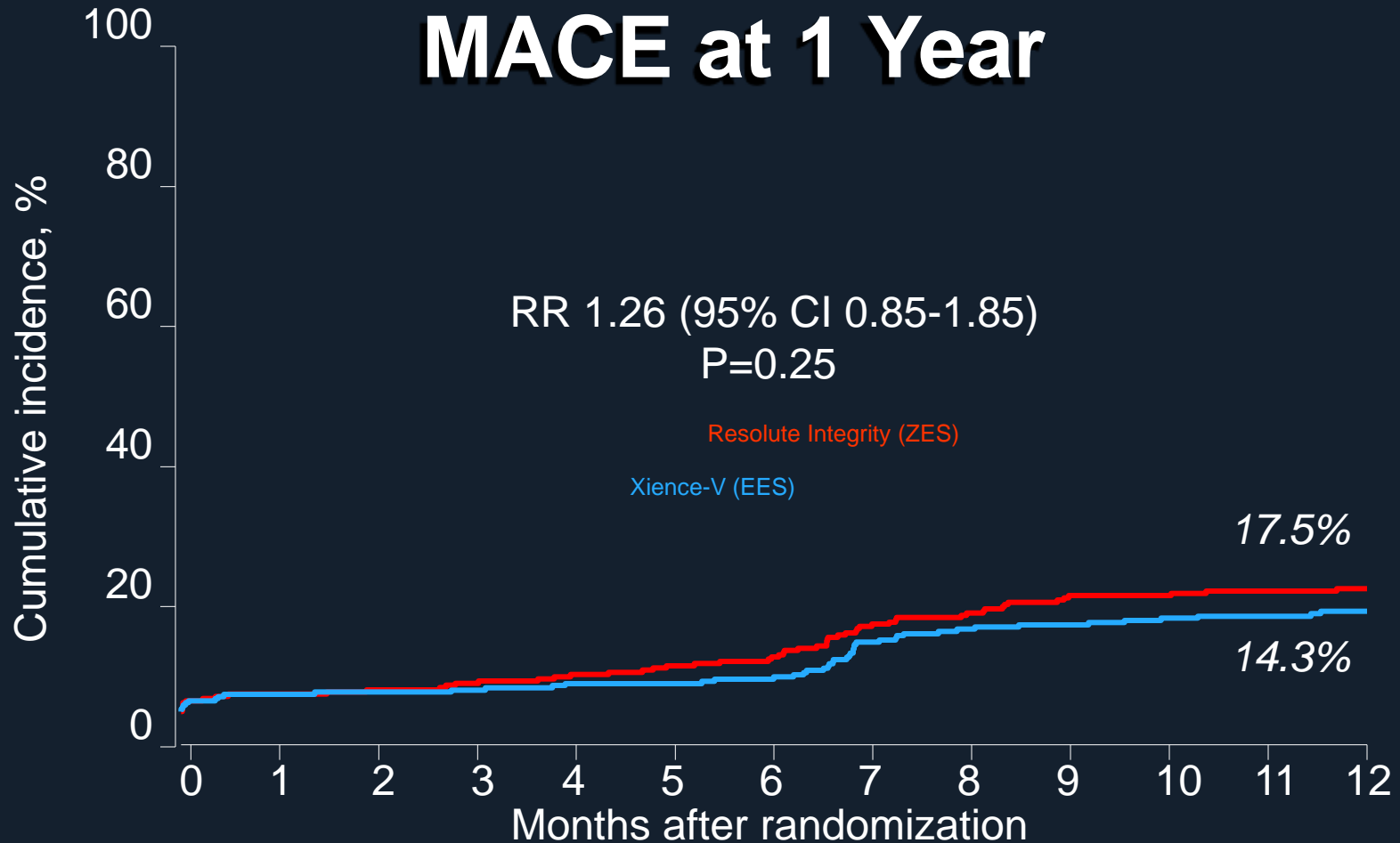
MACE



2nd DES for LM

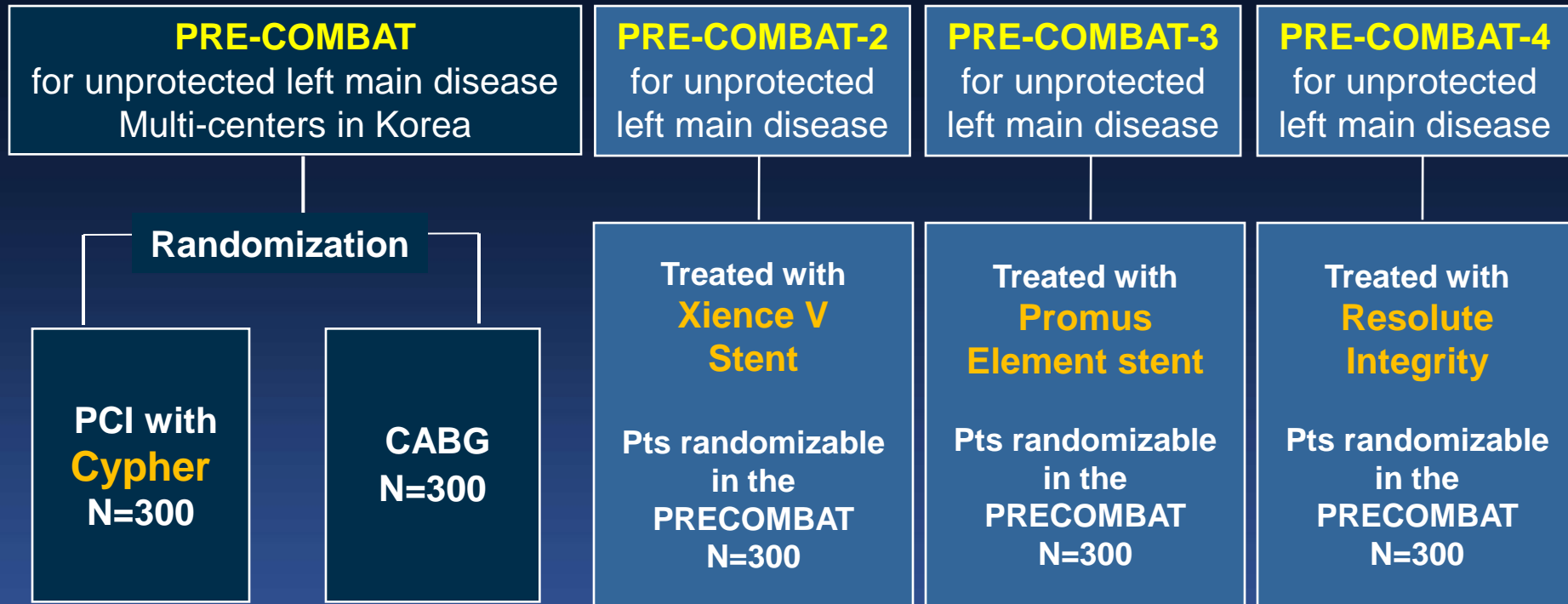
ISAR Left Main 2 (n=650)

MACE at 1 Year



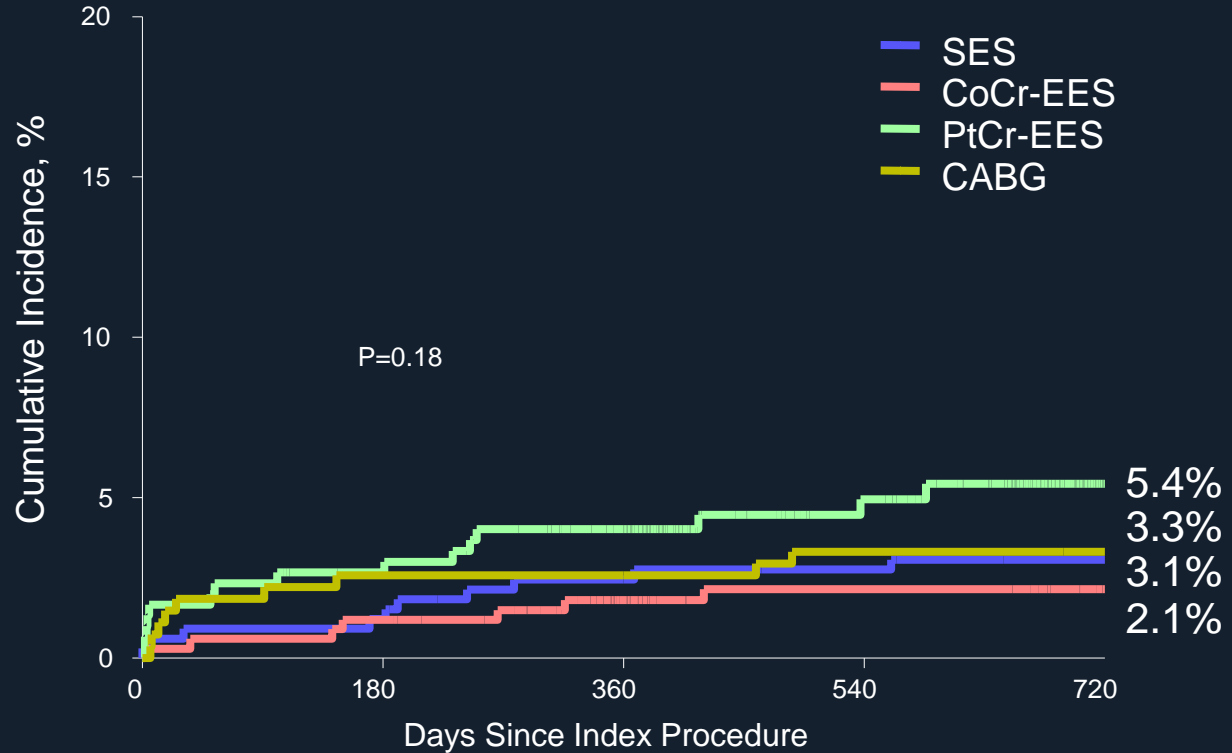
PRECOMBAT Series

New DES Evaluation !



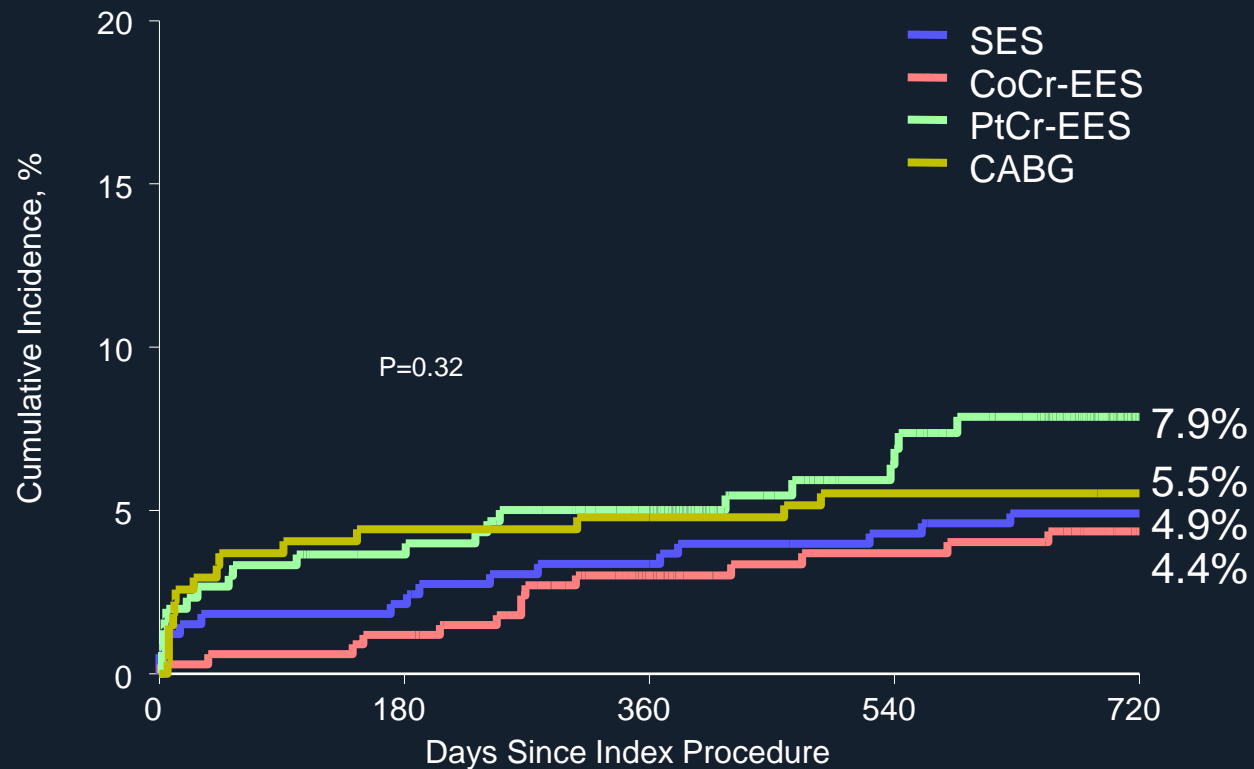
Primary Endpoint (MACCE):
2-year death, MI, Stroke, and ischemic driven TVR

Death



| N. at risk | 0 | 180 | 360 | 540 | 720 |
|------------|-----|-----|-----|-----|-----|
| SES | 327 | 324 | 317 | 315 | 311 |
| CoCrEES | 334 | 331 | 308 | 292 | 282 |
| PtCrEES | 300 | 289 | 273 | 200 | 119 |
| CABG | 272 | 265 | 264 | 262 | 260 |

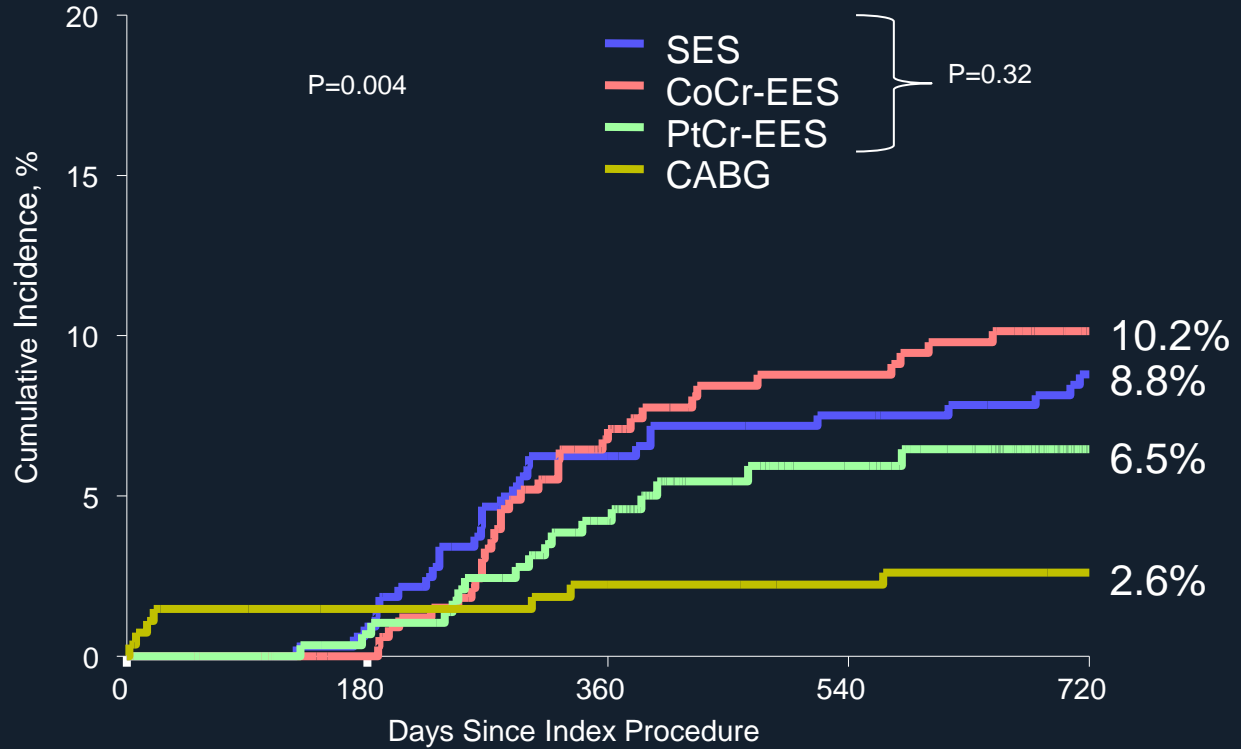
Death, MI, or Stroke



N. at risk

| | | | | | |
|---------|-----|-----|-----|-----|-----|
| SES | 327 | 321 | 314 | 310 | 306 |
| CoCrEES | 334 | 331 | 304 | 287 | 275 |
| PtCrEES | 300 | 286 | 270 | 194 | 116 |
| CABG | 272 | 260 | 258 | 256 | 254 |

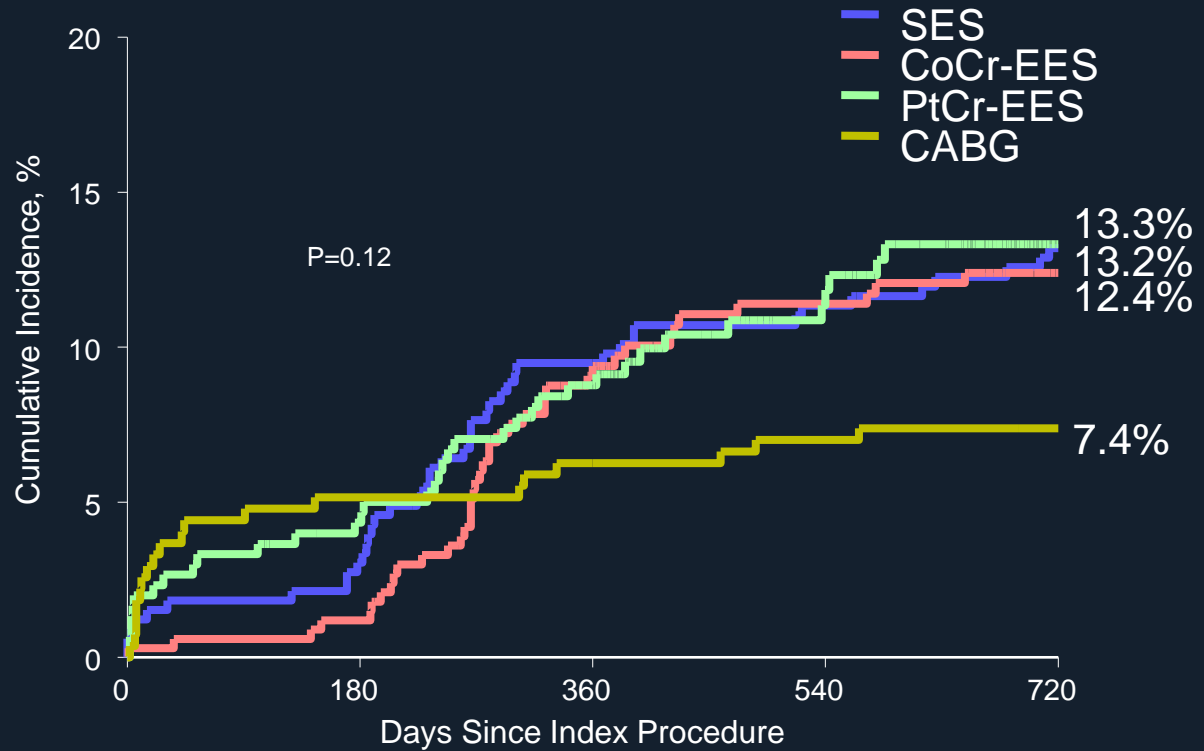
TVR



N. at risk

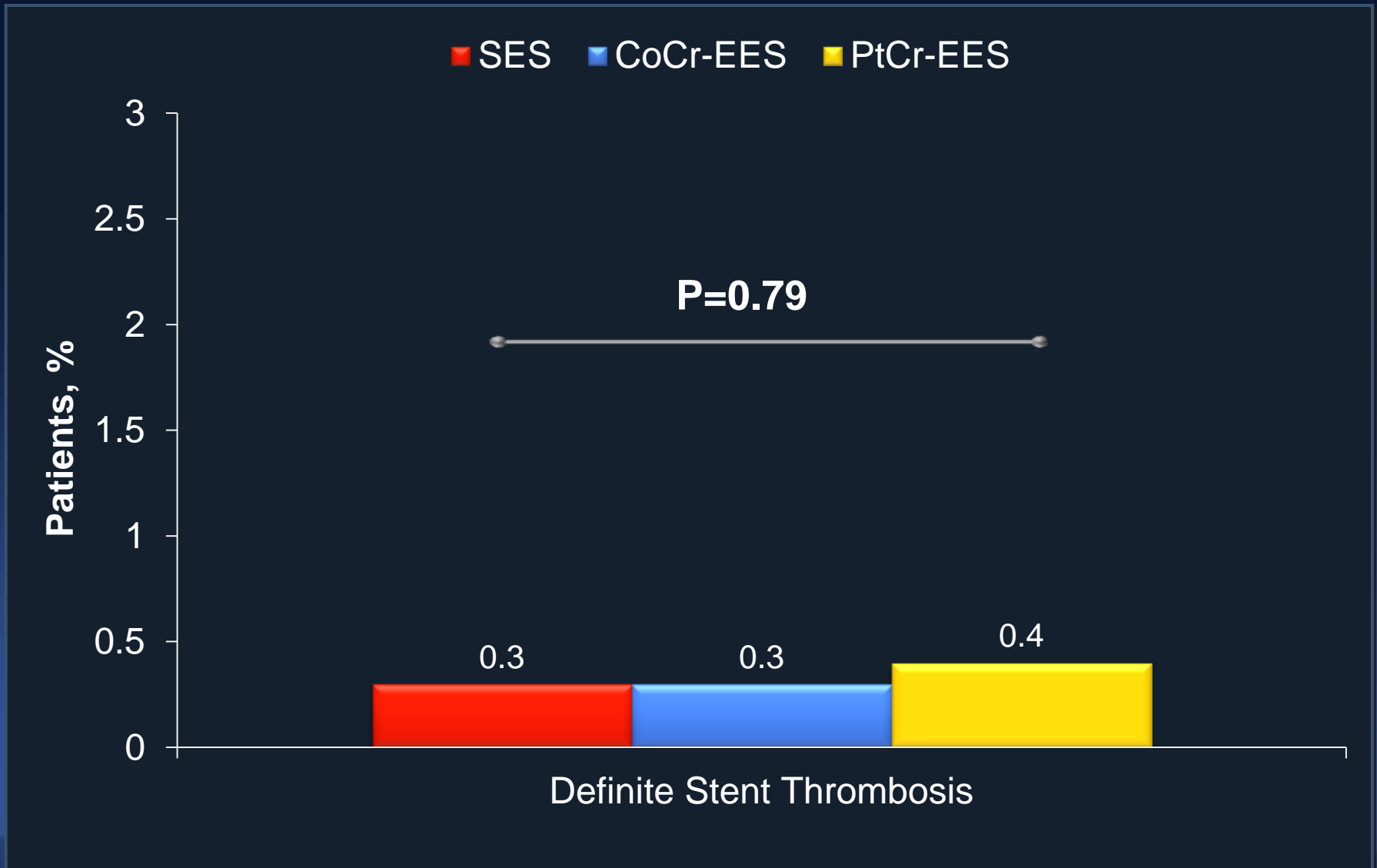
| | | | | | |
|---------|-----|-----|-----|-----|-----|
| SES | 327 | 321 | 298 | 292 | 284 |
| CoCrEES | 334 | 331 | 289 | 269 | 255 |
| PtCrEES | 300 | 287 | 263 | 188 | 114 |
| CABG | 272 | 263 | 260 | 258 | 255 |

MACCE: Death, MI, Stroke, or TVR



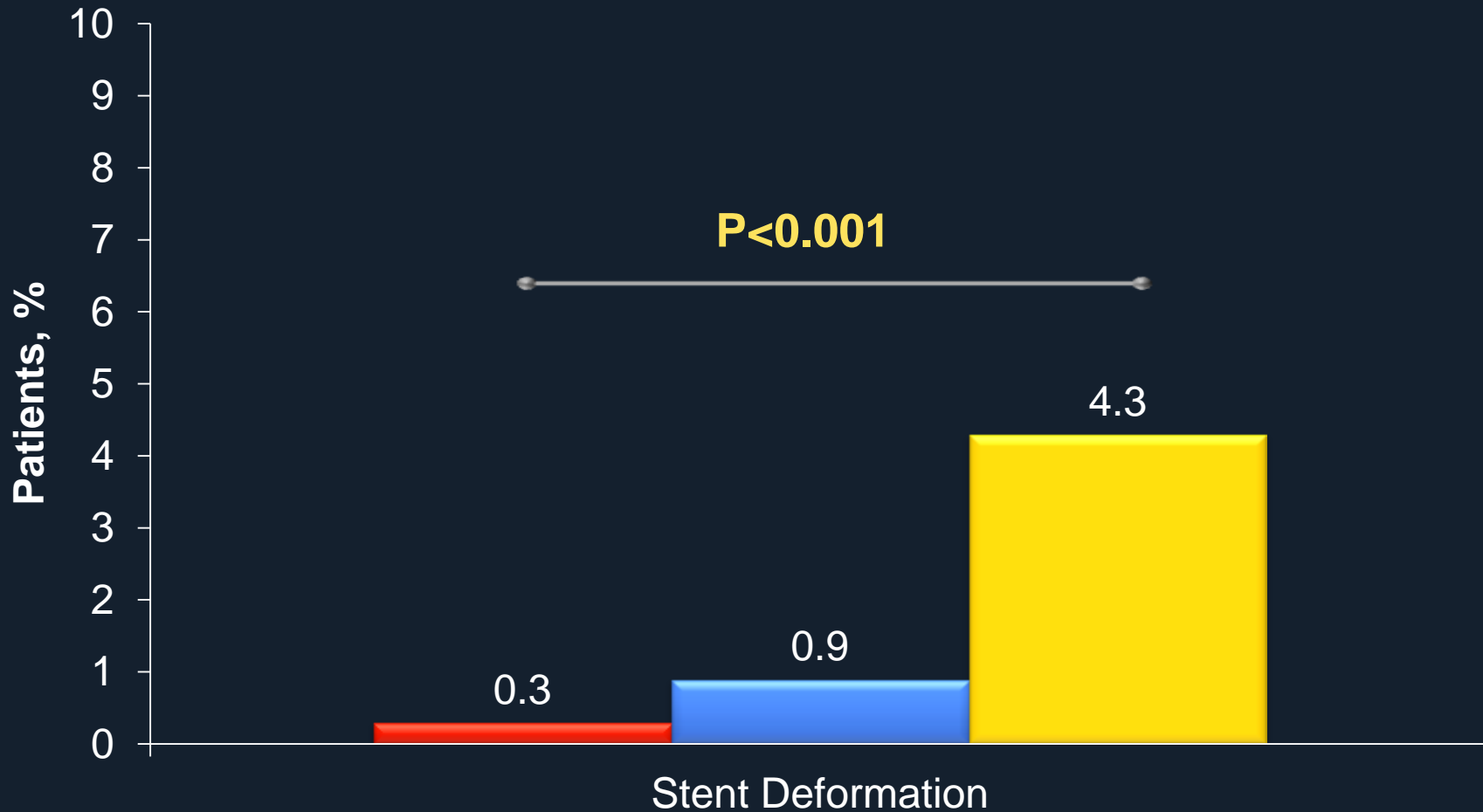
| N. at risk | | | | | |
|------------|-----|-----|-----|-----|-----|
| SES | 327 | 318 | 295 | 288 | 280 |
| CoCrEES | 334 | 331 | 286 | 266 | 253 |
| PtCrEES | 300 | 284 | 259 | 183 | 112 |
| CABG | 272 | 258 | 254 | 252 | 249 |

Definite Stent Thrombosis at 2 Years



Stent Deformation

■ SES ■ CoCr-EES ■ PtCr-EES



Conclusions

- PCI for unprotected LM stenosis has become more generalized after the change of revascularization guideline.
- The clinical outcomes of PCI for LM was comparable to CABG in the acute and long-term periods.
- A higher rate of repeat revascularization is still the limitation of PCI compared with CABG.
- Outcomes of new-generation DES compared with old-generation DES are going to be evaluated.
- The EXCEL trial will clarify several uncertainties for optimal treatment of LM PCI.

Thank you very much

19th CARDIOVASCULAR SUMMIT
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