*PARADIGM SHIFT FOR PCI*

# PHYSIOLOGIC LESION ASSESSMENT SHOULD GUIDE ROUTINE PCI

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I have no further conflict of interest to declare

## DO YOU AGREE ?

*Any treatment in health care should be directed either to*

- **Releave symptoms ( improve quality of life )**

*or to*

- **Improve outcome ( prognosis, longevity)**

*No other rationale for any treatment is possible !*

# *DO YOU AGREE ?*

*Stenting a coronary stenosis is justified if:*

- **that stenosis is responsible for symptoms**

*or*

- **has a negative influence on outcome**

*or both*

*I cannot imagine any other rationale for stenting*
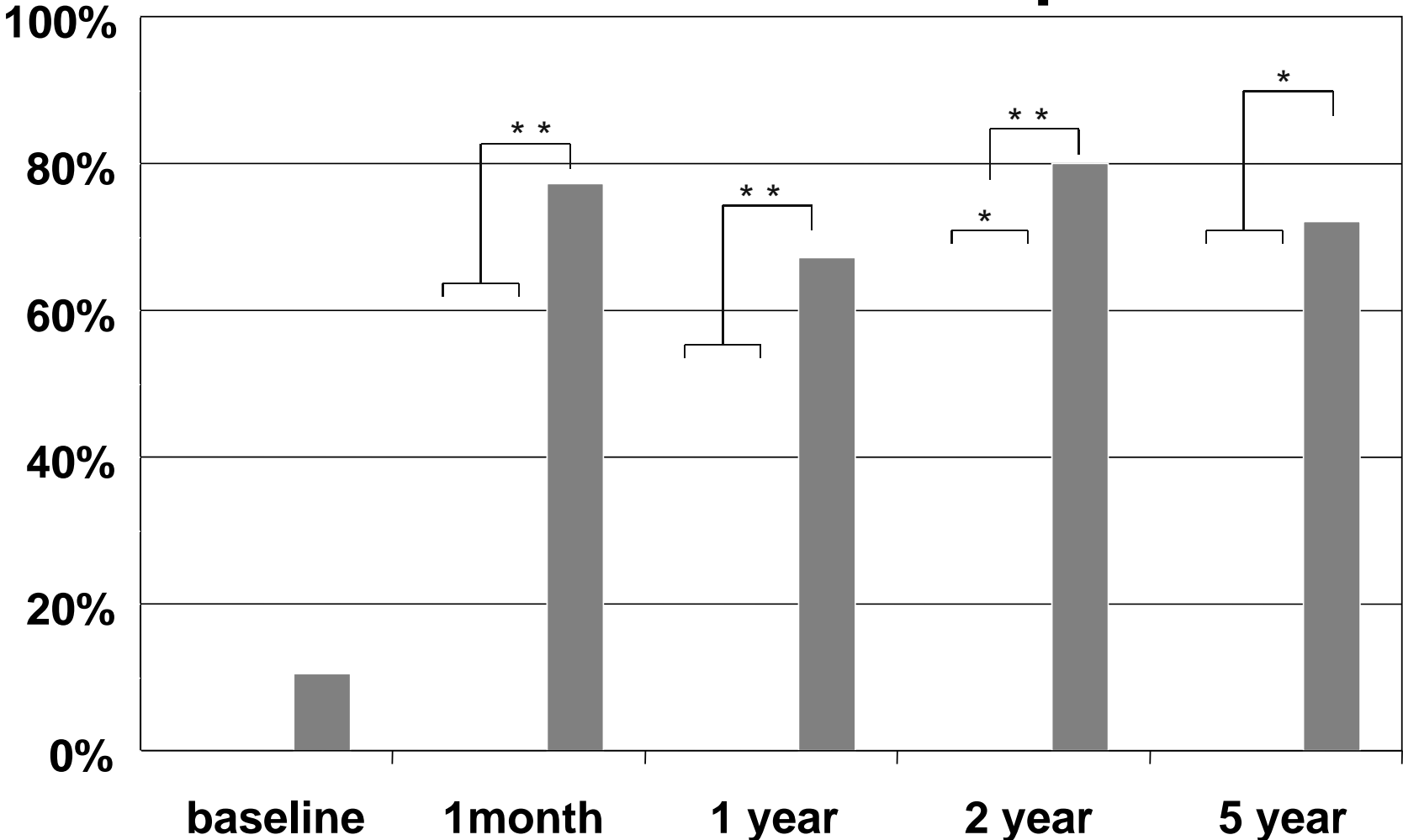
# FUNCTIONALLY  *SIGNIFICANT*  STENOSIS

→ a *functionally significant* stenosis generally gives symptoms (angina) *("ischemic" stenosis, hemodynamically significant stenosis)*

*PCI and stenting is extremely effective in relieving symptoms (angina) in such patients*

*(and much more effective than medical treatment)*

*DEFER, COURAGE, SYNTAX, FAME*

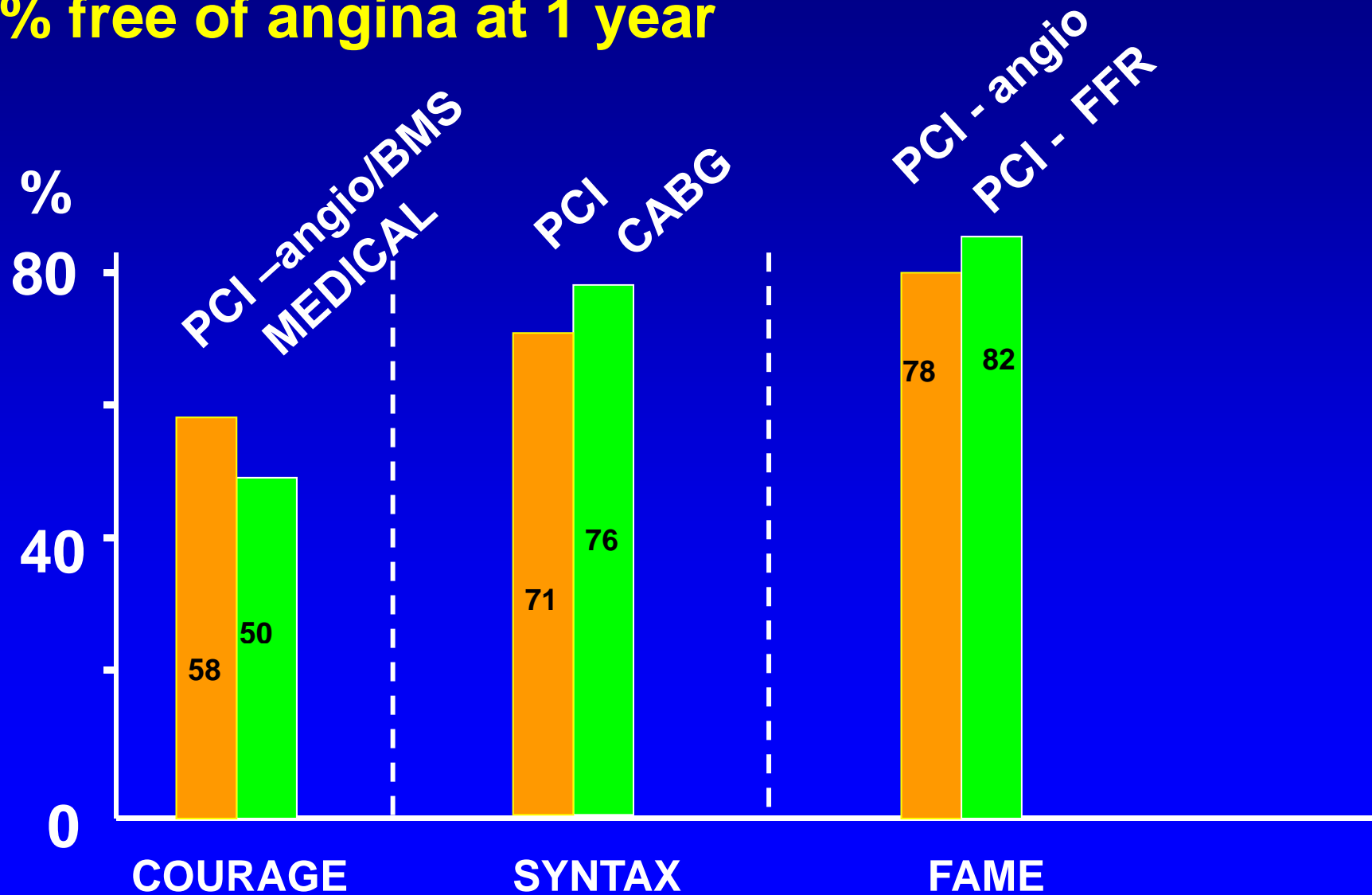DEFER-study, JACC 2007; 49 : 2105-2111

freedom from chest pain

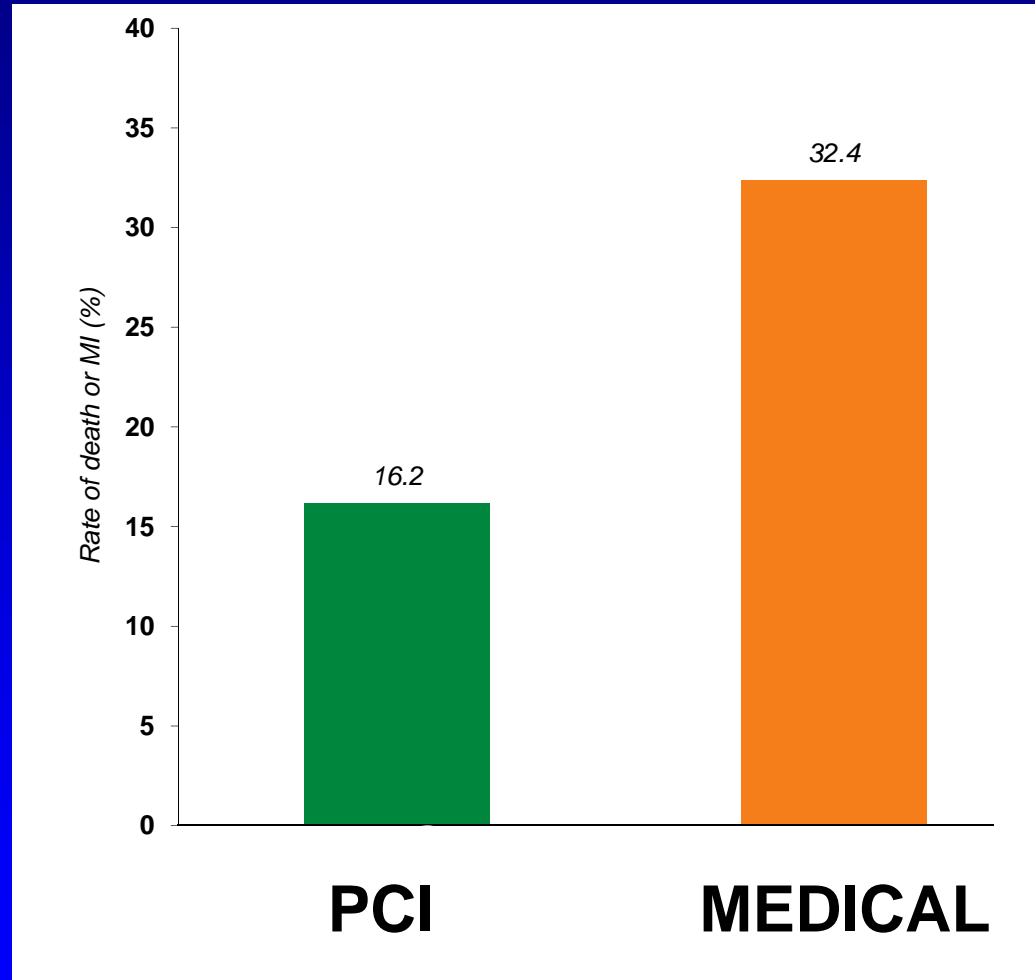Ischemic lesions ( FFR < 0.75) treated by stenting

# FUNCTIONALLY  *SIGNIFICANT*  STENOSIS

*PCI and stenting is extremely effective in* **relieving symptoms** *(angina) in such patients*

*…and often* **improves outcome**

# Death & MI 5 during 5 years of follow-up after PCI vs Medical Treatment in <u>ISCHEMIC</u> stenosis



P=0.001

Shaw et al,
Circulation 2008

# FUNCTIONALLY *SIGNIFICANT* STENOSIS

→ **stenting a *functionally significant* stenosis is justified , when technically feasible**

*DEFER, COURAGE, SYNTAX, FAME*

# FUNCTIONALLY  *NON*-*SIGNIFICANT*  STENOSIS

→ a *functionally non-significant* stenosis
(*"non-ischemic stenosis"*) generally
gives no complaints

*So, from the symptomatic point of view there is no reason to stent such lesion*

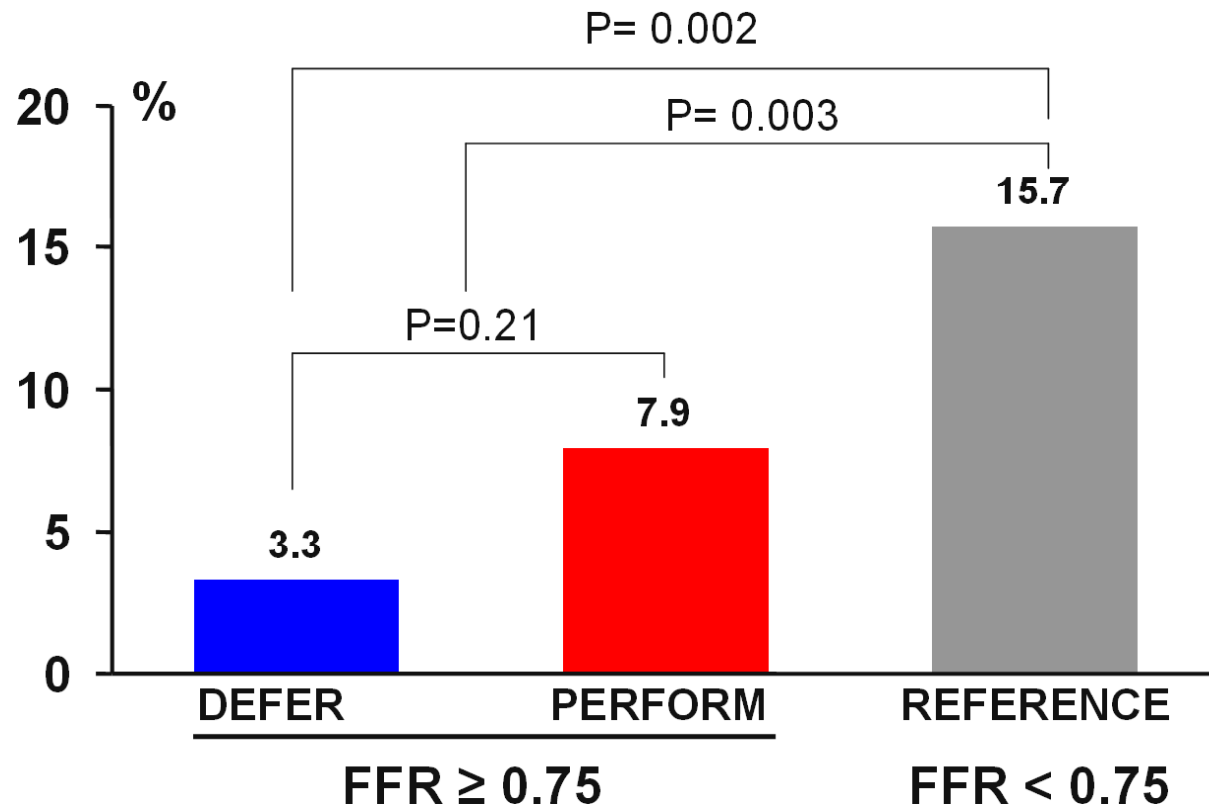# FUNCTIONALLY <u>*NON*</u>-*SIGNIFICANT* STENOSIS

*And what about **prognosis, longevity** ?*

*What about the **risk of experiencing death or MI** ?*

*Do we improve that by stenting a functionally **non**-significant stenosis ?*

# Cardiac Death And Acute MI After 5 Years

- ■ (blue) non-ischemic stenosis, R/x
- ■ (red) non-ischemic stenosis, R/x + stent
- ■ (gray) ischemic stenosis, R/x + stent

P= 0.002
P= 0.003
P=0.21

20 %
15
10
5
0

3.3 — DEFER
7.9 — PERFORM
15.7 — REFERENCE

FFR ≥ 0.75          FFR < 0.75

*JACC, 2008*

# Cardiac Death And Acute MI After 5 Years



JACC, 2008
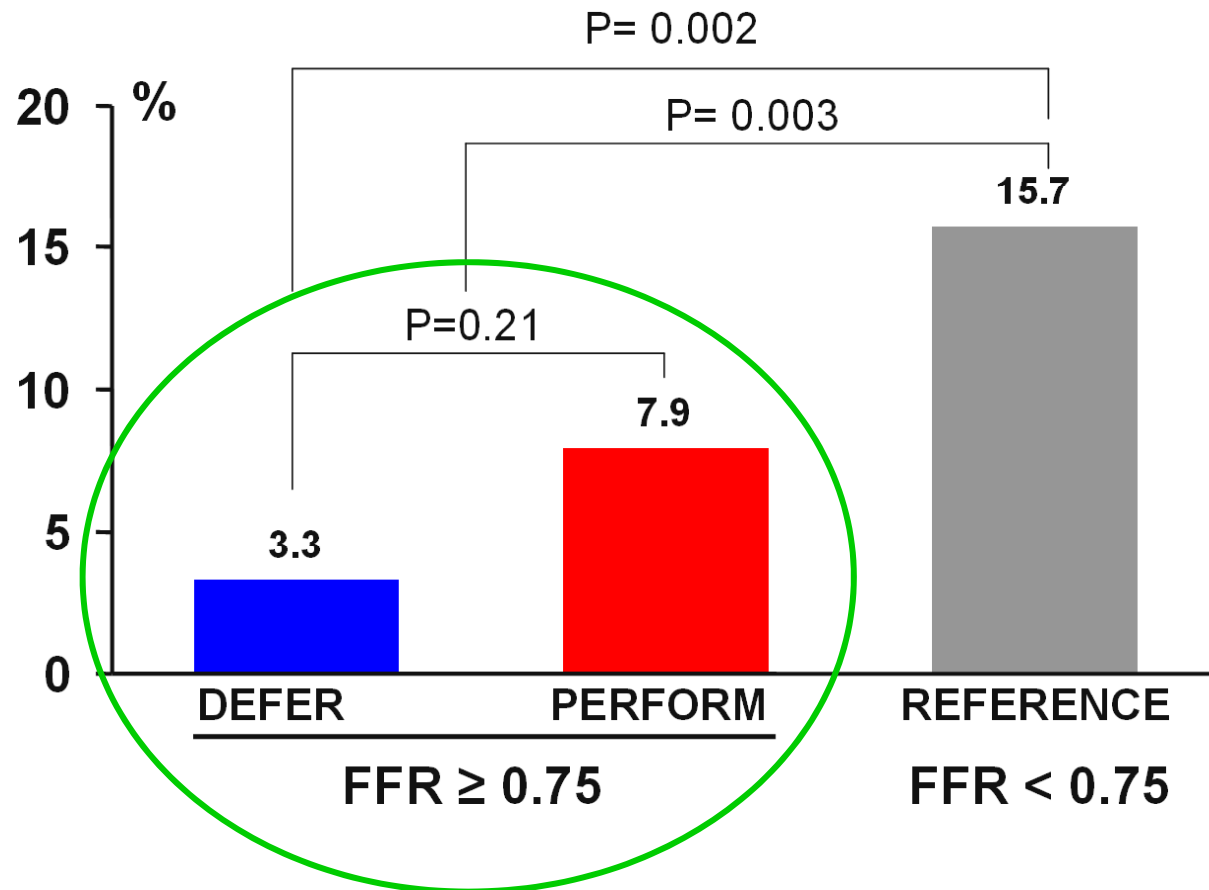
***Risk to die or experience myocardial infarction
in the next 5 years related to a coronary stenosis:***

- **non-ischemic stenosis: <** *1% per year ***
  (NUCLEAR studies, DEFER, FAME)*

- **ischemic stenosis, if left untreated:** *5-10% per year*
  *(Many historical registries, ACIP, etc)*

- **stented stenosis:** *2-3% per year*
  *(e.g DEFER, FAME, SYNTAX,many large studies
  and registries)*

So, at this point it will be clear that *functionally significant (= ischemic) lesions should be revascularized*, …..

…..……whereas it makes *no sense to stent non-ischemic lesions*

*Therefore, the* <u>**key issue**</u> *is to establish if a particular stenosis is associated with reversible ischemia….*

⟶ **Fractional Flow Reserve  (FFR)**

# FFR is the most accurate method to indicate or exclude reversible ischemia

**FFR**  | non-signif. | | stenosis significant |

1.0          0.80      0.75                    0

FFR is the *only* functional index which has ever been validated versus a **true gold standard**.
*(Prospective multi-testing Bayesian methodology)*

<u>*ALL*</u> studies ever performed in a wide variety of clinical & angiographic conditions, found threshold between 0.75 and 0.80

*Sensitivity :  90%*
*Specificity : 100%*

*N Engl J Med 1996; 334:1703-1708*
*Circulation 2010, many others*

*The wind tunnel to prove the effectiveness of any method, is a prospective and randomized trial…..*

→ **FAME study**

# FAME study:  HYPOTHESIS

**FFR – guided Percutaneous Coronary Intervention (PCI) in multivessel disease, is superior to standard angiography – guided PCI**

# FAME study: *Baseline Characteristics (1)*

| | ANGIO-group N=496 | FFR-group N=509 | P-value |
|---|---|---|---|
| Age, mean±SD | 64±10 | 65±10 | 0.47 |
| Male, % | 73 | 75 | 0.30 |
| *Diabetes, %* | 25 | 24 | 0.65 |
| Hypertension, % | 66 | 61 | 0.10 |
| Current smoker, % | 32 | 27 | 0.12 |
| Hyperlipidemia, % | 74 | 72 | 0.62 |
| *Previous MI, %* | 36 | 37 | 0.84 |
| *Unstable angina, %* | 36 | 29 | 0.11 |
| *Previous PCI , %* | 26 | 29 | 0.34 |
| LVEF, mean±SD | 57±12 | 57±11 | 0.92 |
| *LVEF < 50% , %* | 27 | 29 | 0.47 |

# FAME study: *Baseline Characteristics (2)*

| | ANGIO-group N=496 | FFR-group N=509 | P-value |
|---|---|---|---|
| *# indicated lesions per patient* | 2.7±0.9 | 2.8±1.0 | 0.34 |
| 50-70% narrowing, No (%) | 550 (41) | 624 (44) | - |
| 70-90% narrowing, No (%) | 553 (41) | 530 (37) | - |
| 90-99% narrowing, No (%) | 207 (15) | 202 (14) | - |
| Total occlusion, No (%) | 40 (3) | 58 (4) | - |
| *Patients with ≥1 total occlusion (%)* | 7.5 | 10.6 | 0.08 |
| *Patients with prox LAD involved, No (%)* | 186 (38) | 210 (41) | 0.39 |
| % lesions in segment 1,2,6,7,or 11 | 960 (71) | 1032 (73) | 0.42 |

# FAME study: *Procedural Results (1)*

| | ANGIO-group N=496 | FFR-group N=509 | P-value |
|---|---|---|---|
| *# indicated lesions per patient* | $2.7 \pm 0.9$ | $2.8 \pm 1.0$ | 0.34 |
| *Stents per patient* | $2.7 \pm 1.2$ | $1.9 \pm 1.3$ | <0.001 |

*1005 patients; almost 3000 stenoses;*

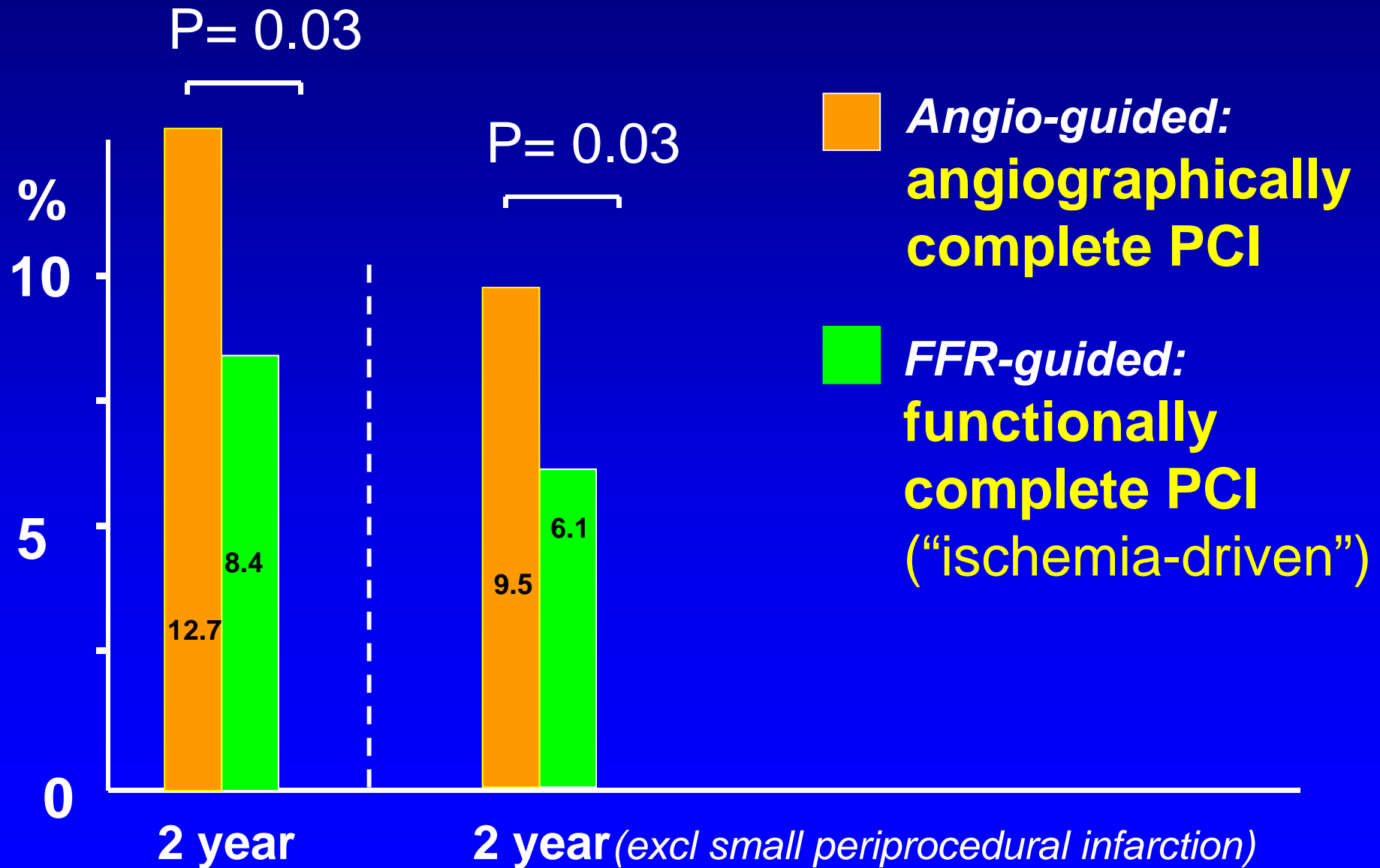*Angio-guided:  all angiographic significant stenoses stented*
*PCI-guided:    stenting of FFR-positive lesions only*
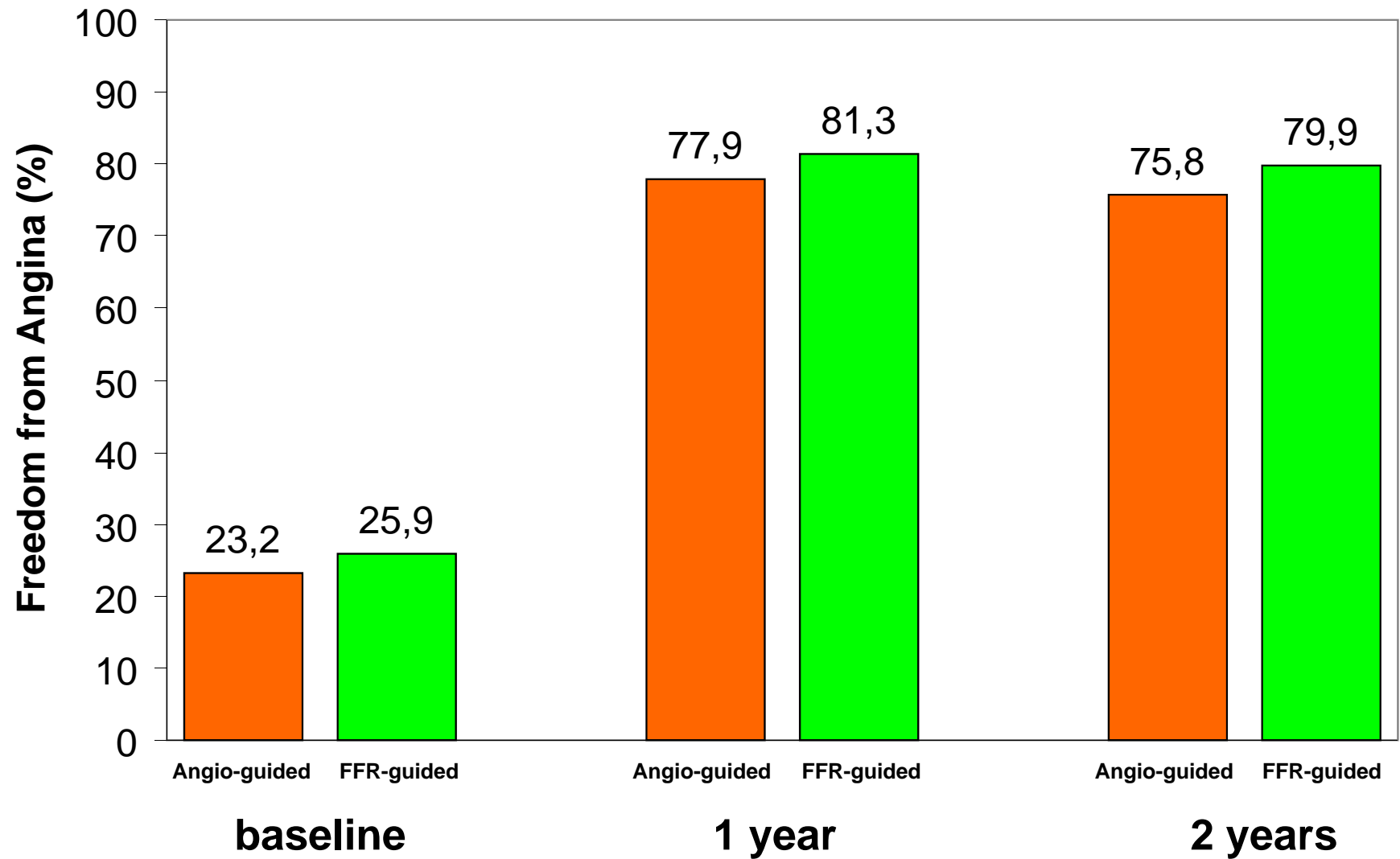
# FAME study: *Adverse Events at 1 year*

| | ANGIO-group N=496 | FFR-group N=509 | P-value |
|---|---|---|---|
| **Events at 1 year, No (%)** | | | |
| **Death, MI, CABG, or repeat-PCI** | **91 (18.4)** | **67 (13.2)** | **0.02** |
| Death | 15 (3.0) | 9 (1.8) | 0.19 |
| Death or myocardial infarction | 55 (11.1) | 37 (7.3) | 0.04 |
| CABG or repeat PCI | 47 (9.5) | 33 (6.5) | 0.08 |
| Total no. of MACE | 113 | 76 | 0.02 |
| **Myocardial infarction, specified** | | | |
| All myocardial infarctions | 43 (8.7) | 29 (5.7) | 0.07 |
| Small periprocedural CK-MB 3-5 x N | 16 | 12 | |
| Other infarctions ("late or large") | 27 | 17 | |

# DEATH & MI in the FAME study after 2 years

P= 0.03

P= 0.03

% 
10

5

0

12.7

8.4

9.5

6.1

**2 year**

**2 year** *(excl small periprocedural infarction)*

■ *Angio-guided:* **angiographically complete PCI**

■ *FFR-guided:* **functionally complete PCI ("ischemia-driven")**

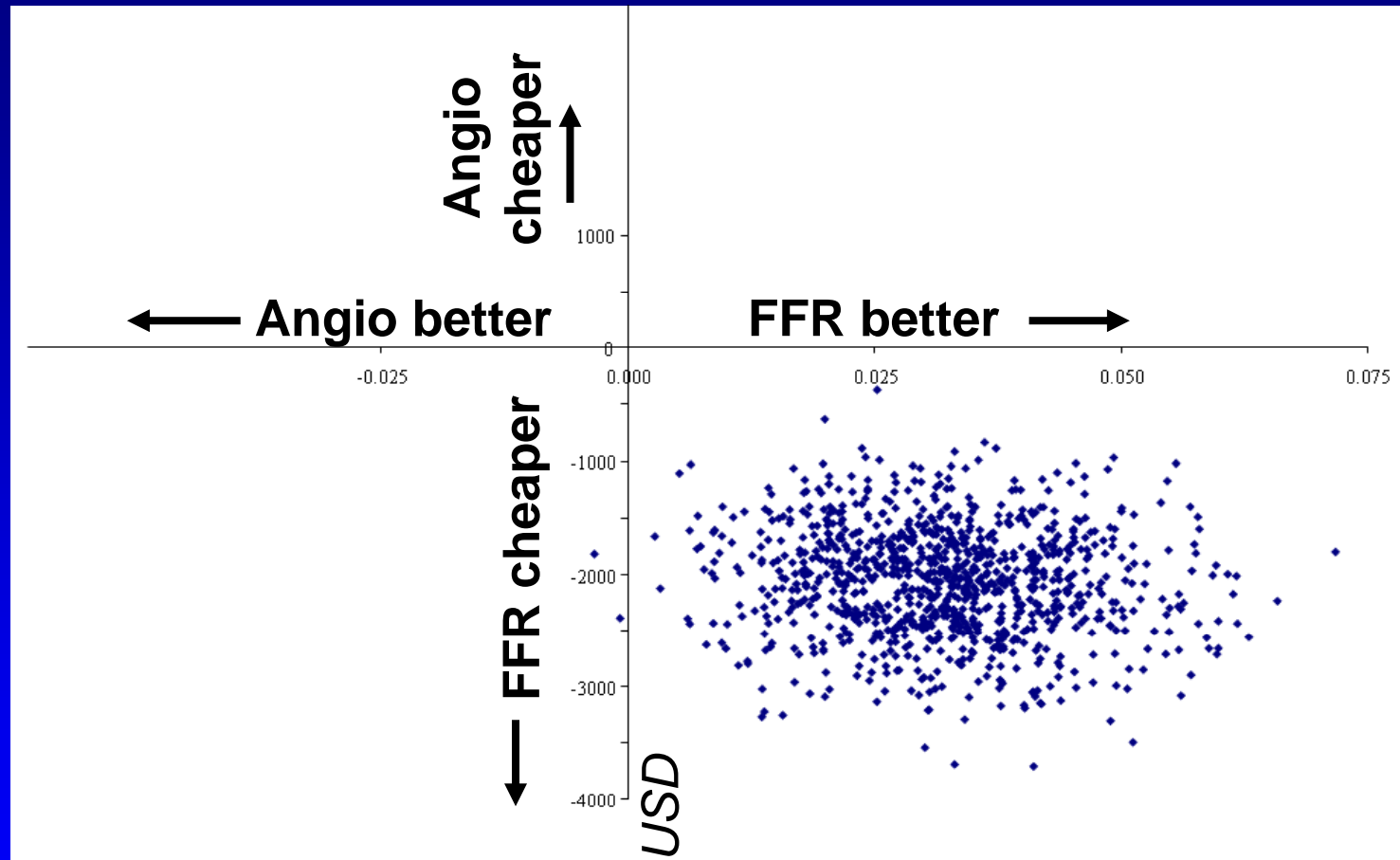# Freedom from Angina in the FAME study

# *FFR –guided PCI:*

- improves outcome
- improves quality of live
- is cost-saving
- reduces radiation and contrast exposure
- does not prolong time of procedure

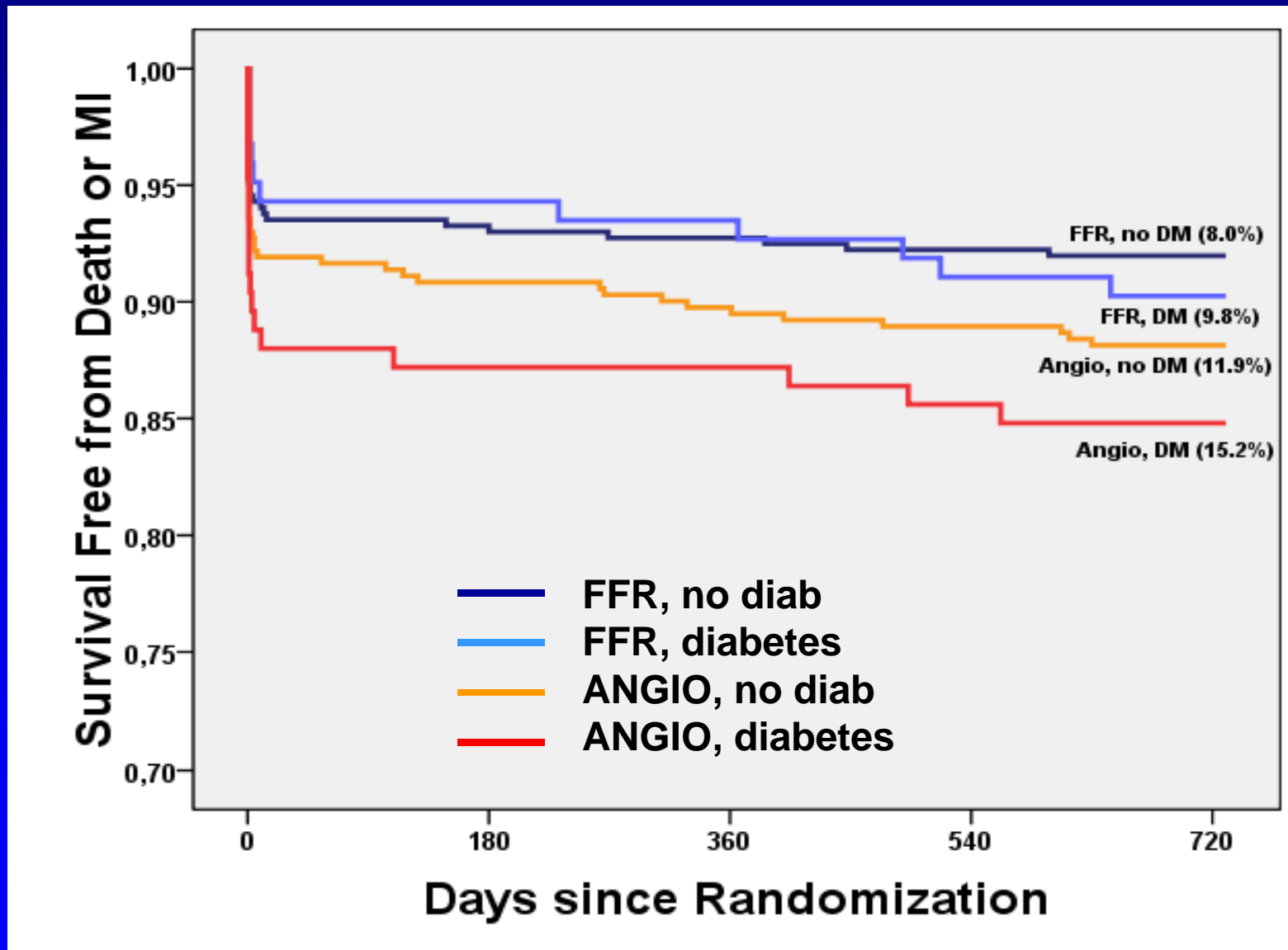**Tonino et al, NEJM 2009; Pijls et al, JACC 2010**
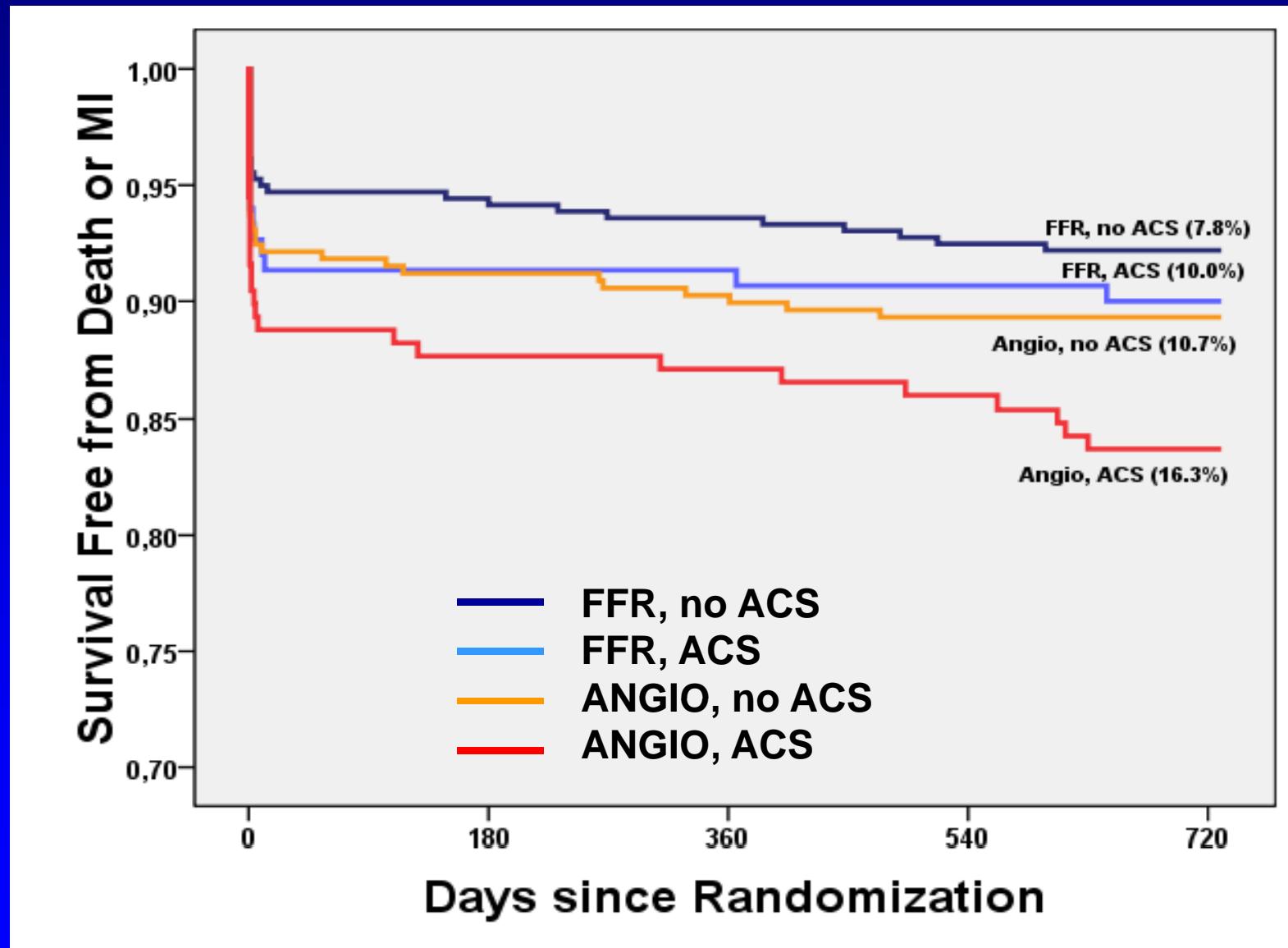
# FAME study: Economic Evaluation (1)



*An FFR-guided strategy to multivessel PCI is one of those rare situations in medicine in which a new innovative treatment not only improves outcome but is also cost-saving*
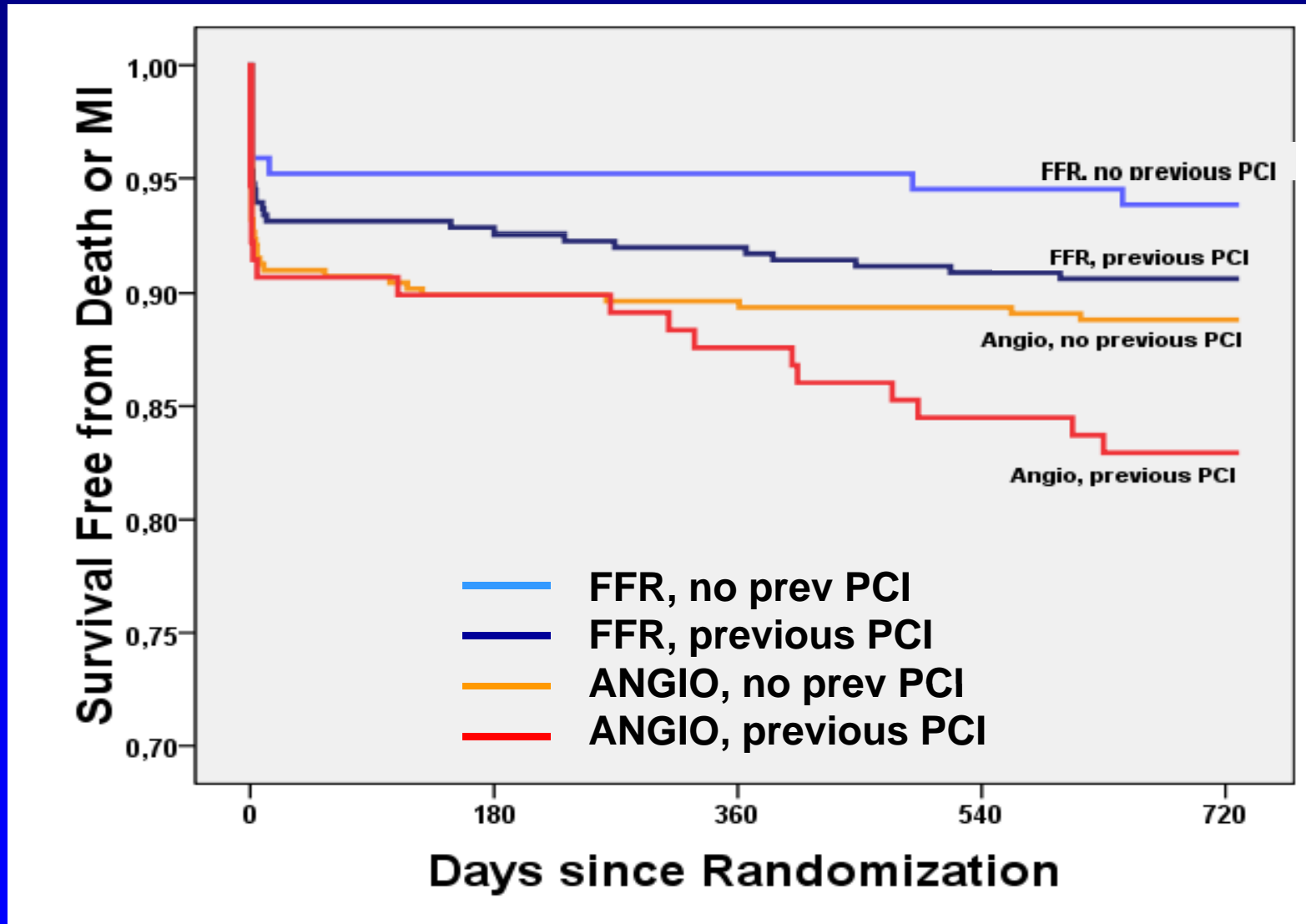
*Fearon et al, Circulation 2010*

# FAME study: Diabetes vs Non-Diabetes

FAME study: Unstable Angina & Non-STEMI

# FAME study: Patients with Previous PCI

# Outcome of Deferred Lesions:

**513 Deferred Lesions and 901 stented lesions in 509 FFR-Guided Patients**

*2 Years*

**9**
**Late Myocardial Infarctions**

→ **8**
**Due to a New Lesion or Stent Related**

**1**
**Myocardial Infarction due to an Originally Deferred Lesion**

*Only 1/513 or 0.2% of deferred lesions resulted in a late myocardial infarction*

# Outcome of Deferred Lesions:

**513 Deferred Lesions and 901 stented lesions in 509 FFR-Guided Patients**

*2 Years*

**53 Repeat Revascularizations**

**37
in a New Lesion and/or
in a Restenotic One**

**6
Without FFR or
Despite an FFR > 0.80**

**10
Originally Deferred Lesions
with Clear Progression**

*Only 10/513 or 1.9% of deferred
lesions clearly progressed
requiring repeat revascularization*

# FFR UPGRADED TO LEVEL I A INDICATION

## 10 – Procedural aspects of PCI

| Table 28: Specific PCI devices and pharmacotherapy | | |
|---|---|---|
| | **Class** | **Level** |
| **FFR-guided PCI is recommended for detection of ischemia-related lesion(s) when objective evidence of vessel-related ischamia is not available** | **I** | **A** |
| DES* are recommended for reduction of restenosis/reocclusion, if no contraindication to extended DAPT | I | A |
| Distal embolic protection is recommended during PCI of SVG disease to avoid distal embolisation of debris and prevent MI | I | B |
| Rotablation is recommended for preparation of heavily calcified or severely fibrotic lesions that cannot be crossed by a balloon or adequately dilated before planned stenting | I | C |

*ESC-EACTS Guidlines for Myocardial Revascularisation, August 30, 2010*

# CONCLUSIONS

*Physiologic Lesion Assessment by FFR to guide routine PCI is superior to current angiography guided treatment.*

*FFR improves outcome of PCI significantly*

*and supports the evolving paradigm of*

*"Functionally Complete Revascularization",
i.e. stenting of ischemic lesions and
medical treatment of non-ischemic ones.*