

Understanding of Post-PCI FFR

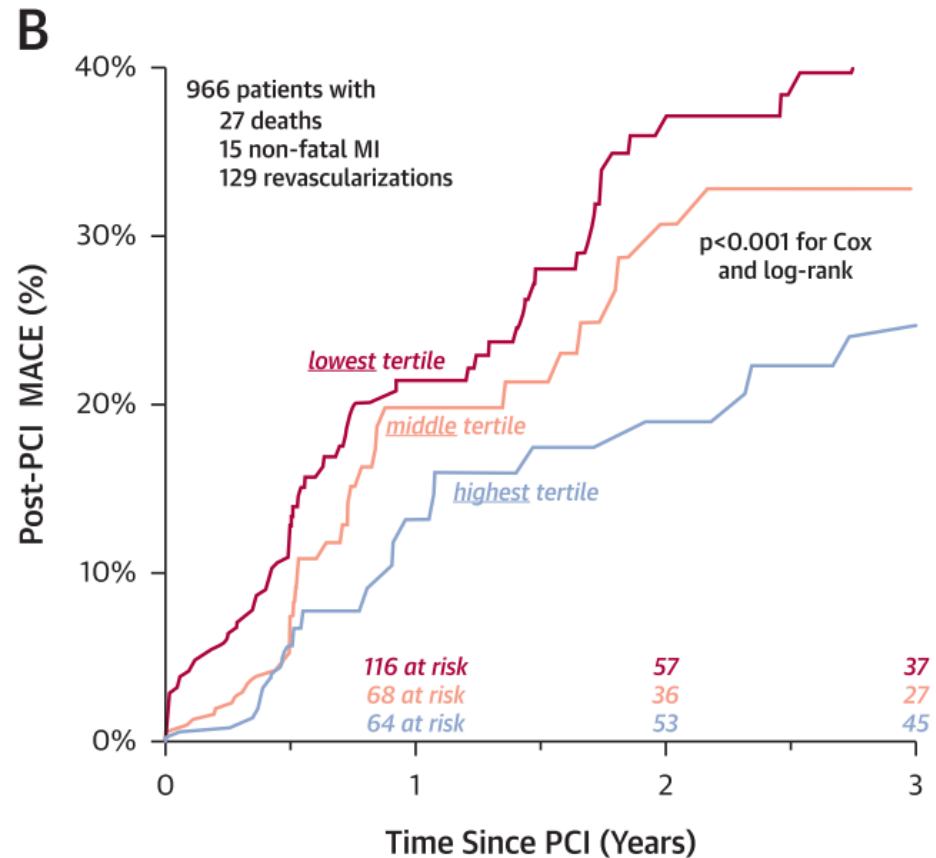
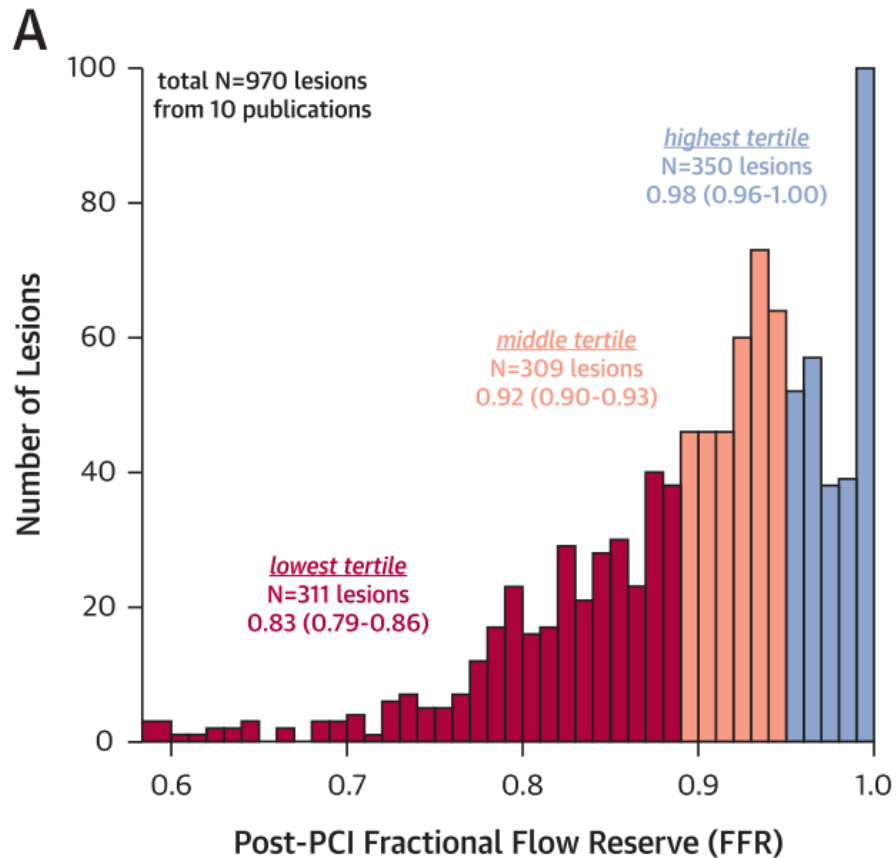
Post-PCI FFR and Percent FFR Increase

Joo Myung Lee, MD, MPH, PhD

**Heart Vascular Stroke Institute,
Samsung Medical Center, Seoul, Republic of Korea**

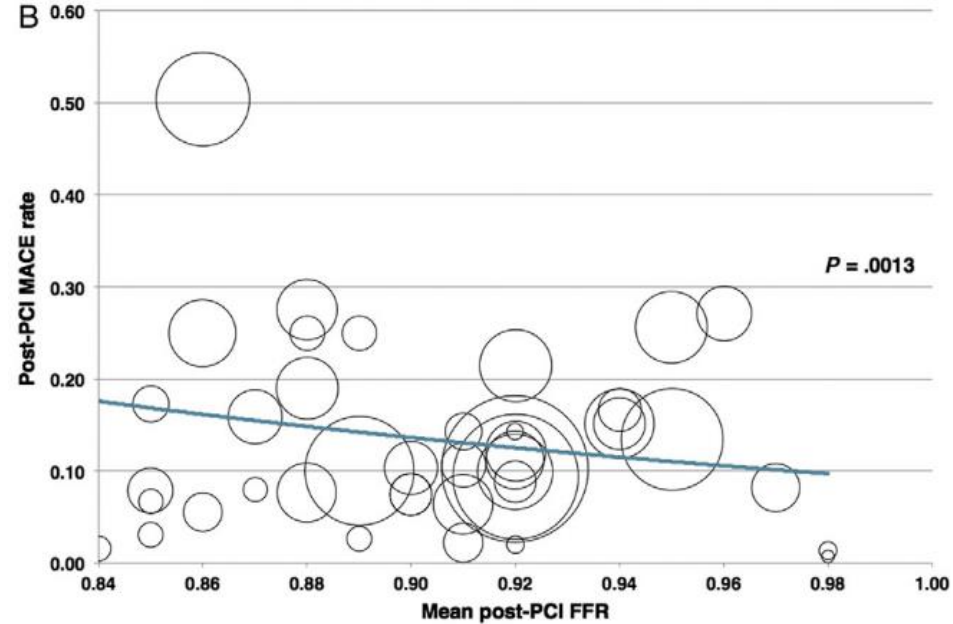
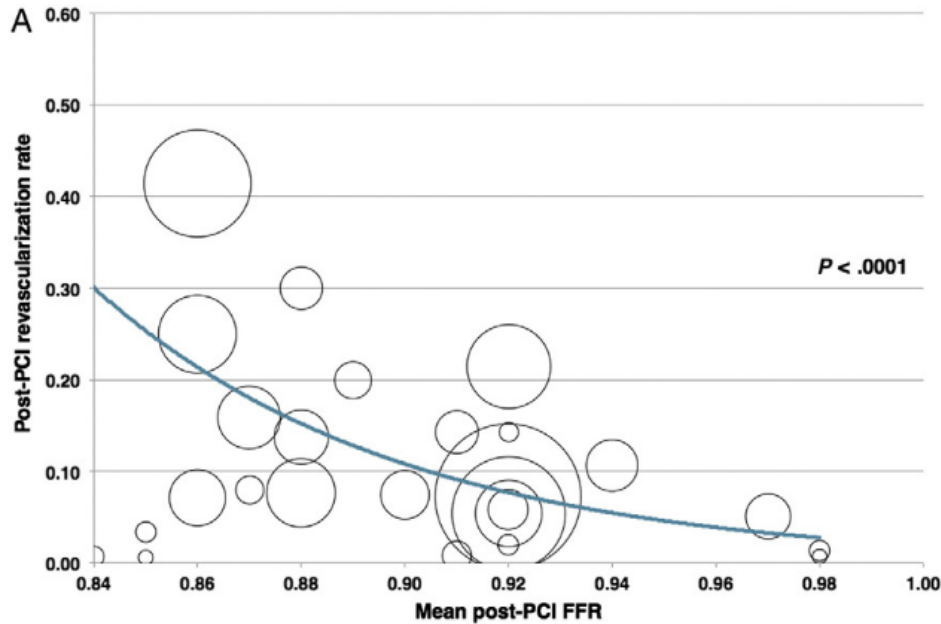


Post-PCI FFR and Clinical Outcome



Patient level meta-analysis
Post-PCI FFR showed an inverse relationship with subsequent events
(HR 0.86, 95% CI 0.80-0.93, p<0.001).

Post-PCI FFR and Clinical Outcome



Study level meta-analysis also indicated
higher post-PCI FFR values were associated with
Lower risk of revascularization and MACE.

Post-PCI FFR

Various Cut-Off values and C-index for Clinical Outcome

	Patient number	Study period	Clinical presentation	Used stent	Primary outcome	Follow-up duration	BCV	Note
Pijls et al.	750	2000-2001	No exclusion criteria	BMS	Any death, AMI, TVR	6 months	0.90	BMS data
Leesar et al.	66	Published in 2011	Excluding ACS	BMS/DES	MACE	2 years	0.96	BCV was based on previous evidence
Nam et al.		Published						LAD was independent of low FFR
Matsuo et al.								able value implantation
Doh et al.								sted DES station
Agarwal et al.								CI needs intervention
Kasula et al.								population
Piroth et al.	659	2010-2012	Stable disease	DES	VOCE	2 years	0.92	Low Predictive value and FAME2
Li et al.	1,476	2012-2013	Silent ischemia, SA, UA	DES	TVF	3 years	0.88	0.905 cut-off in LAD 2 nd generation DES

Higher post-PCI FFR was associated with better clinical outcomes.

Optimal cut-off value of post-PCI FFR were from 0.86 to 0.96, according to study population, definition of outcome, type of device, and included vessels

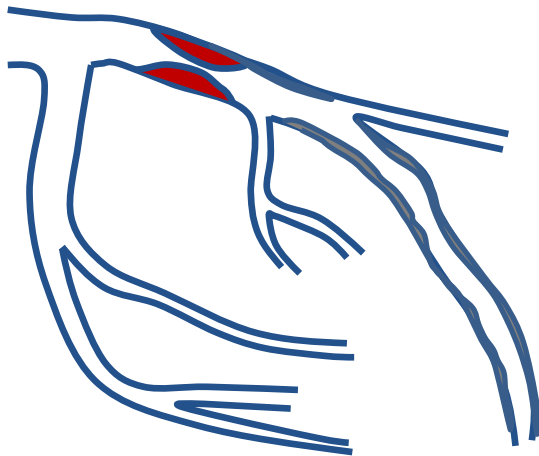
Positive Predictive Value and Likelihood ratio of Post-PCI FFR in predicting clinical outcome were consistently low.

Limited Predictability of Post-PCI FFR Alone

Per-Vessel Diagnosis vs. Per-stenosis Treatment

Physiologic Response from Focal Treatment depends on
“Relative contribution of focal stenosis on diffuse disease”

Focal >> Diffuse



Higher Physiologic Gain from Stenting
Underlying Diffuse Disease (minor component)
Reduced Per-vessel Ischemic Burden

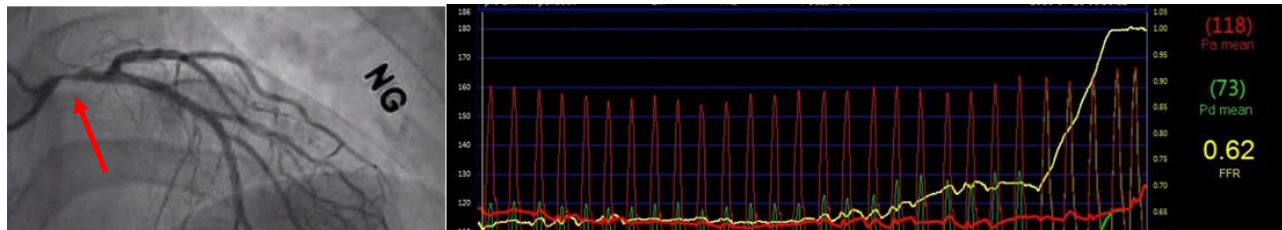
Focal << Diffuse



Limited Physiologic Gain from Stenting
Underlying Diffuse Disease (major component)
Similar Per-vessel Ischemic Burden

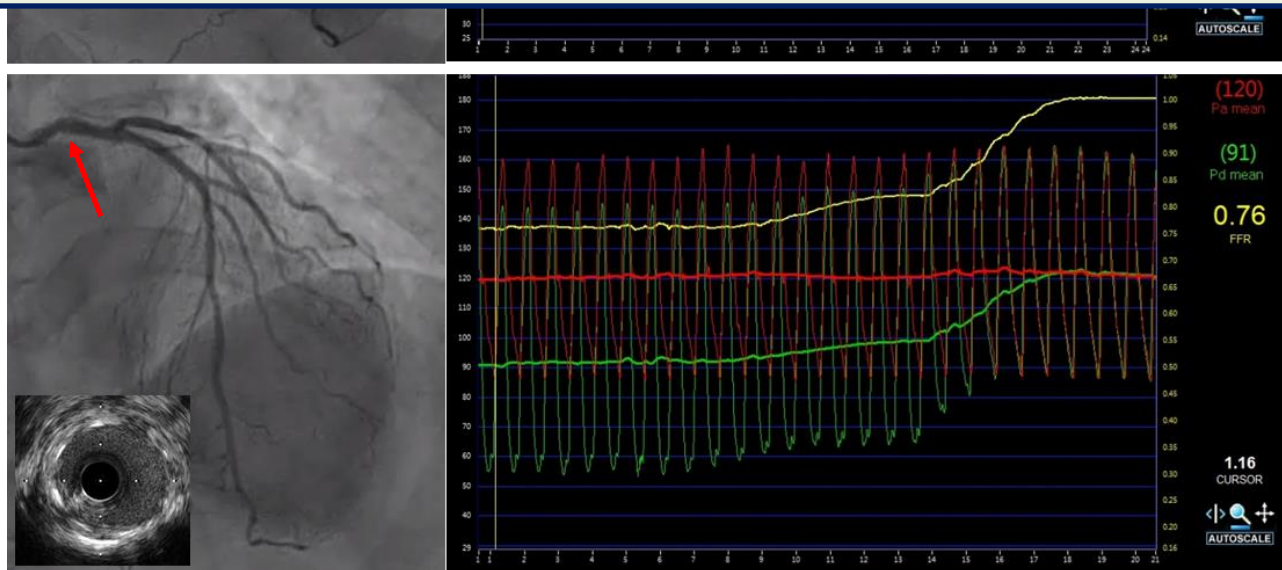
Percent FFR Increase

- Relative Contribution of Focal Stenosis, Relieved by Stent -



Focal Treatment of LM provided

14% Increase of LAD FFR with 23% of Percent FFR Increase



Percent FFR Increase $\rightarrow [(\text{Post-PCI FFR} - \text{Pre-PCI FFR}) / (\text{Pre-PCI FFR})] \times 100$

Example: $(0.76 - 0.62 / 0.62) \times 100 = 23\%$

Relative increase of FFR (Percent FFR Increase) would provide Additional Prognostic Information?

- **COE-PERSPECTIVE registry**
- **621 Patients who underwent PCI based on low Pre-PCI FFR (≤ 0.80)**
- Underwent PCI and measured FFR after angiographically successful stent implantation (residual stenosis $< 20\%$ by visual estimation)
- All patients used 2nd generation DES

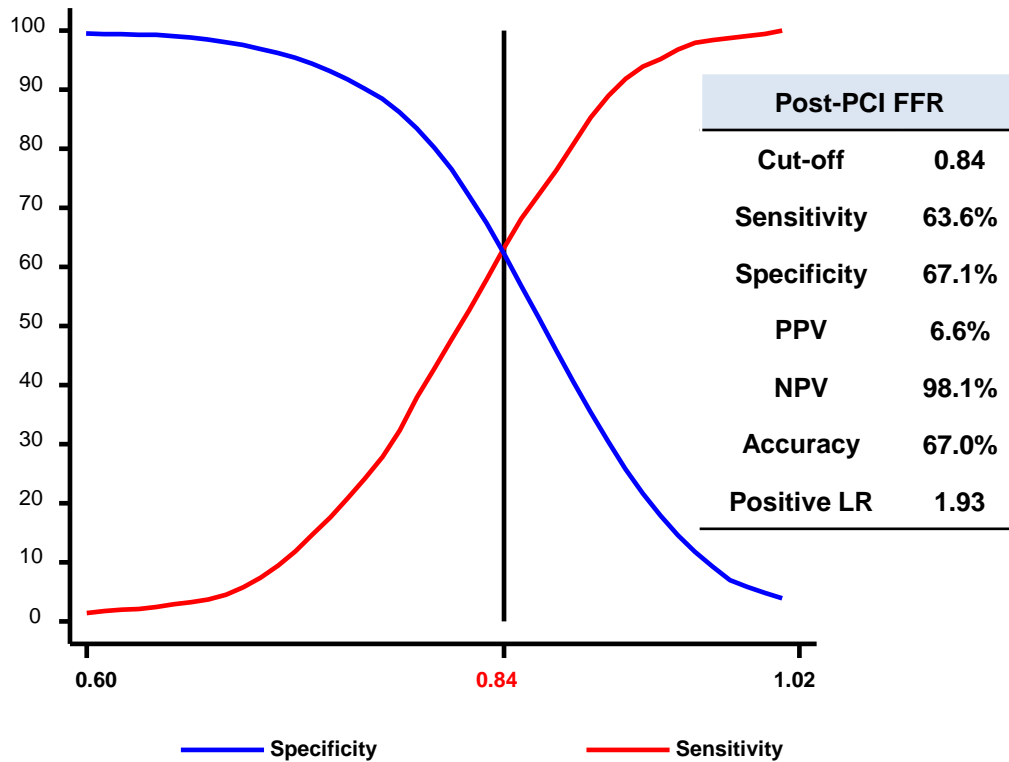
- **Primary outcome**
 - **Target vessel failure (TVF) at 2 Years**
 - **A composite of cardiac death, target vessel related MI and clinically driven TVR**

- **Prognostic Impact of Absolute and Relative Physiologic Results of PCI**
 - **Absolute Post-PCI FFR**
 - **Percent FFR increase**

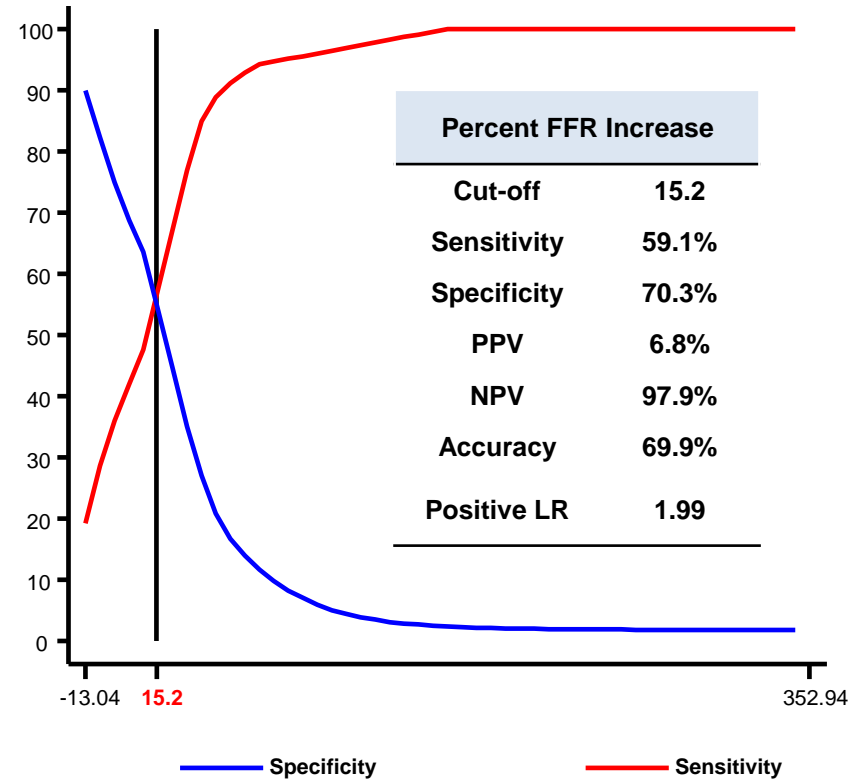
Post-PCI FFR vs. Percent FFR Increase

- Target Vessel Failure at 2 Years -

Post-PCI FFR



Percent FFR increase



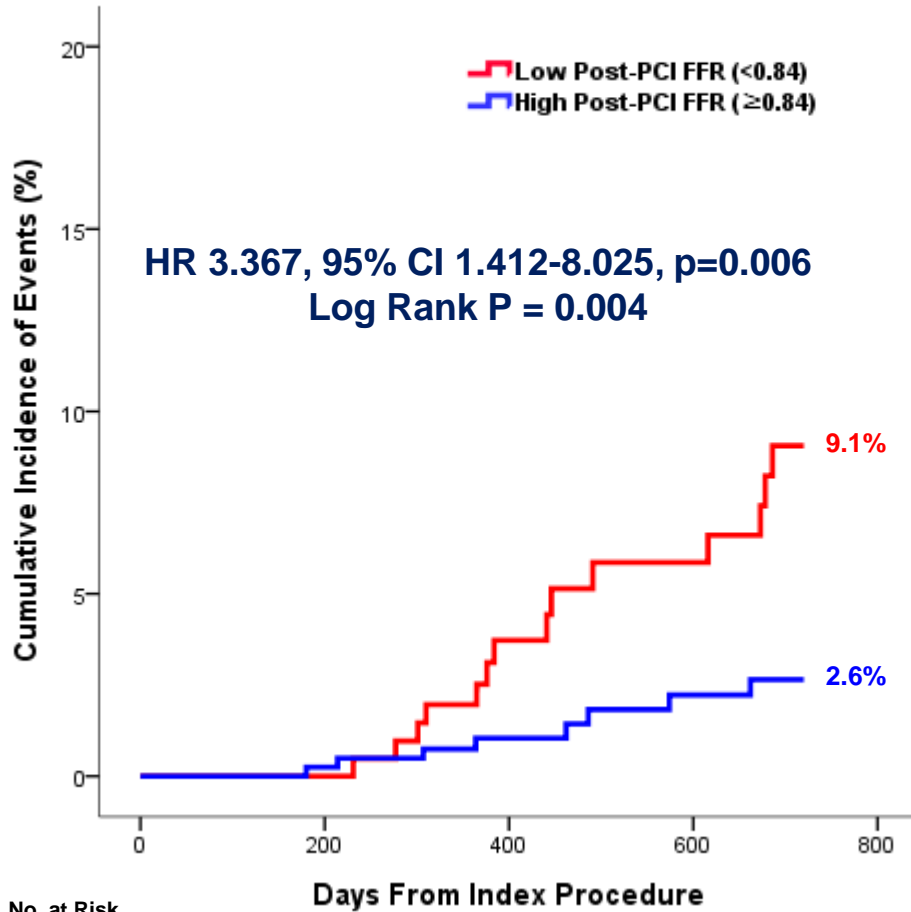
Post-PCI FFR \geq 0.84
(Positive LR 1.93)

Percent FFR increase \geq 15%
(Positive LR 1.99)

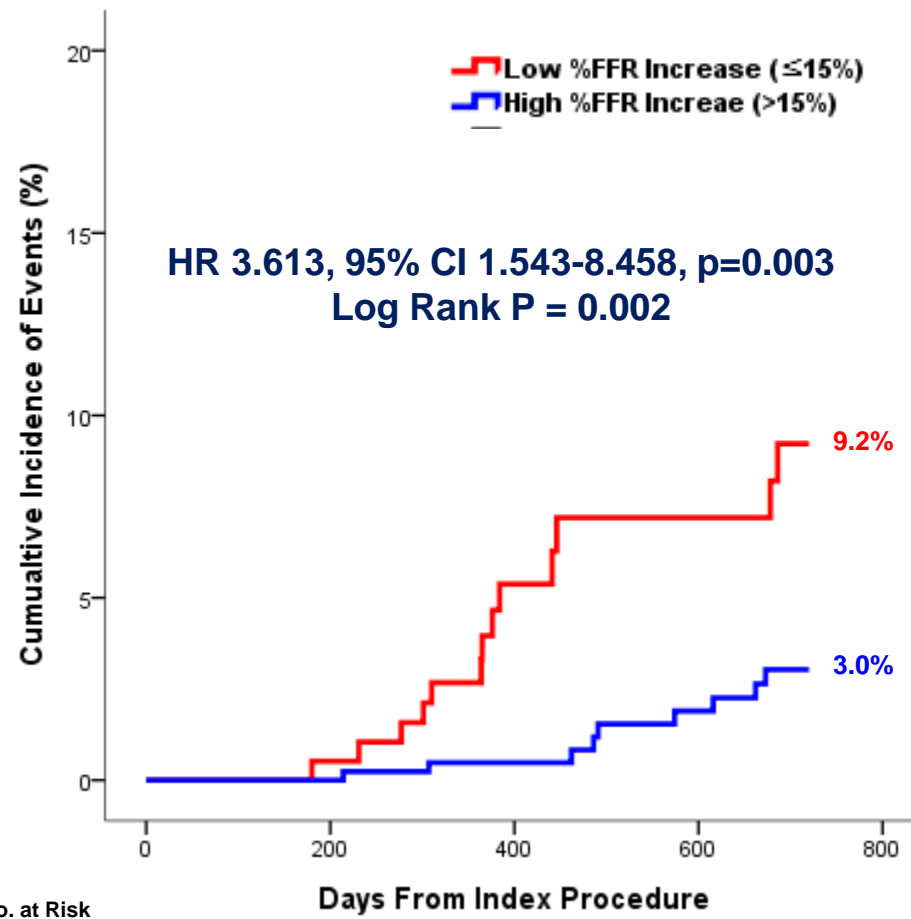
Post-PCI FFR vs. Percent FFR Increase

- Target Vessel Failure at 2 Years -

Post-PCI FFR



Percent FFR increase



Low Post-PCI FFR (<0.84)

211 208 146 127 123

High Post-PCI FFR (≥0.84)

410 404 277 246 245

Low %FFR Increase (≤15%)

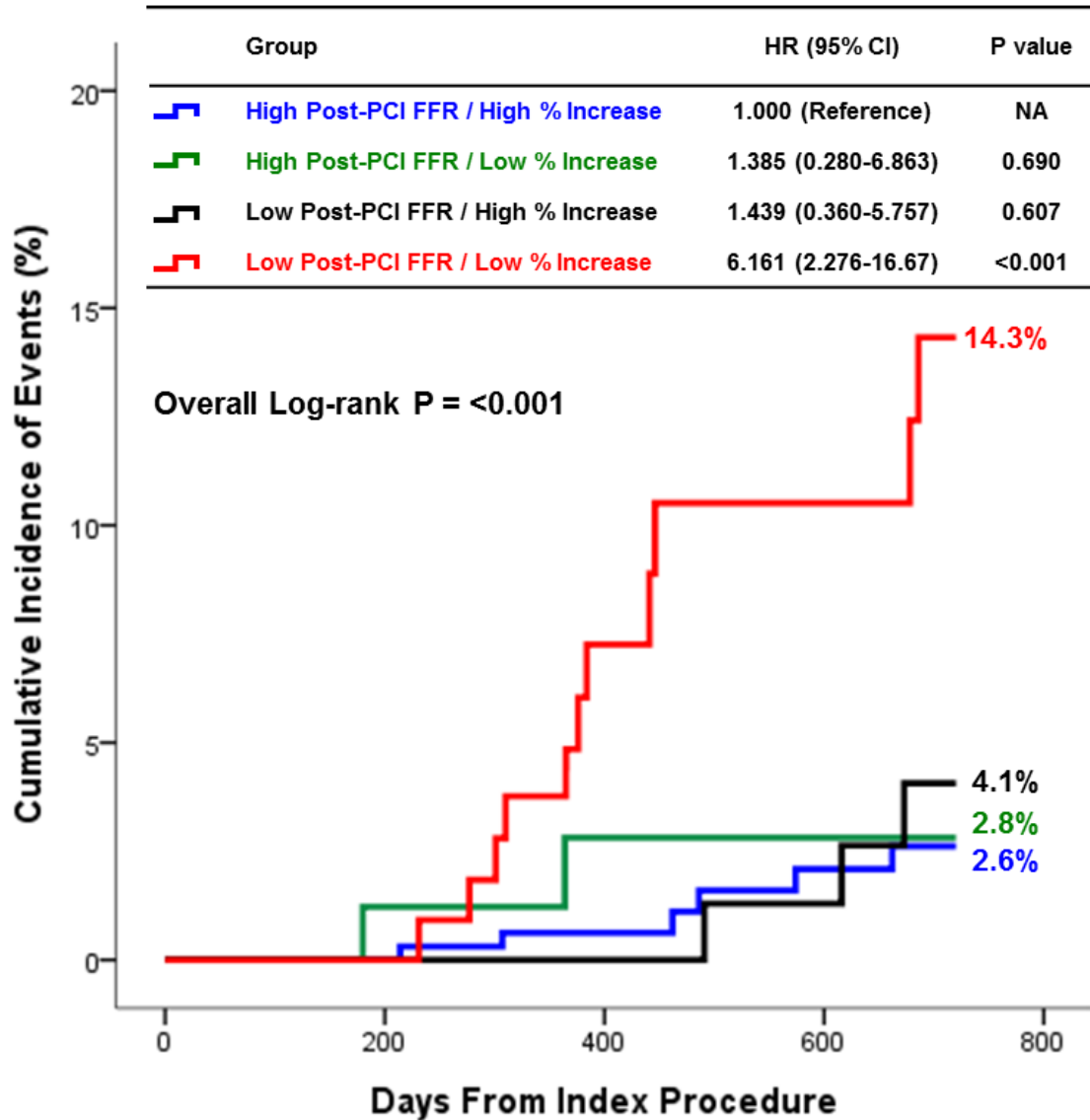
191 190 117 99 97

High %FFR Increase (>15%)

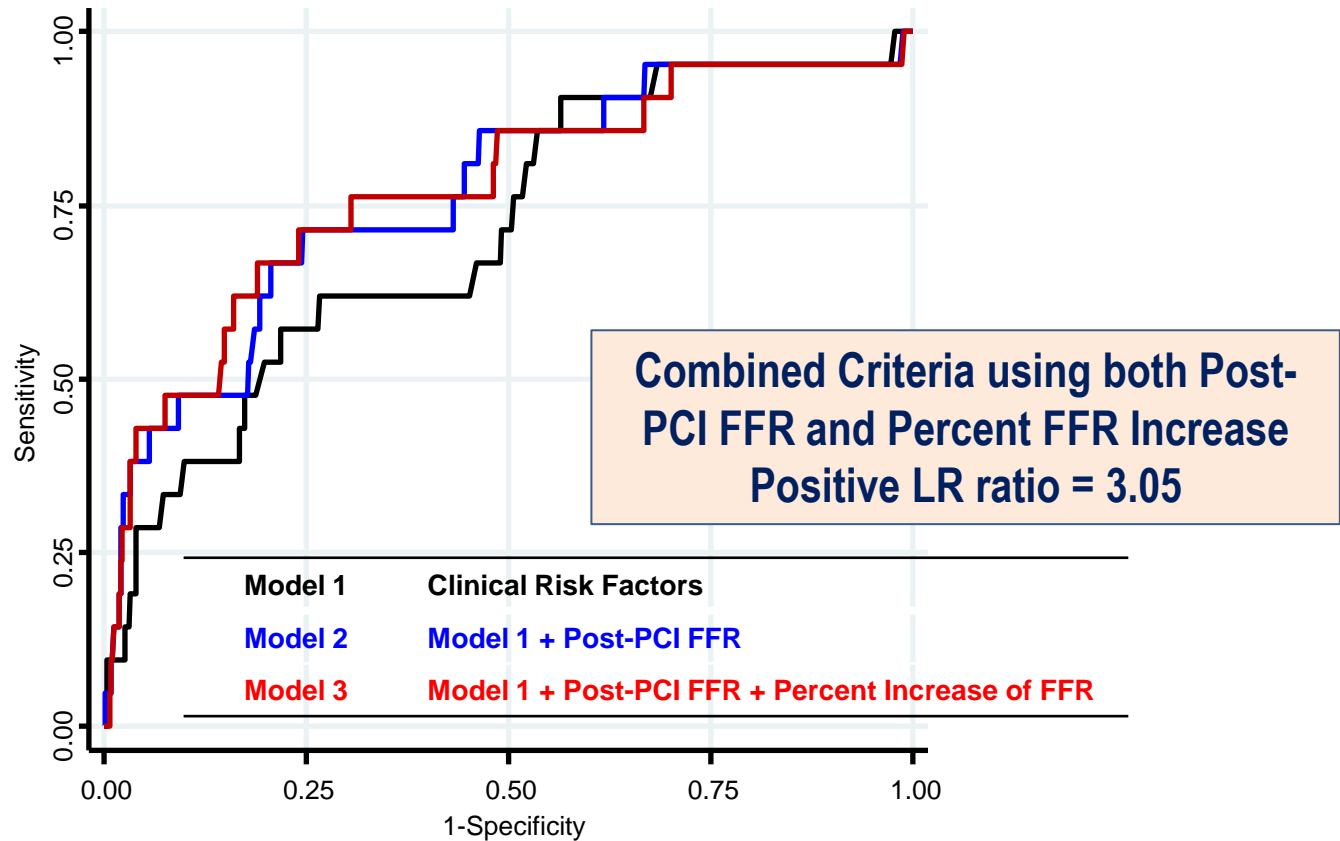
430 422 306 274 271

High Percent FFR Increase, But Low Post-PCI FFR

- What will be the prognosis? -



Increased Risk Prediction using Both Percent FFR Increase and Post-PCI FFR



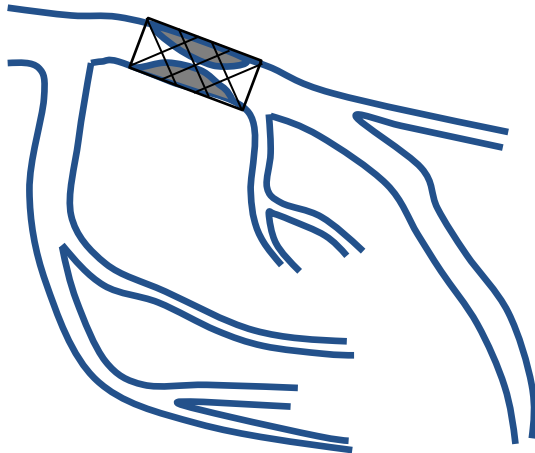
	Models	C-index	Relative IDI	P value	NRI	P value
—	Model 1 Clinical Risk Factors	0.734				
—	Model 2 Model 1 + Post-PCI FFR	0.774	0.618	0.006	0.678	0.002
—	Model 3 Model 2 + Percent FFR Increase	0.783	0.702	0.009	0.479	0.031

Physiologic Response to Focal Treatment

- Predominant Focal Disease -

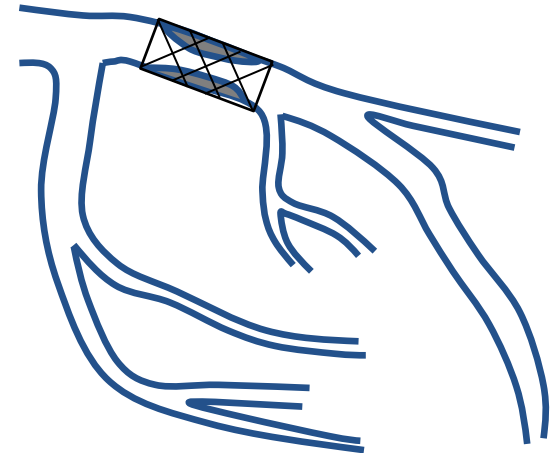
In Predominant Focal Disease, Physiologic Response from Focal Treatment depends on “Severity of Focal Disease”

Severe Focal Stenosis



Higher Physiologic Gain with PCI
(High Percent Increase of FFR)
No Residual Disease Burden
(High Post-PCI FFR)

Modest Focal Stenosis



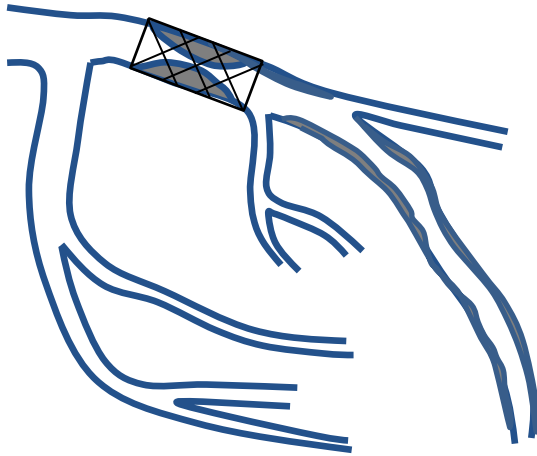
Modest Physiologic Gain with PCI
(Low Percent Increase of FFR)
No Residual Disease Burden
(High Post-PCI FFR)

Physiologic Response to Focal Treatment

- Mixed Focal and Diffuse Disease -

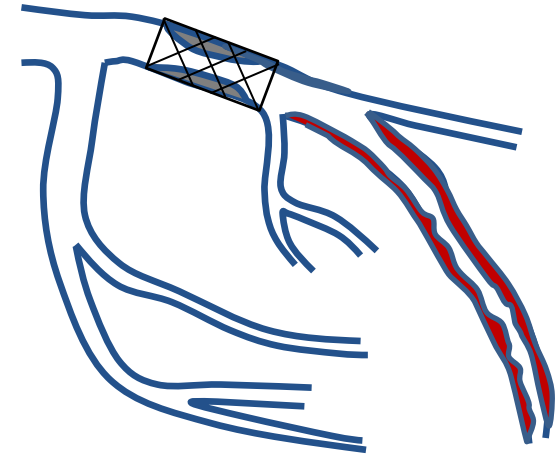
Physiologic Response from Focal Treatment depends on
“Relative contribution of focal stenosis on diffuse disease”

Focal >> Diffuse



Higher Physiologic Gain from Stenting
(High Percent FFR Increase)
Underlying Diffuse Disease (minor component)
(Low Post-PCI FFR)
Reduced Per-vessel Ischemic Burden
(Favorable Outcome)

Diffuse >> Focal



Limited Physiologic Gain from Stenting
(Low Percent FFR Increase)
Underlying Diffuse Disease (major component)
(Low Post-PCI FFR)
Similar Per-vessel Ischemic Burden
(Worse Clinical Outcome)

Summary

- **Post-PCI FFR and Percent FFR increase reflect physiologic results from PCI and both indices possess prognostic implication.**
- **Physiologic response after stenting depends on “severity of focal stenosis” and “relative contribution of focal and diffuse disease in per-vessel ischemia”.**
- **The physiologic effect of focal stenting has limited role in patients with higher contribution of diffuse disease than focal stenosis. These patients shows low percent FFR increase, low post-PCI FFR, higher risk of future clinical event.**
- **But, those with higher contribution of focal stenosis in underlying diffuse disease, successful PCI with high percent FFR increase would provide favorable outcome despite low post-PCI FFR.**
- **Integrated interpretation using both absolute (Post-PCI FFR) and relative (Percent FFR increase) physiologic results would provide higher predictability for future clinical events.**