

iFR as the Gold Standard Index!

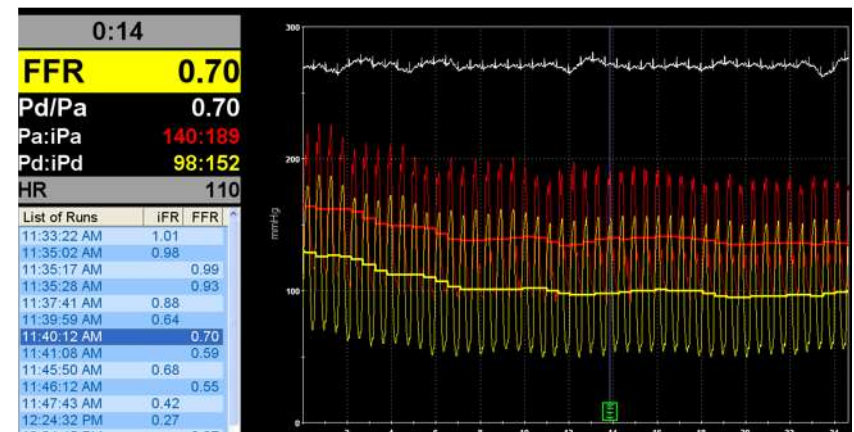
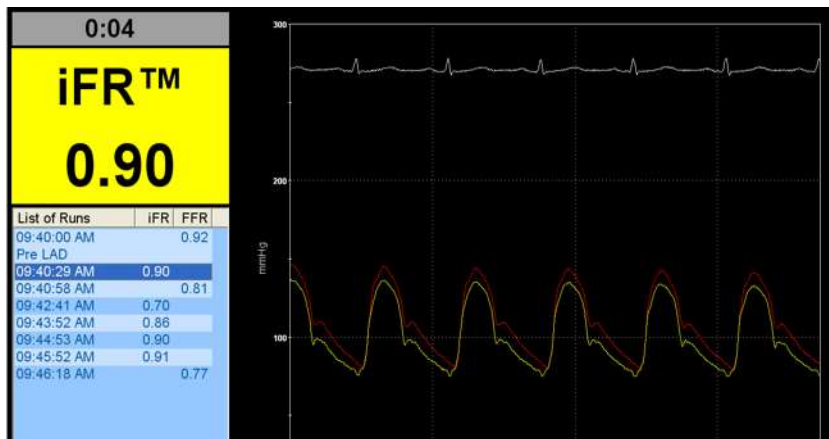
Bon-Kwon Koo, MD, PhD

Seoul National University Hospital, Seoul, Korea



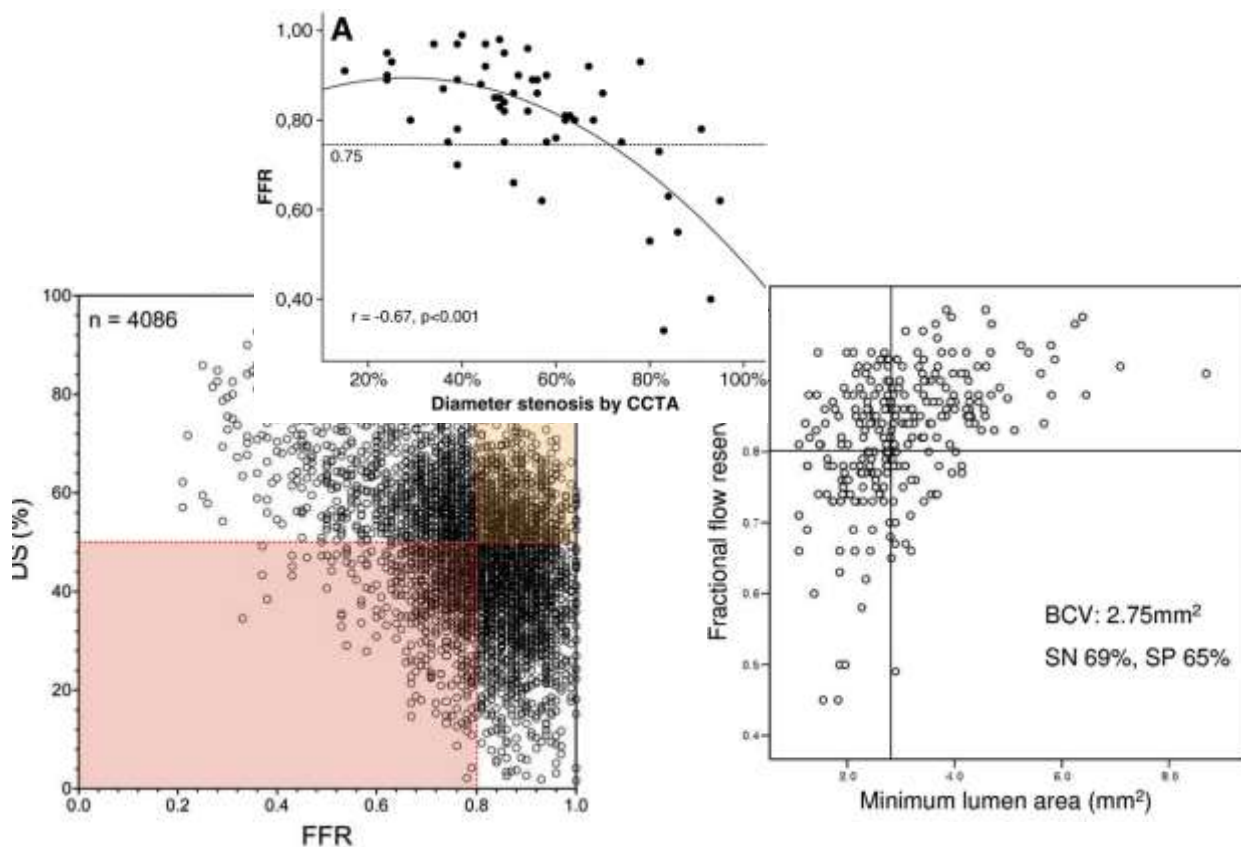
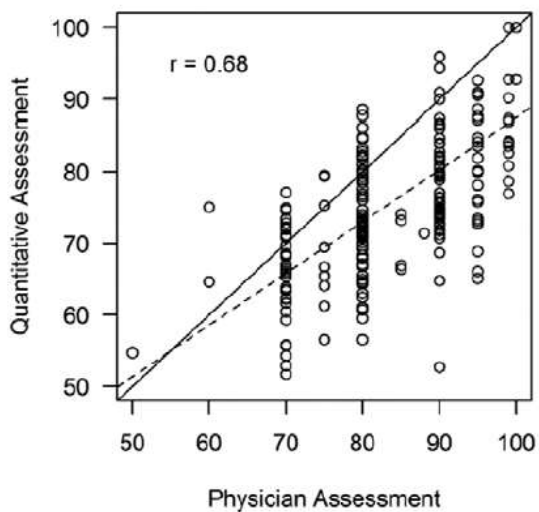
Conflict of Interest

- I measure both resting and hyperemic physiologic indexes in all cases.
- Most of my physiology-guided decision is based on FFR in daily practice.



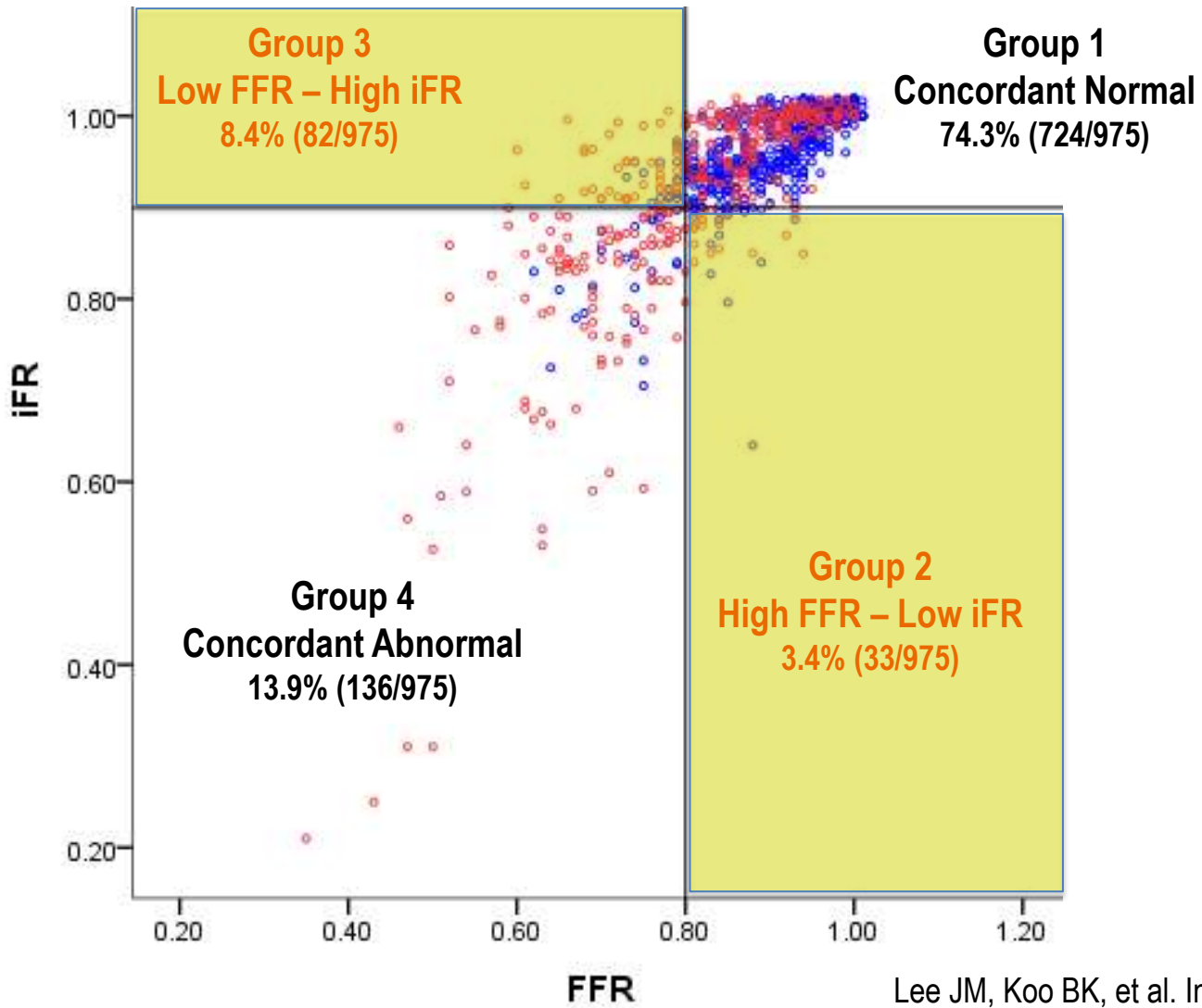


Discordance is everywhere...



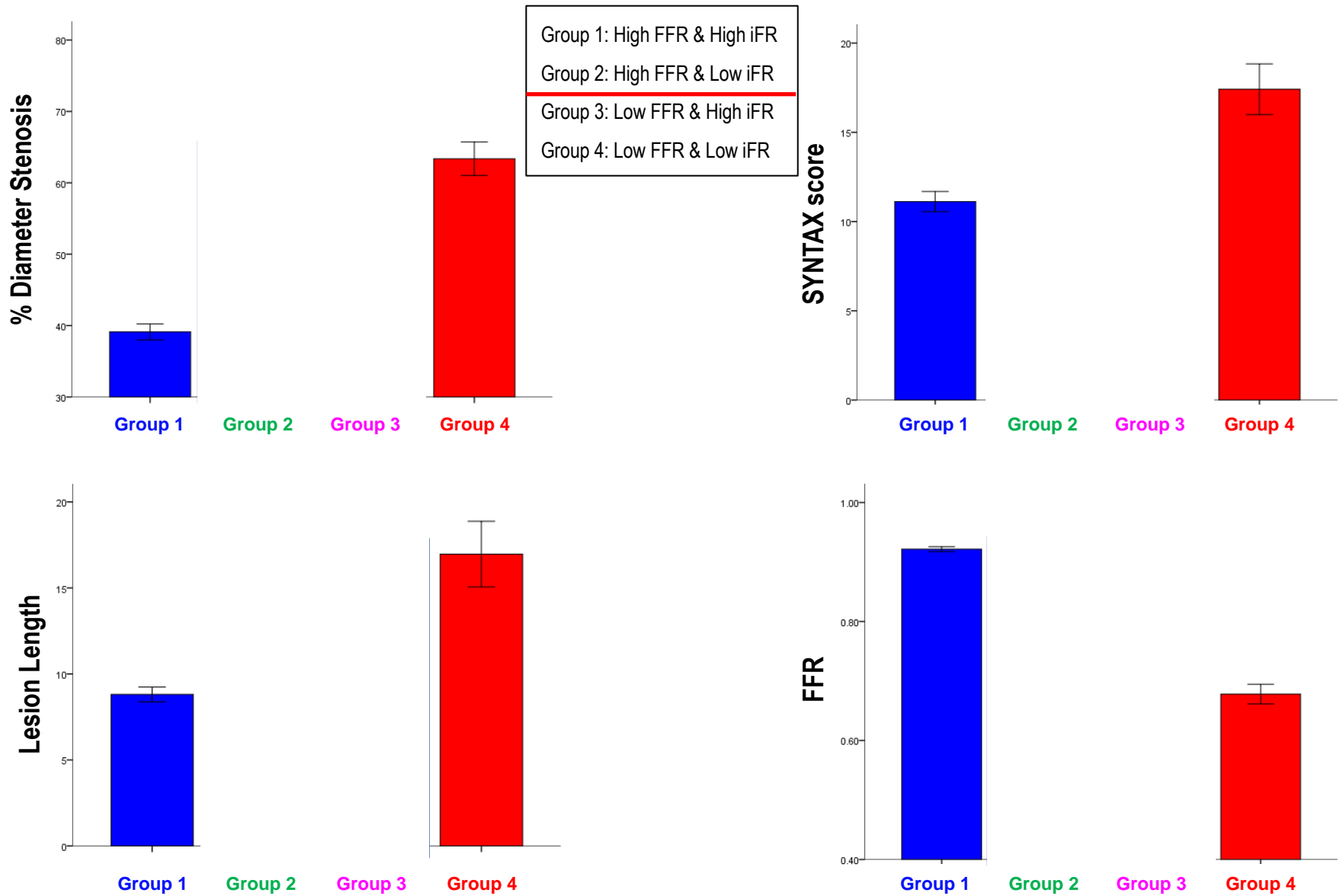
...and generally interpreted in terms of “superiority and inferiority concept”.

If there is only one truth, discordance has no meaning...

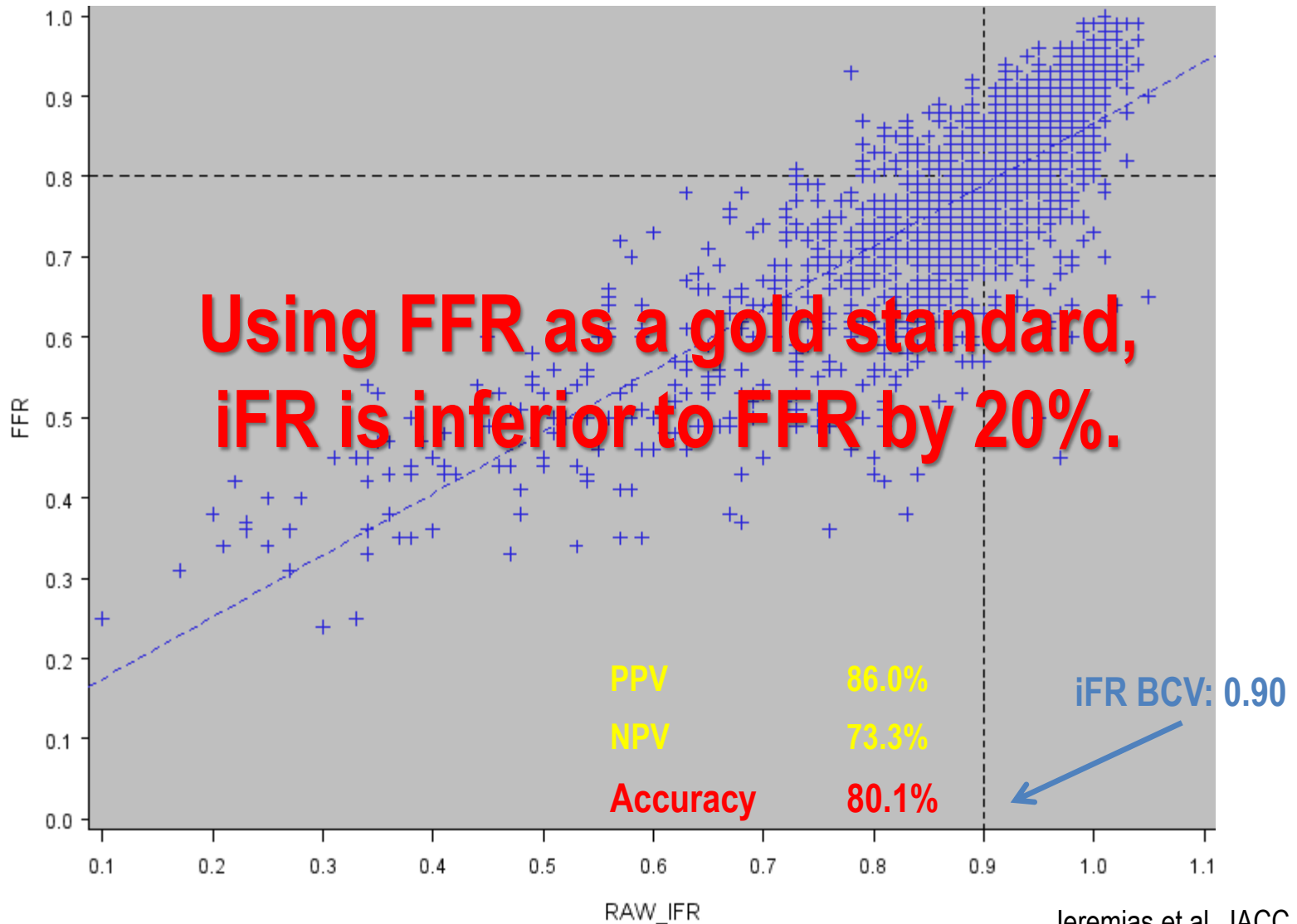


Lee JM, Koo BK, et al. Int J Cardiol 2017
Lee JM, Koo BK, et al. Eur Heart J 2018

Clinical relevance of iFR/FFR discordance



RESOLVE: FFR vs iFR (n=1539)



Jeremias et al. JACC 2014

iFR as the Gold Standard Index!



gold standard *noun* [S] (GOOD THING)

- ★ something that is very good and is used for measuring how good other similar things are:

I think "Sesame Street" is still the gold standard for preschool television.

From Cambridge dictionary



Why FFR is not a single (only) gold standard index?

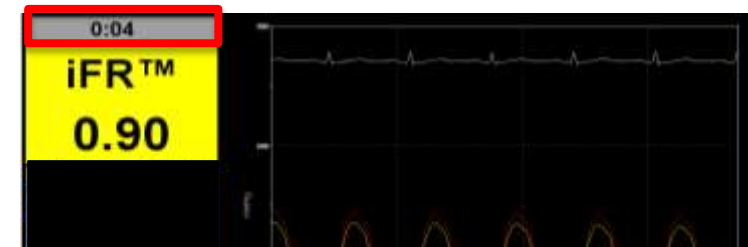
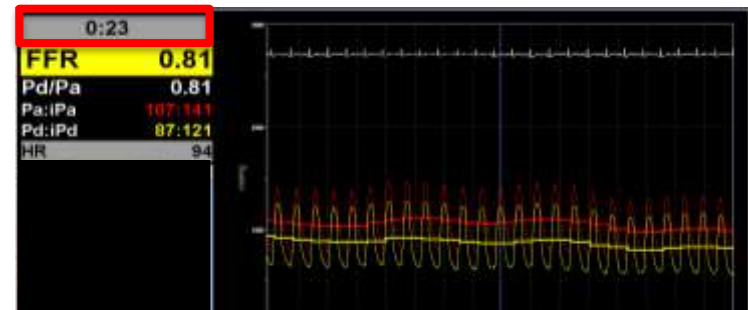
Prerequisites for a new comer

- **User friendly**
- **No (Less) side effect**
- Scientific background
- Clinical data
 - Better or at least complementary to existing indexes
- Cost-saving or cost-effective

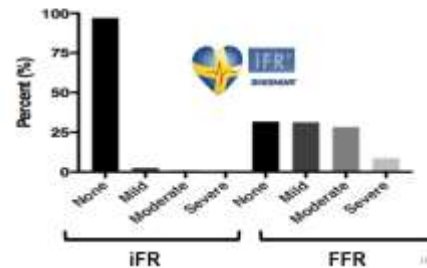
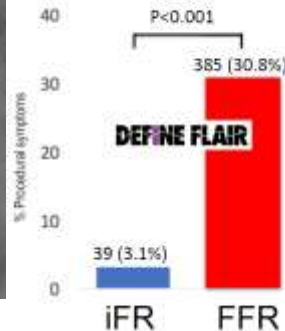
iFR doesn't need hyperemia and measurement is instantaneous.

iFR, How easy?

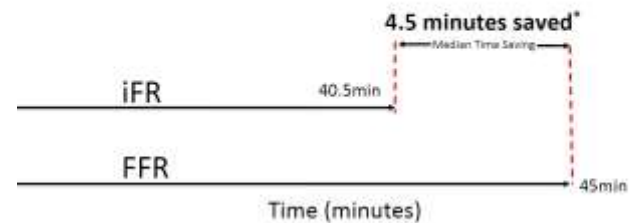
20 sec with adenosine, chest discomfort....



iFR: fewer side effect



DEFINE FLAIR: iFR guided revascularization reduces procedure time



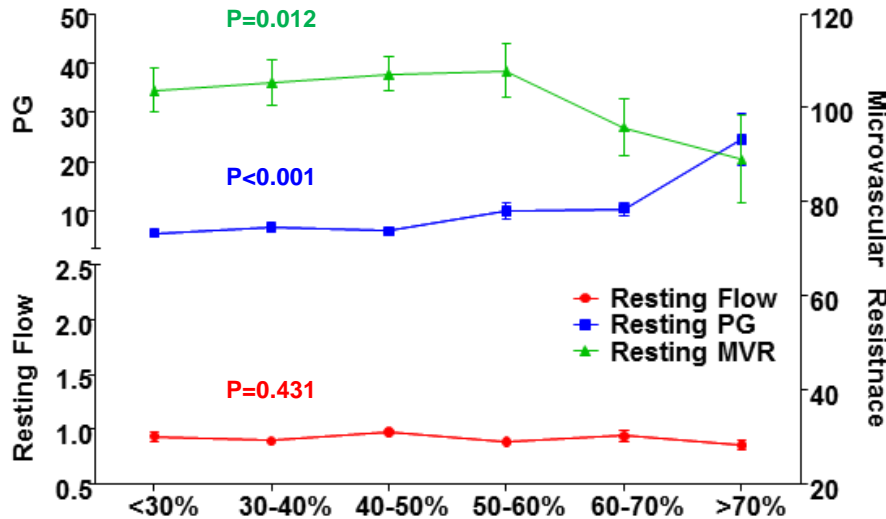
* Threshold for reduction in median time (p<0.001)

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Coronary Circulatory Responses to Epicardial Stenosis

Resting

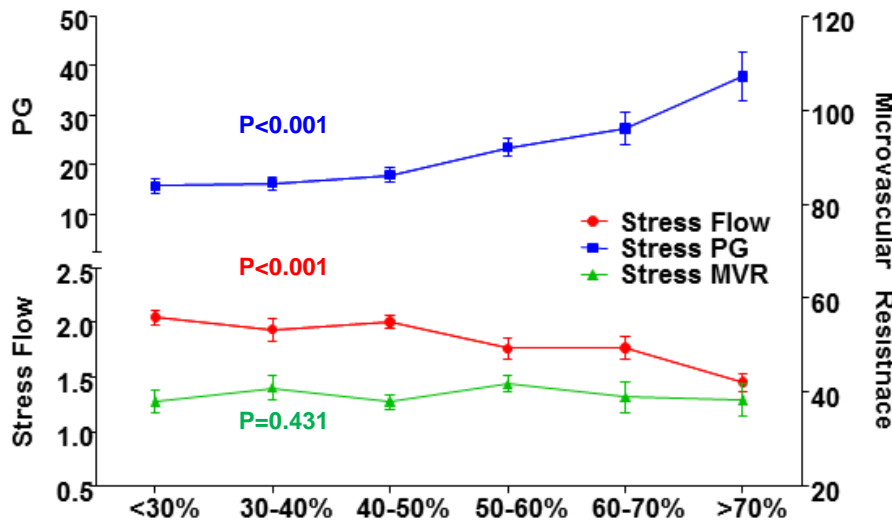


As stenosis severity (epicardial resistance) increases

- No change in resting flow
- MV resistance ▼
- Resting pressure gradient ▲

*MV, microvascular; PG, pressure gradient

Hyperemia



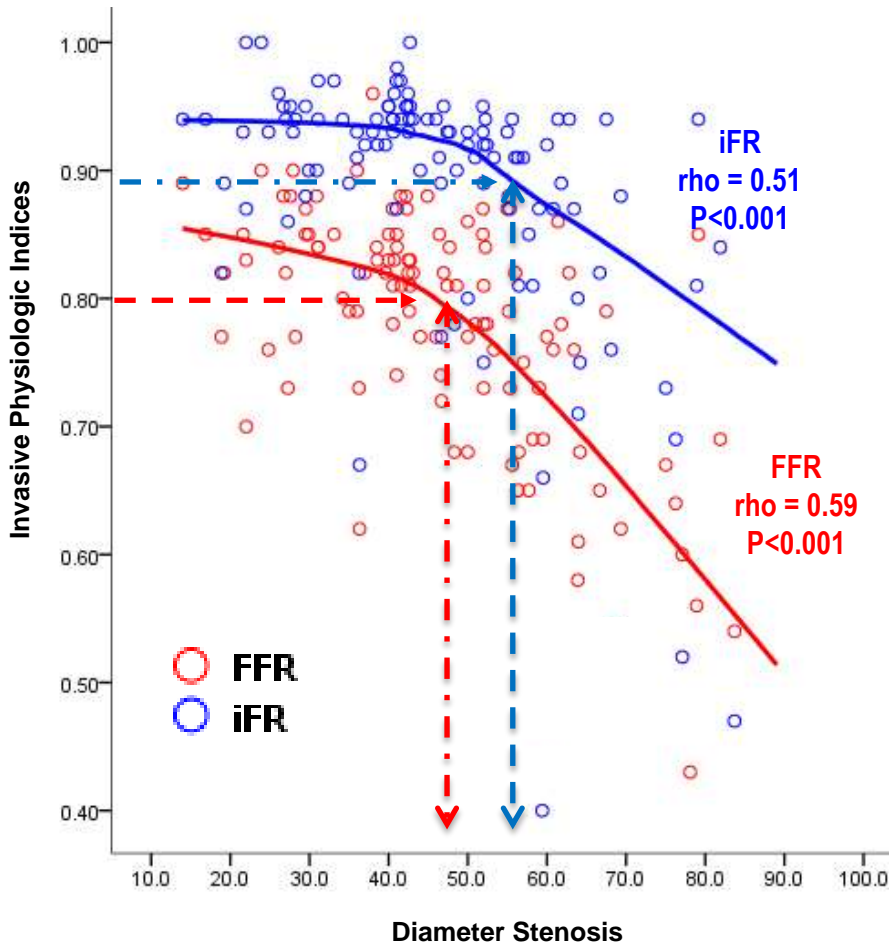
As stenosis severity (epicardial resistance) increases

- Minimal and stable MV resistance
- Hyperemic flow ▼
- Hyperemic pressure gradient ▲

JM Lee, BK Koo et al. Circulation 2017

Invasive Physiologic Indices vs. Stenosis, Resistance and Flow

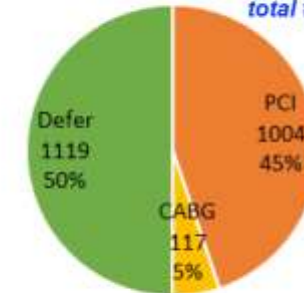
Angiographic stenosis



pooled analysis of Define FLAIR and iFR Sweedeheart

iFR guide (n=2240)

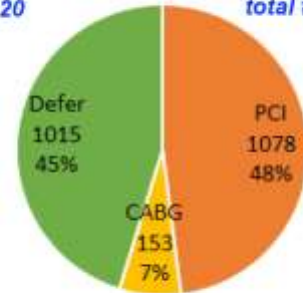
total # of stents 1520



■ PCI ■ CABG ■ Defer

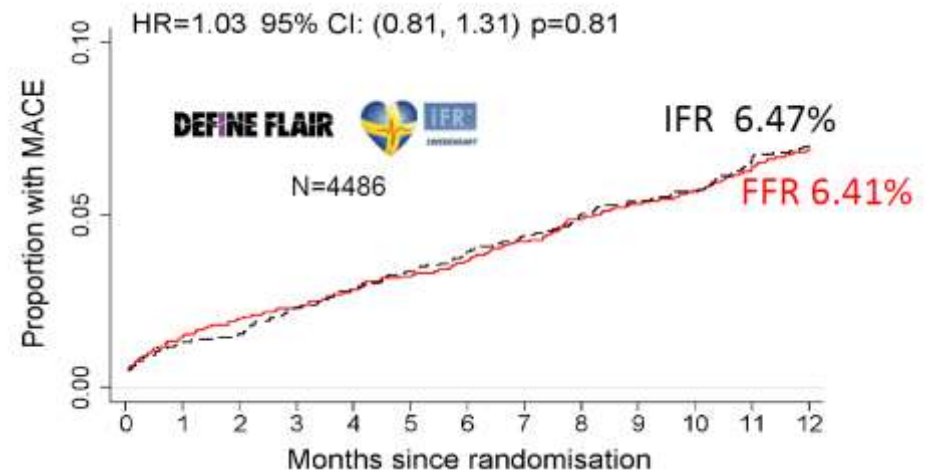
FFR guide (n=2246)

total # of stents 1693



■ PCI ■ CABG ■ Defer

Significantly less revascularisation based on iFR interrogation (P < 0.01)



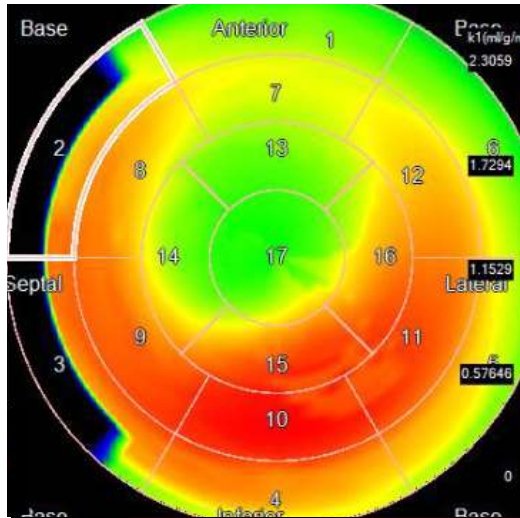
Lee JM, Koo BK, et al Circulation 2017

Escaned J, EuroPCR 2017

Prerequisites for a new comer

- User friendly
- No (Less) side effect
- Scientific background
- **Clinical data**
 - **Better or at least complementary to existing indexes**
- **Cost-saving or cost-effective**

iFR vs. FFR: Who can be the judge?



	Flow (ml/g/min)				Reserve	
	Stress		Rest		Reserve	
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	1.51	0.30	0.86	0.14	1.77	0.28
LCX	1.74	0.35	0.82	0.16	2.09	0.21
RCA	1.77	0.44	0.85	0.21	2.06	0.19
Global	1.63	0.37	0.84	0.16	1.92	0.29

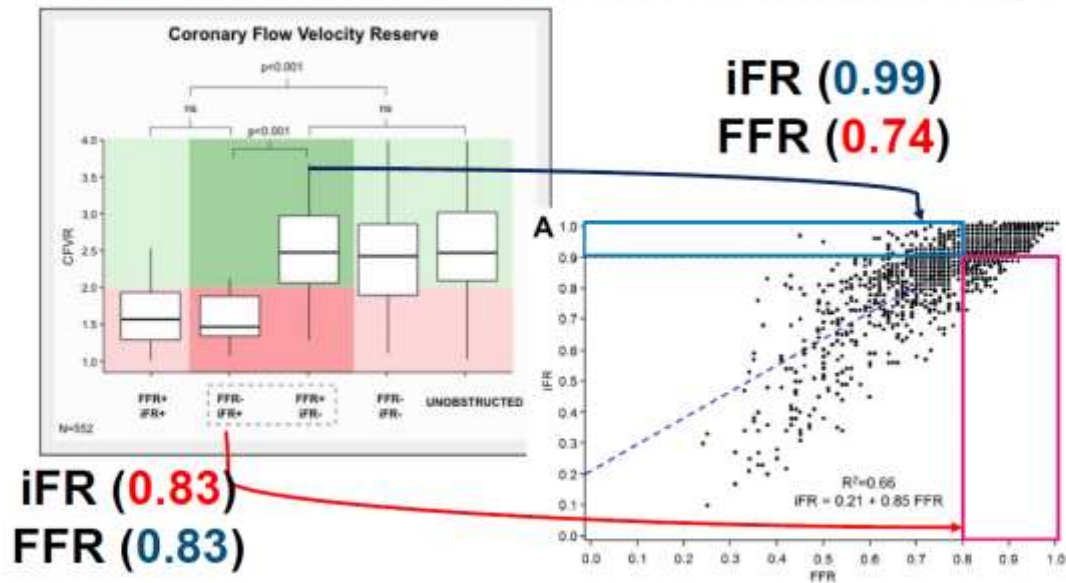
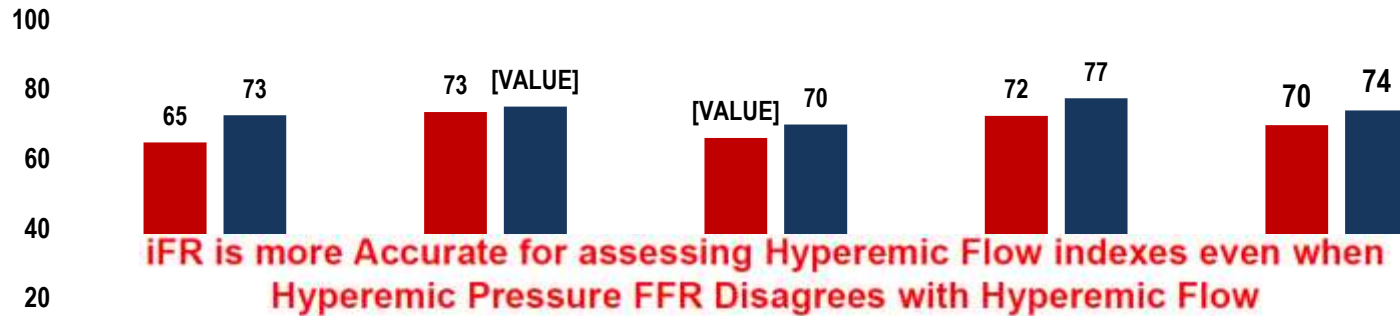


N13-Ammonia PET perfusion scan

Diagnostic Performance of FFR and iFR

■ FFR ■ iFR

PET-derived CFR as Gold Standard



acy

= relative flow reserve

Cook, Jeremias, Kikuta, Shiono, Stone, Davies et al. J Am Coll Cardiol Cardiovasc Interv 2017.

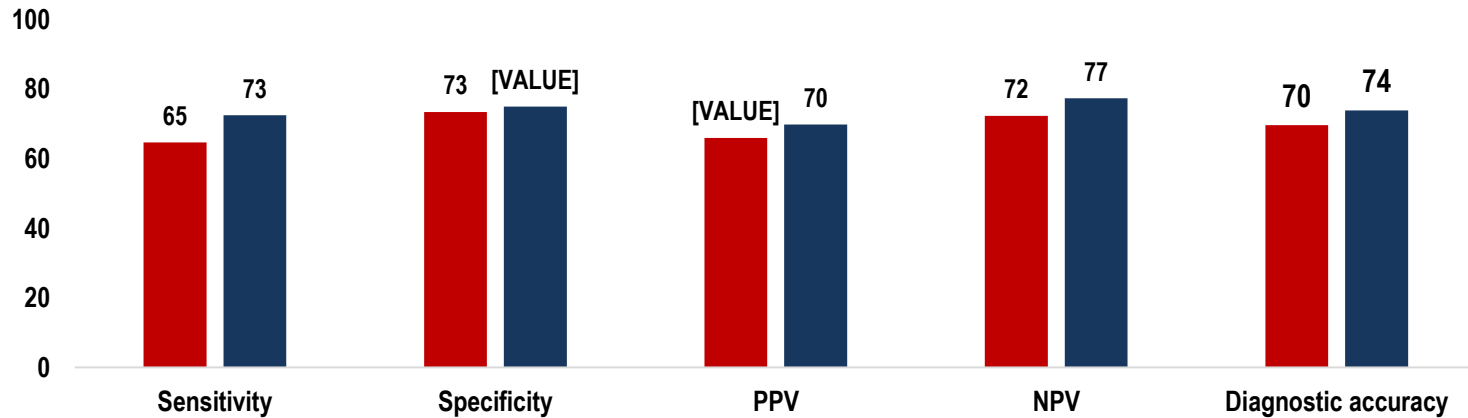
Jeremias A, Fearon WF, Pijls NHJ et al. RESOLVE. J Am Coll Cardiol 2014;63:1253-61.

Hwang D, Lee JM, Koo BK, et al. JACC interv 2016

Diagnostic Performance of FFR and iFR

■ FFR ■ iFR

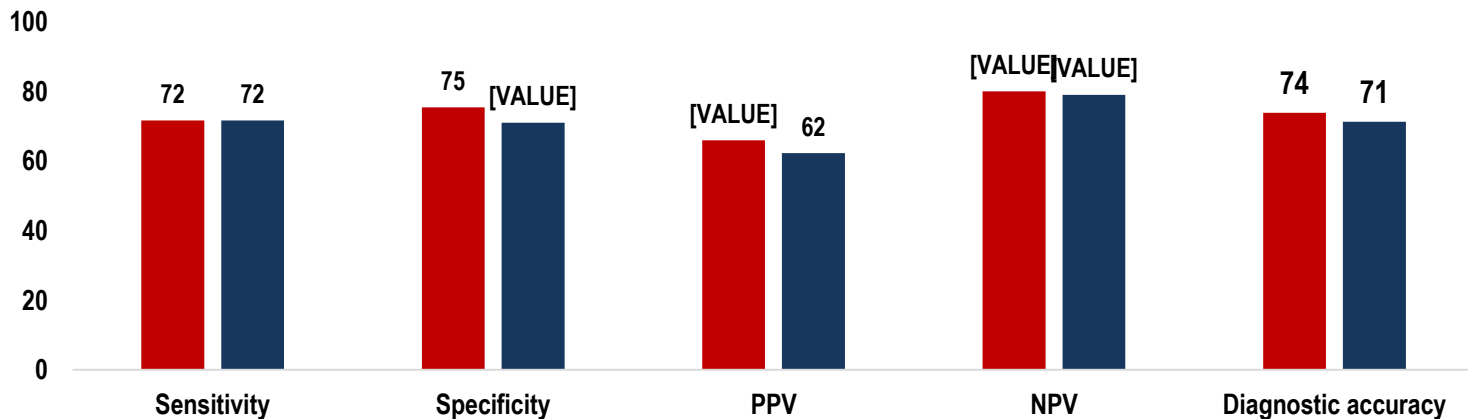
PET-derived CFR as Gold Standard



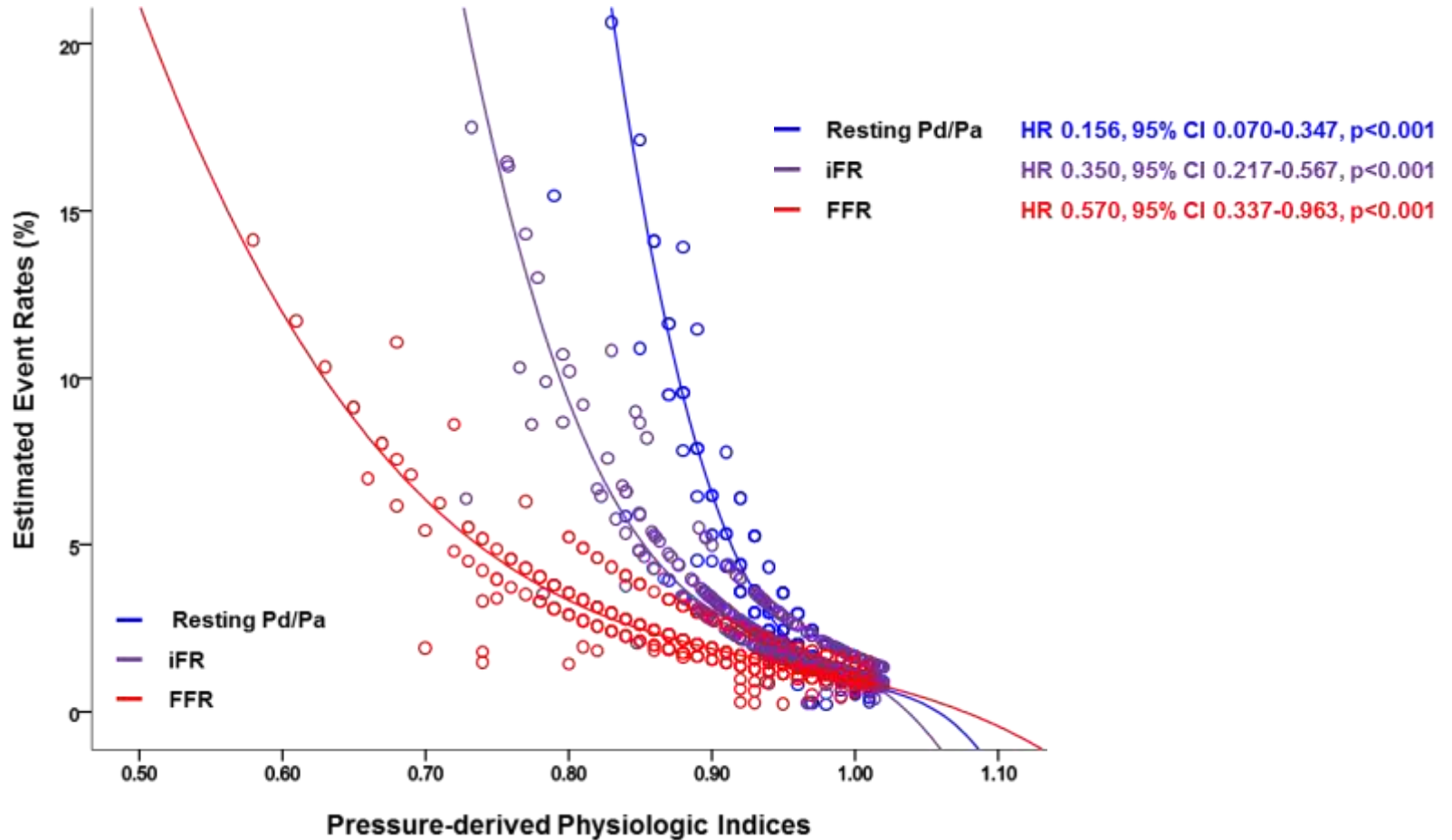
CFR = coronary flow reserve, RFR = relative flow reserve

■ FFR ■ iFR

PET-derived RFR as Gold Standard



Association with Clinical outcomes



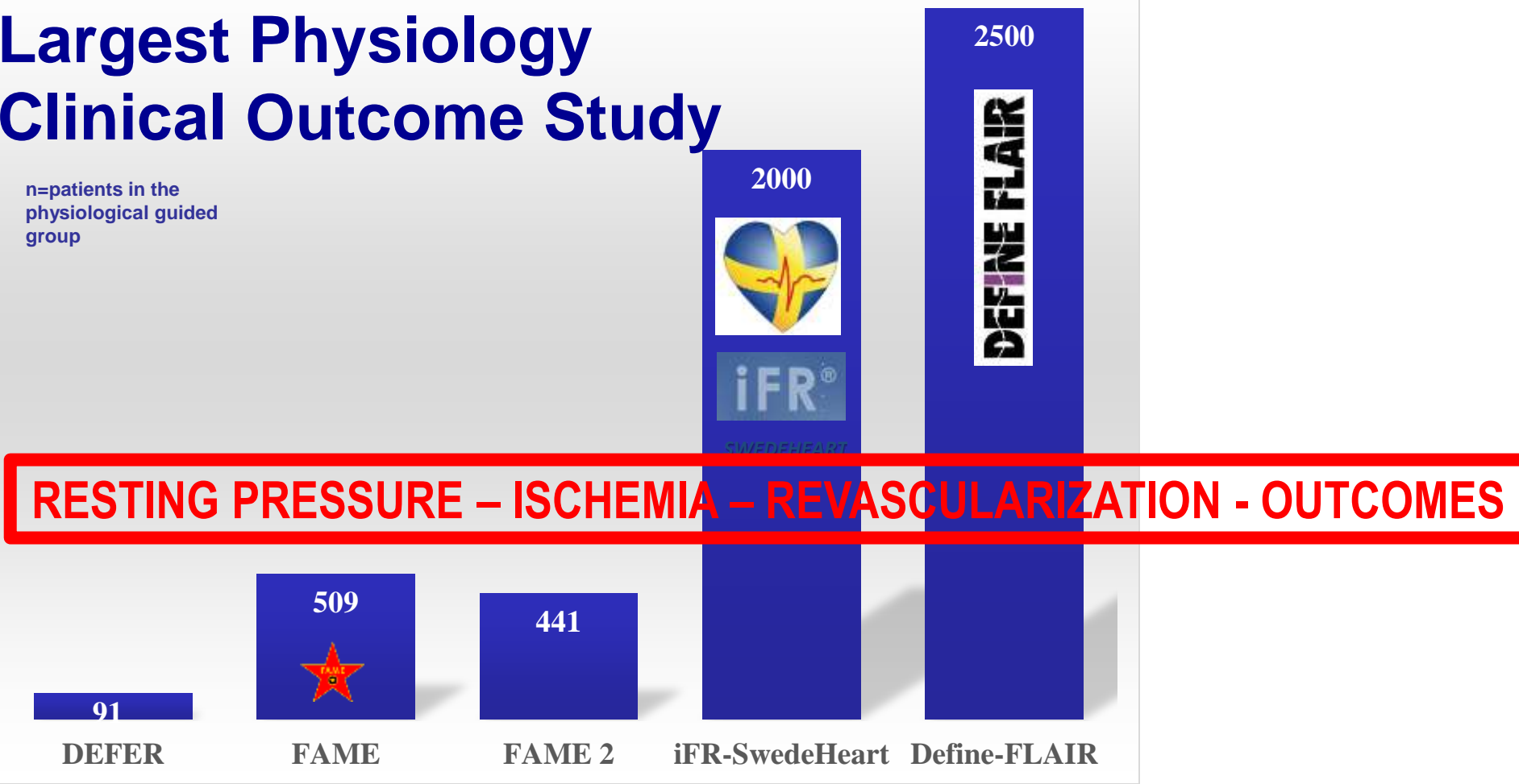
Lee JM, Koo BK, et al. Circulation 2017

Lee JM, Koo BK, et al. JACC 2017

DEFINE-FLAIR

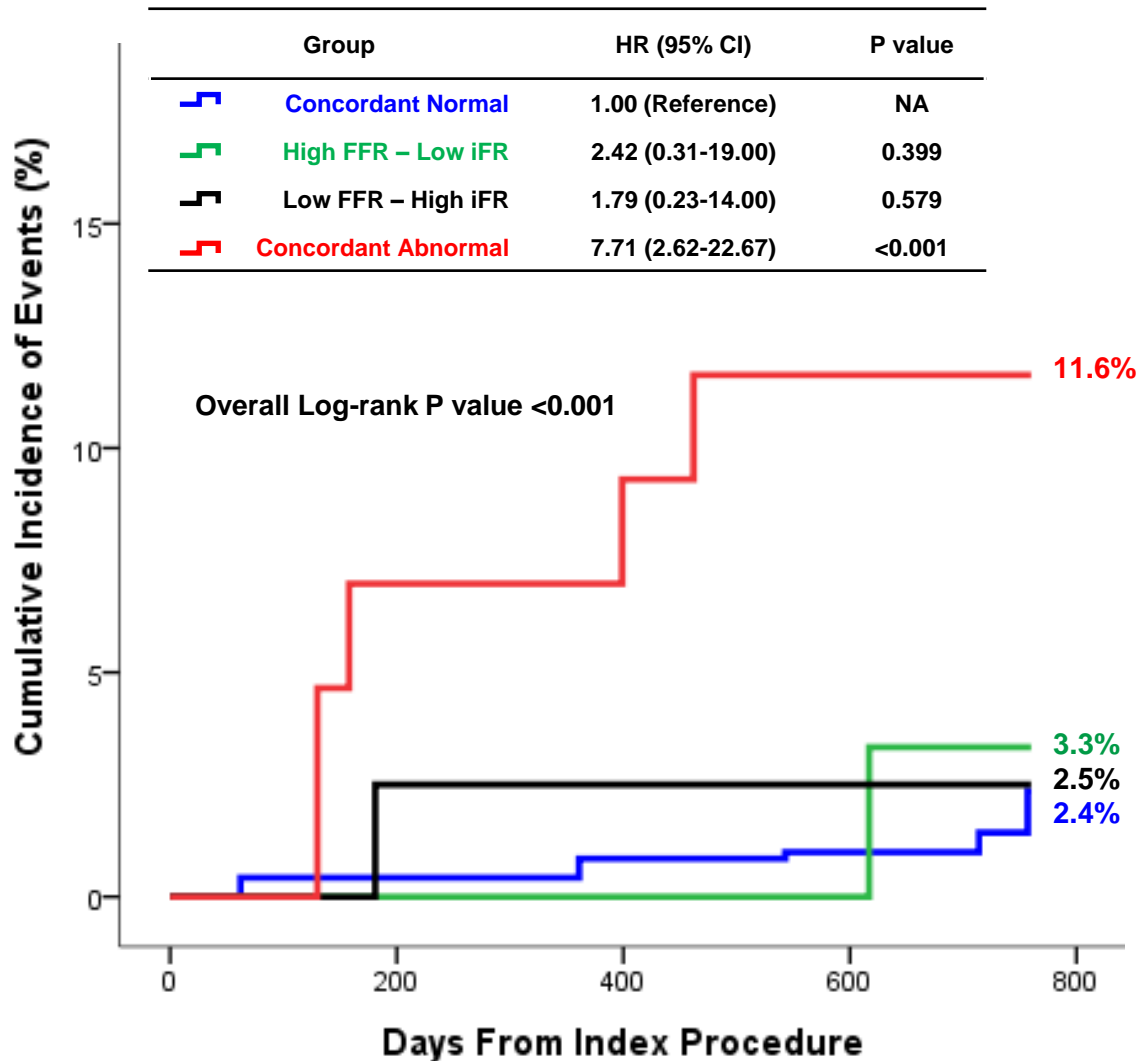
Largest Physiology Clinical Outcome Study

n=patients in the
physiological guided
group



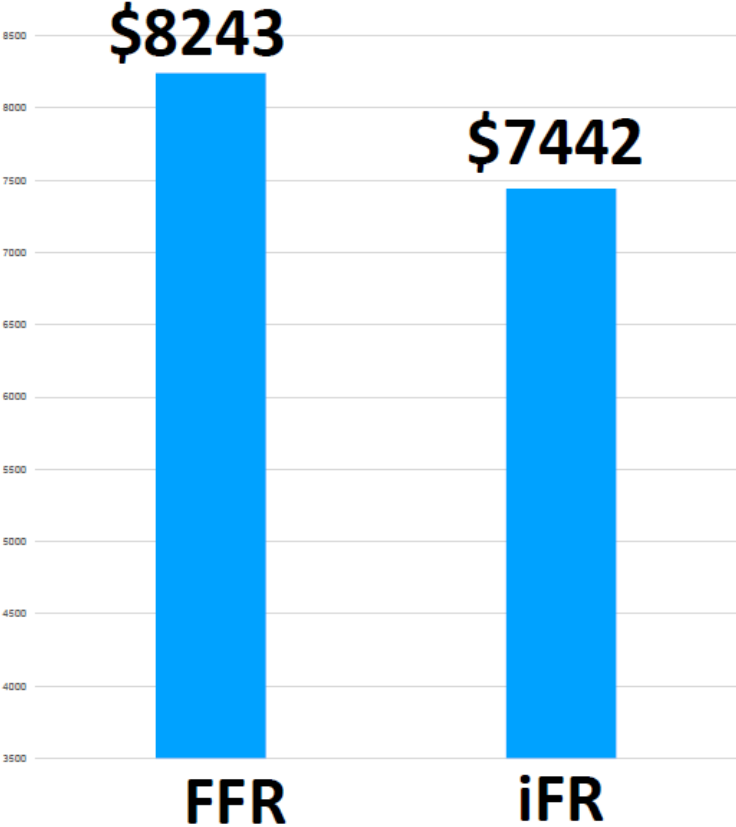
Modified from Dr Escaned's presentation

Clinical outcomes according to FFR/iFR classification



Significantly Lower Cost with iFR

Adjusted Δ \$896
($p=0.006$)



Shorter procedural duration

No hyperaemic medication

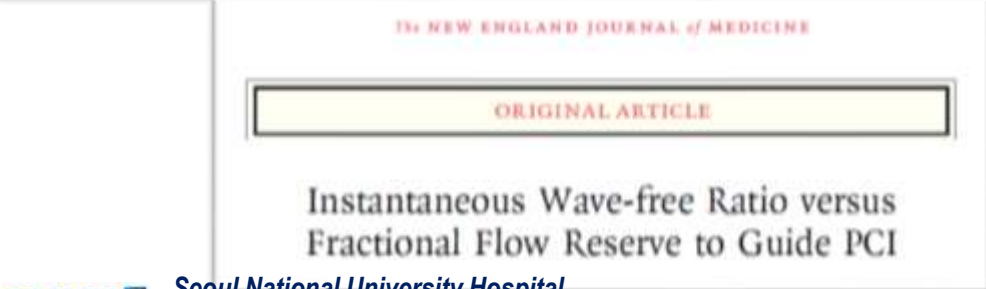
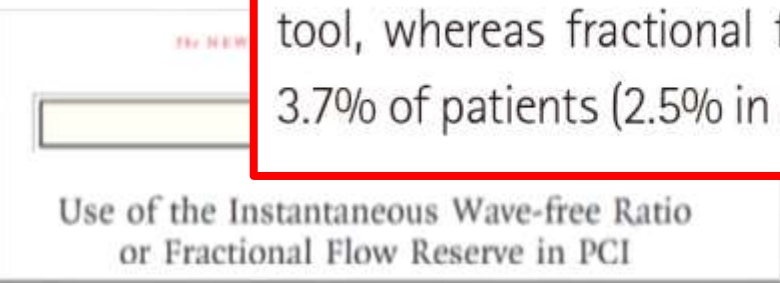
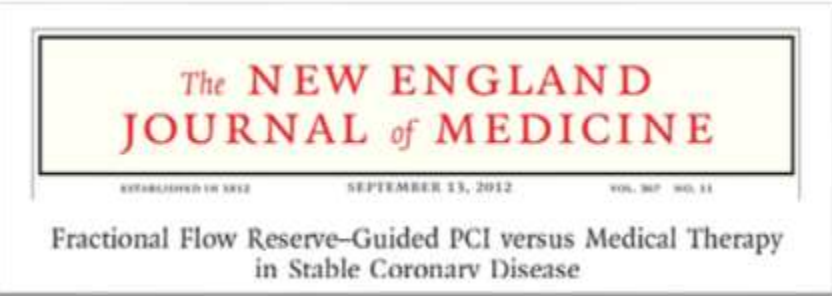
Lower PCI rates

Fewer CABG procedures

Fewer Unplanned PCI (LAD)

Lord J, Tanaka N, Yokoi H, Takashima H, Kikuta Y, Koo BK, Nam CW, Matsuo H, Serruys PW, Escaned J, Patel M, Davies J, *et al.* ACC.18. Submitted

Great success vs. Ugly fact



Original Article

<https://doi.org/10.4076/kcj.2017.0001>
Print ISSN 1738-6620 • On-line ISSN 1738-6666



The Current Status of Percutaneous Coronary Intervention in Korea –Based on Year 2014 Cohort of Korean Percutaneous Coronary Intervention (K-PCI) Registry–

Jae-Sik Jang, MD¹, Kyoo-Rok Han, MD², Keon-Woong Moon, MD³, Dong Woon Jeon, MD⁴, Dong-Ho Shin, MD⁵, Jung-Sun Kim, MD⁶, Duk-Woo Park, MD⁷, Hyun-Jae Kang, MD⁸, Juhan Kim, MD⁹, Jang-Wahn Bae, MD⁹, Seung-Ho Hur, MD¹⁰, Byung Ok Kim, MD¹¹, Donghoon Choi, MD¹², Hyeon-Cheol Gwon, MD¹³, and Hyo-Soo Kim, MD⁷

19.1%, and drug-eluting balloon (DEB) was used in 5.9% of patients. A bare-metal stent was placed in only 1.1% of all patients. Intravascular ultrasound (IVUS) was used in 28.6% of patients (27.1% in ACS patients, 32.7% in non-ACS patients) as an adjunctive PCI support tool, whereas fractional flow reserve (FFR) was only performed in 3.7% of patients (2.5% in ACS patients, 7.2% in non-ACS patients).

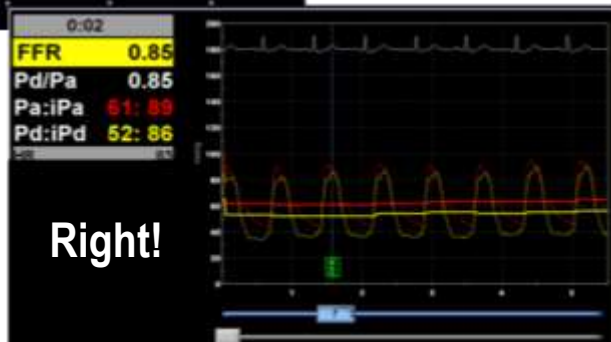
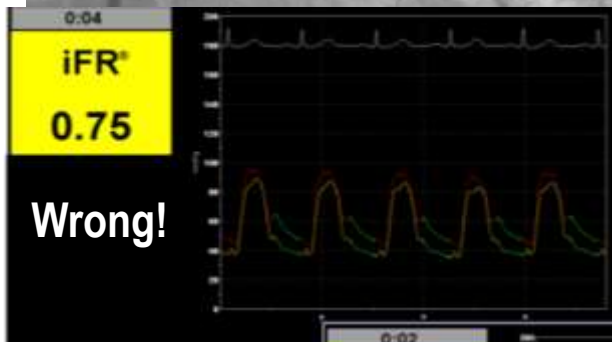
tool, whereas fractional flow reserve (FFR) was only performed in 3.7% of patients (2.5% in ACS patients, 7.2% in non-ACS patients).

Other in-hospital event rates were low including, non-fatal MI 1.6%, stroke 0.2%, urgent repeat revascularization 0.3%, and stent thrombosis in 0.4% (172 patients). There were significantly higher rates of all-cause mortality (3.0 vs. 2.0; p<0.001) and cardiac mortality (2.0 vs. 1.4%; p<0.001) in women undergoing PCI. The rates for transfusion during hospitalization were 2.2%, which was higher in women (2.9 vs. 1.9%; p<0.001). Although the number of PCI procedures peaked in March and December, the incidence of in-hospital cardiac events was evenly distributed throughout the year. However, the rates of in-hospital cardiac events were significantly higher when PCI cases were performed during weekends than for procedures performed during weekdays (9.4 vs. 3.8%; p<0.001; Fig. 6), this is likely because most cases performed over the weekend were in emergency settings.

“Physiology”

vs. Coronary Physiologic Index

From Ancient Greek φύσις (*physis*), meaning 'nature, origin', and -λογία (*-logia*), meaning 'study of'



M/78 Dyspnea, Chest discomfort

s/p Lung cancer surgery, COPD

Stomach cancer +

iFR: **bad**

FFR: good

Which is more accurate in terms of prediction of **patient's** risk?

Why FFR is not a single (only) gold standard index?

- Both FFR and iFR are smart and useful physiologic indices.
- Understanding the similarities and differences of physiologic indices and integrated use will maximize the benefit of invasive physiologic assessment.
- The goal is not to prove which is a gold standard, but to increase the use of physiology-guided clinical decision in daily practice.



<https://www.youtube.com/watch?v=UmAtMWJfEgk> (with minor modification)