

Cardiac Rehabilitation In Ischemic Heart Disease: After PCI or CABG

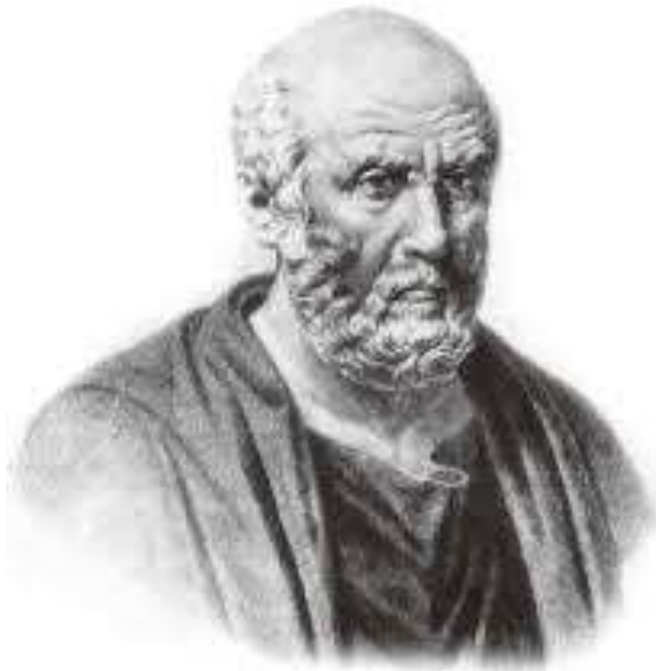


성균관대의대 강북삼성병원 순환기내과
이종영



강북삼성병원

심장재활 뿌리를 찾아서...



이제 직업에 종사할 허락을 받으며, 나의 생애를 인류 봉사에 바칠 것을 엄숙히 서약하노라.

"인생은 짧고 예술은 길다 이것도 내 명대사지."

우리가 먹는 것이 곧 우리 자신이 된다.
- 히포크라테스

음식이란 약이 되기도 하고 독이 되기도 한다.

최고의 운동은 걷기이다.
적지도 많지도 않은 음식과 운동은 건강을 위한 가장 훌륭한 처방이다.

웃음이야말로 몸과 마음을 치료하는 명약이다.

Cardiac Rehabilitation History: Three turning points

- ▶ Before 1951: 6 weeks strict bedrest after myocardial infarction

- ▶ One : 1951: L... "chair treatment"
- Trans Assoc ... 17

- ▶ Two: Preside

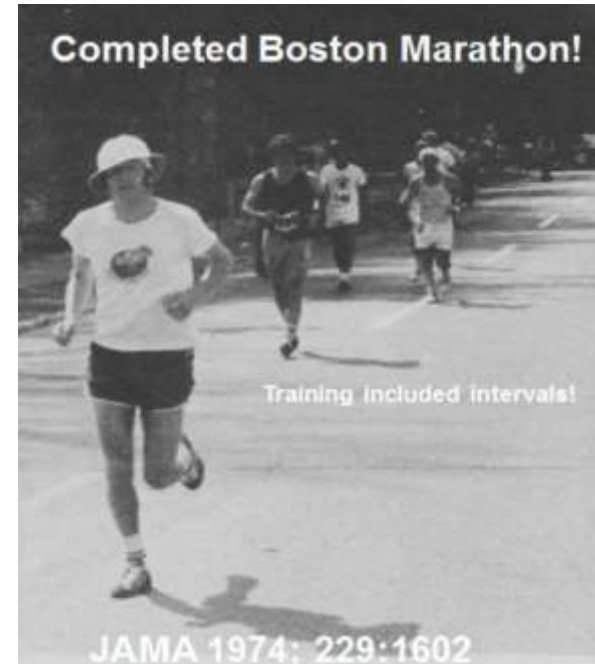


Dr. Paul D. White and former President Dwight D. Eisenhower at dinner of International Cardiology Foundation, Americana Hotel, New York City on October 29, 1963.

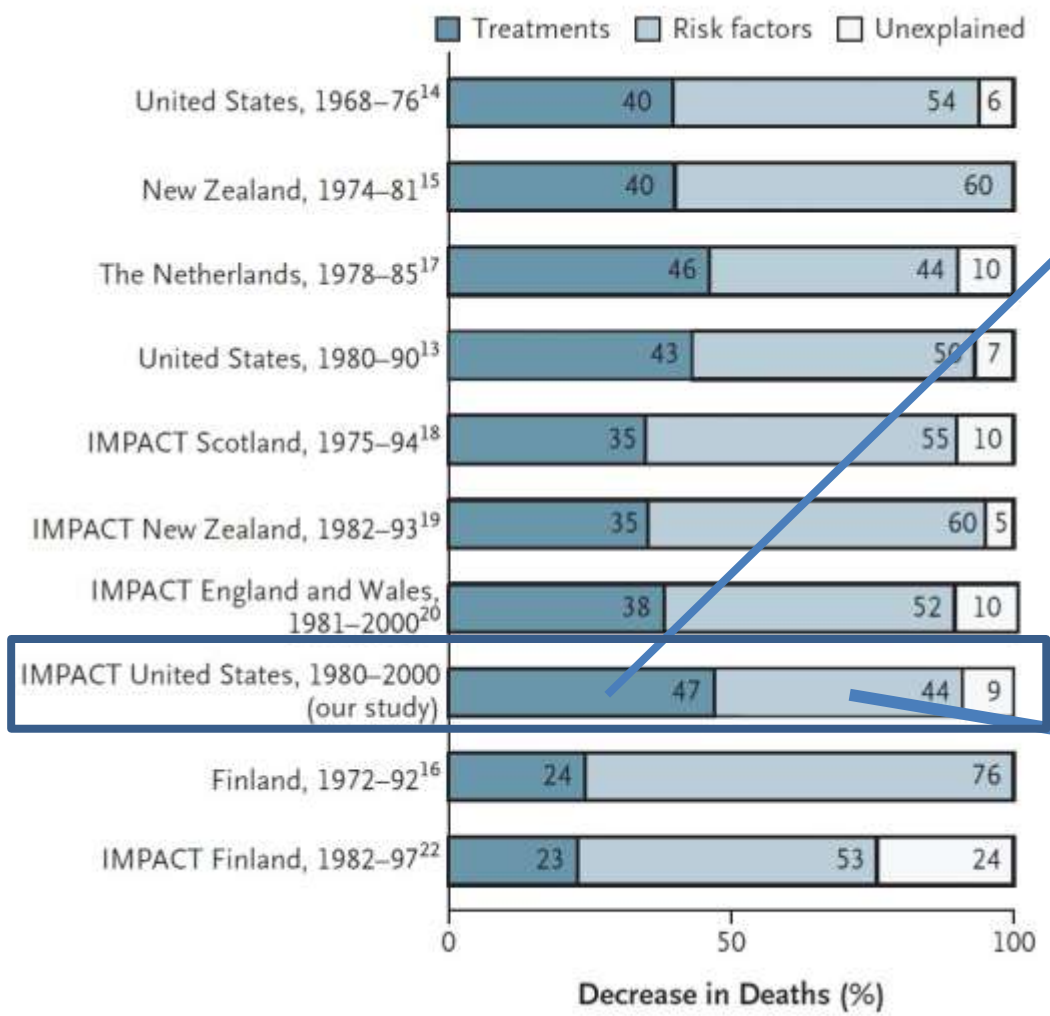
Served complete second term, died in 1969 at 79 years-old

Cardiac Rehabilitation History: Three turning points

- ▶ Three: Dr. Terry Kavanagh, Toronto Rehabilitation center
 - CR pioneer in Canada
 - Outpatient program started in late 1960's
 - Progressive walk-jog format for exercise training
 - Eight post-MI patients made history in the early 1970's



Explaining the decrease in US death from coronary disease, 1980-2000



47% from treatment

- Secondary prevention after MI or revascularization (11%)
- Initial treatment for MI or unstable angina (10%)
- Treatment for heart failure (9%)
- Revascularization for chronic angina (5%)
- Other therapy (12%)

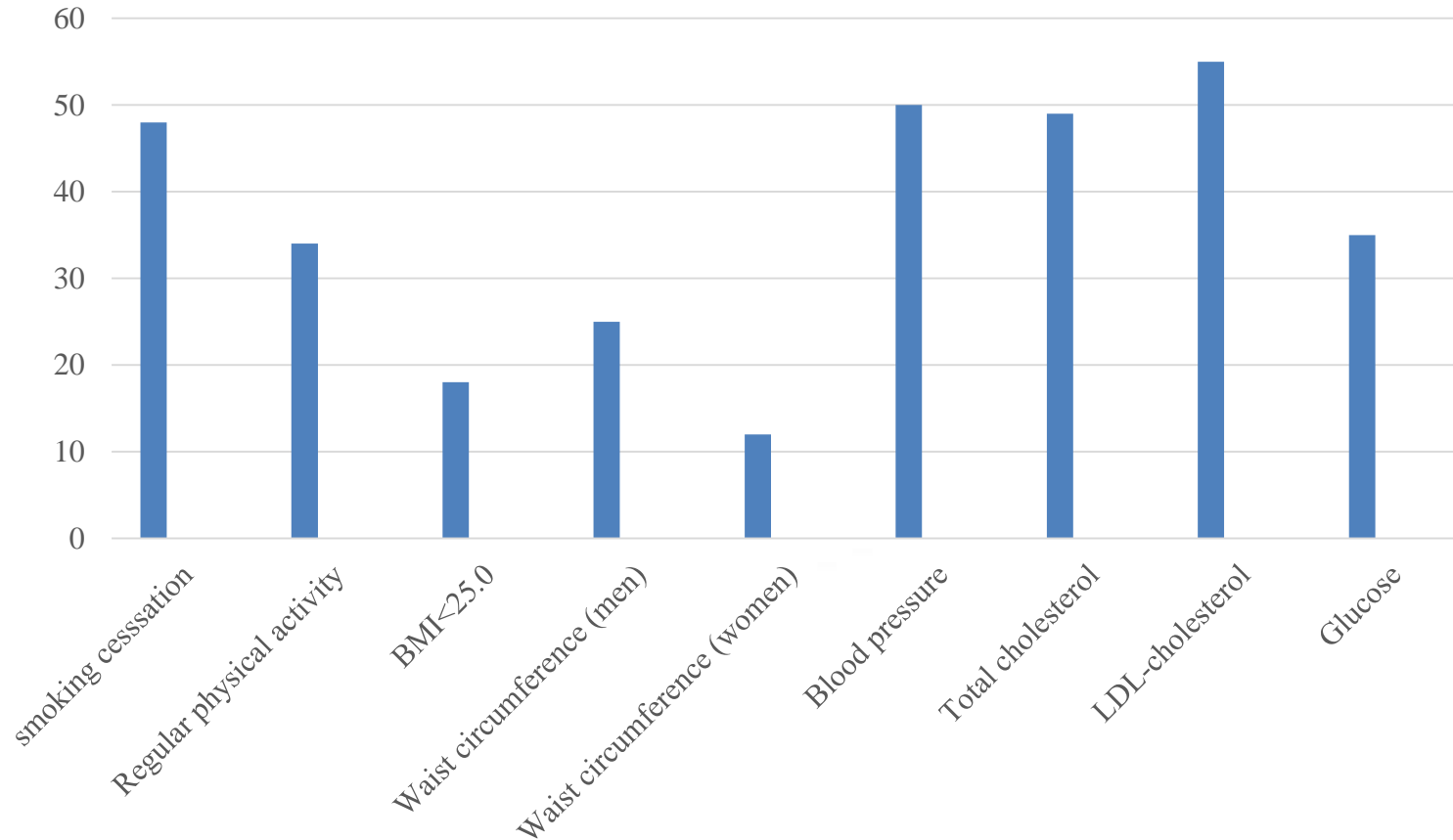
44% from risk factor modification

- Total cholesterol (24%)
- Systolic blood pressure (20%)
- Smoking (12%)
- Physical activity (5%)

Insufficient management of risk factors

EUROASPIRE I,II, III

Proportion at goal



EUROASPIRE
I: 1995-1996 (n=3180)
II: 1999-2000 (n=2975)
III: 2006-2007 (n=2392)

Core Components of Cardiac Rehab

AHA/AACVPR SCIENTIFIC STATEMENT

Core Components of Cardiac Rehabilitation/Secondary Prevention Programs: 2007 Update

A Scientific Statement From the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation

Gary J. Balady, MD, FAHA, Chair, Mark A. Williams, PhD, Co-chair, Philip A. Ades, MD, Vera Bittner, MD, FAHA, Patricia Comoss, RN, Jo Anne M. Foody, MD, FAHA, Barry Franklin, PhD, FAHA, Bonnie Sanderson, RN, PhD, and Douglas Southard, PhD, MPH, PA-C

- Patient assessment
- Nutritional counseling
- Lipid management
- Blood pressure management
- Weight management
- Diabetes management
- Tobacco cessation
- Psychosocial management
- Physical activity counseling
- Exercise training

2011 ACC/AHA guideline for CABG

PRACTICE GUIDELINE

4.9. Cardiac Rehabilitation

CLASS I

1. Cardiac rehabilitation is recommended for all eligible patients after CABG (299–301, 301a–301d). (Level of Evidence: A)

Society of Cardiol

299. Engblom E, Korpilahti K, Hamalainen H, et al. Quality of life and return to work 5 years after coronary artery bypass surgery. Long-term results of cardiac rehabilitation. *J Cardiopulm Rehabil.* 1997; 17:29–36.
300. Hansen D, Dendale P, Leenders M, et al. Reduction of cardiovascular event rate: different effects of cardiac rehabilitation in CABG and PCI patients. *Acta Cardiol.* 2009;64:639–44.
301. Milani RV, Lavie CJ. The effects of body composition changes to observed improvements in cardiopulmonary parameters after exercise training with cardiac rehabilitation. *Chest.* 1998;113:599–601.

2011 ACC/AHA guideline for PCI

ACCF/AHA/SCAI Practice Guideline

6.4.3. Cardiac Rehabilitation: Recommendation

Class I

- 1. Medically supervised exercise programs (cardiac rehabilitation) should be recommended to patients after PCI, particularly for moderate- to high-risk patients for whom supervised exercise training is warranted.^{796–804} (*Level of Evidence: A*)**

ACC/AHA Practical Guidelines

Patient Group	Recommendation	Evidence
CABG	1	A
STEMI	1	B
Unstable Angina/NSTEMI	1	B
Chronic Stable Angina/IHD	1	A
Heart Failure	1	B (IIa*)
CVD in Women	1	B
PCI	1	A
PAD	1	A

ICD - pending

CABG: JACC 2011;58:e123-e210

STEMI: JACC 2013;61:e78-e140

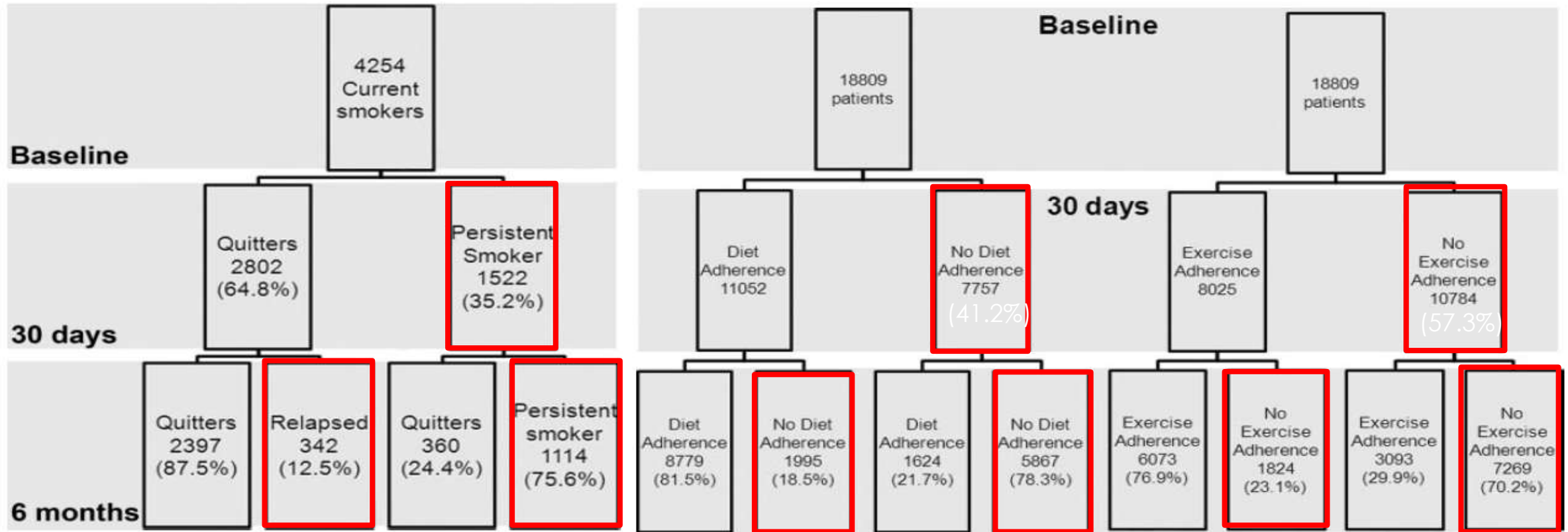
UA/NSTEMI: JACC 2014; epub ahead of print:doi:10.1016/j.jacc.2014.09.017

CSA/IHD: JACC 2012;60(24):2564-2603

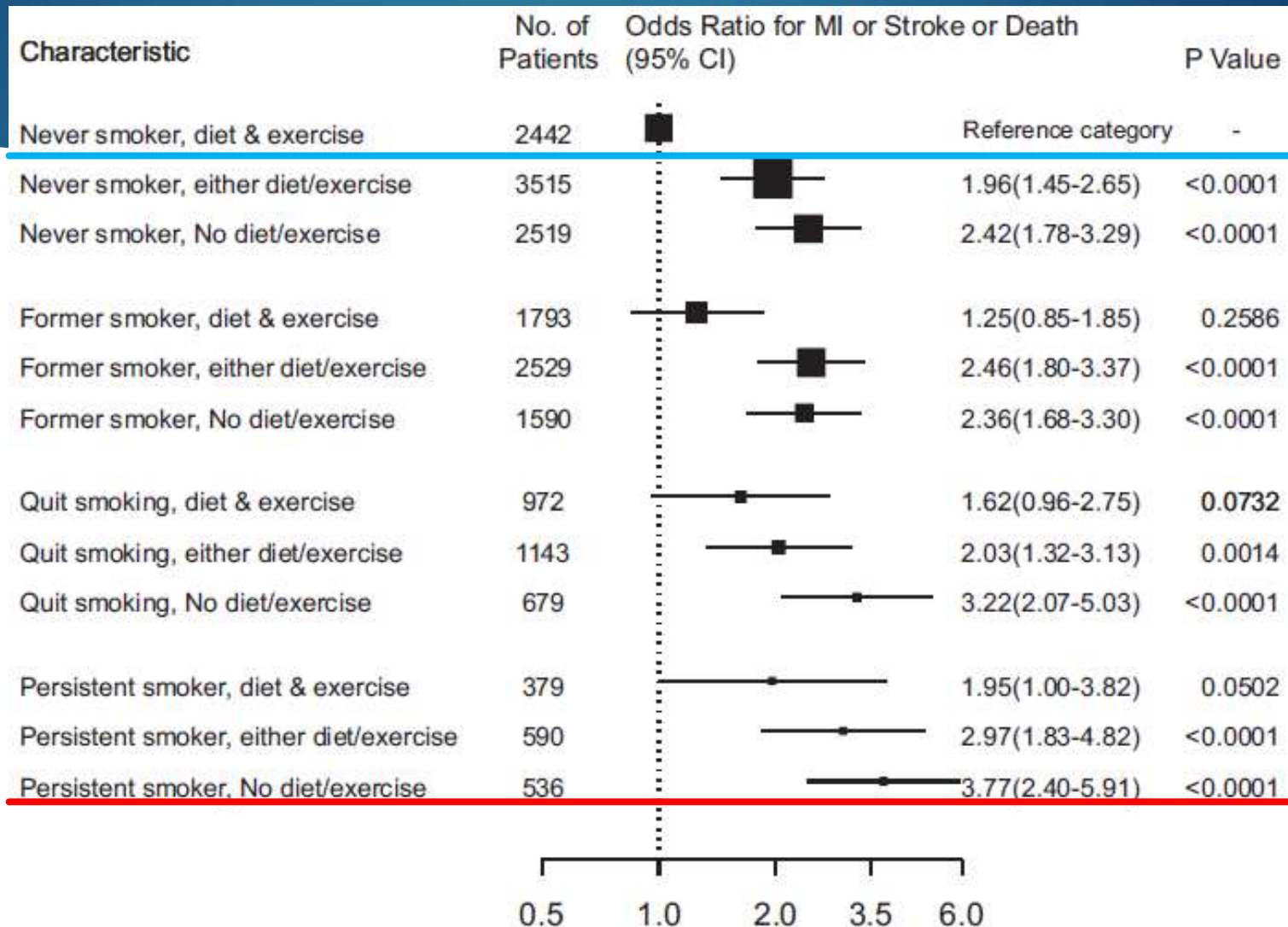
HF: JACC 2013;62(16):e147-e239

Association of Risk factor modification early after Acute Coronary Syndrome

- ▶ 18,809 patients (41 countries)
- ▶ OASIS 5 randomized trial



Acute Coronary Syndrome



After PCI

2,395 consecutive patients in Minnesota (Mayo Clinic)
Between 1994 and 2008

Propensity score-matched analysis

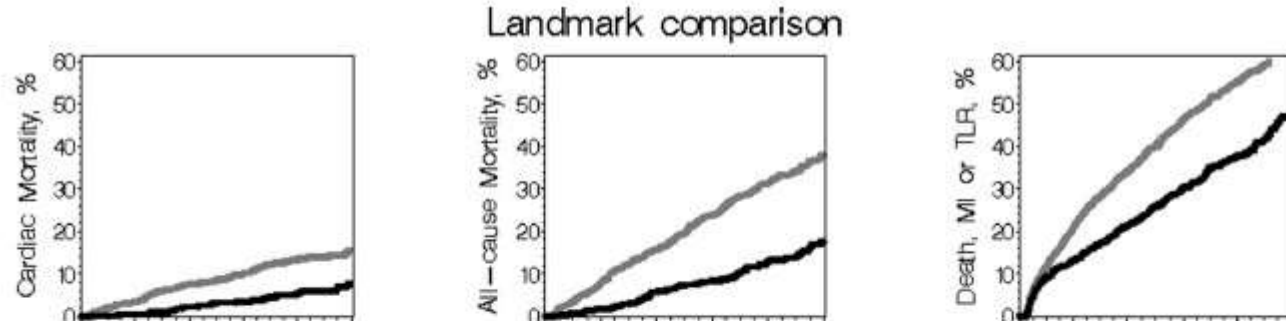
Propensity score stratification

Regression adjustment with propensity score in a 3-month landmark analysis

Median **6.3** years

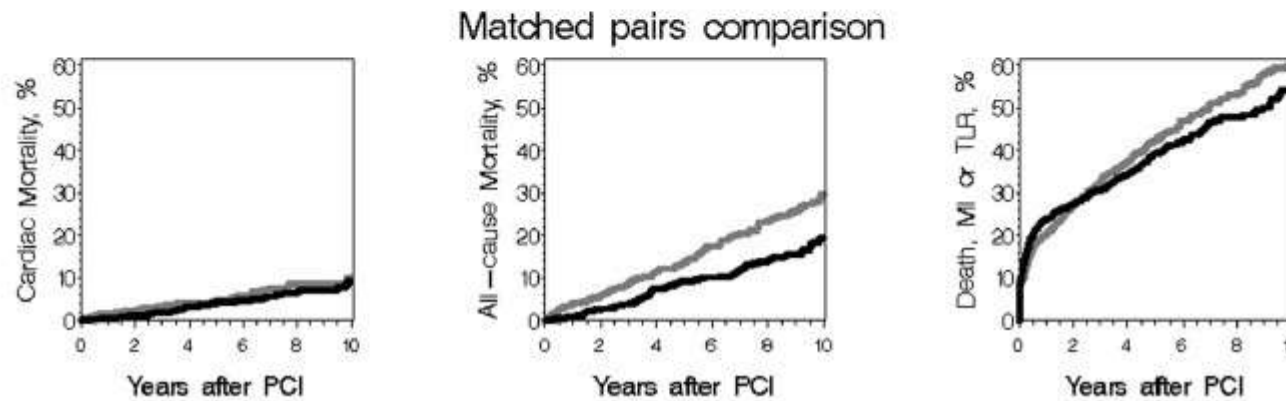
CR participation : 40% of patients

After PCI



Relative mortality reduction (47%)

Cardiac Rehab 785 630 527 377 250 131 Cardiac Rehab 785 630 527 377 250 131 Cardiac Rehab 785 552 432 278 167 82



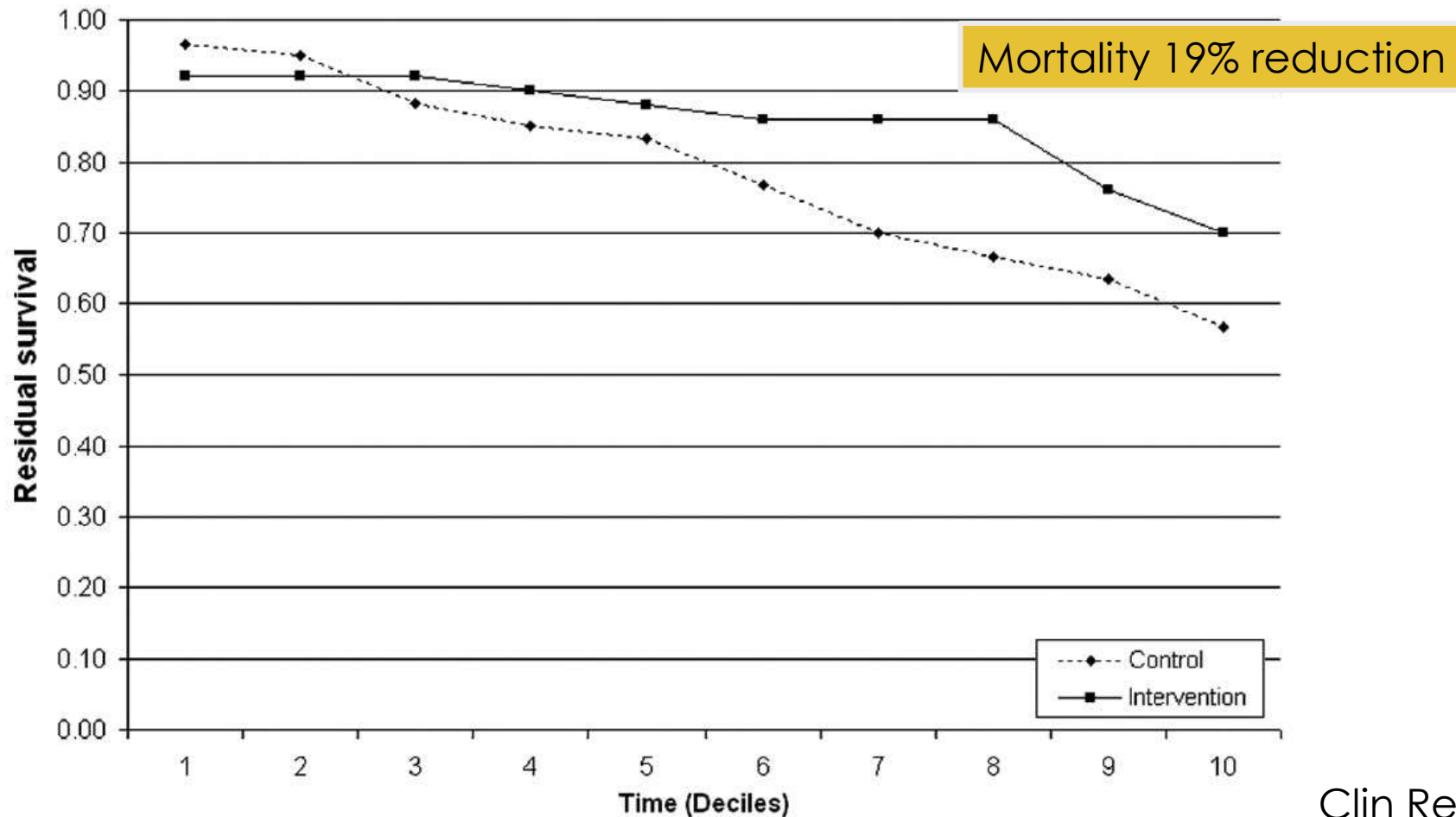
Post-CABG (Dutch Registry)

- ▶ 35919 patients with an ACS and/or coronary revascularization or valve surgery
- ▶ 11014 (30.7%) received CR

	Month 6–12 Adjusted hazard ratio (95% CI)	Month 6–24 Adjusted hazard ratio (95% CI)	Month 6–48 Adjusted hazard ratio (95% CI)
Full cohort	0.50** (0.37–0.67)	0.58** (0.48–0.71)	0.65** (0.56–0.77)
Age ≤70	0.48** (0.29–0.78)	0.52** (0.38–0.72)	0.60** (0.45–0.78)
Age >70	0.50** (0.34–0.73)	0.63** (0.50–0.79)	0.68** (0.56–0.83)
Male	0.45** (0.31–0.64)	0.55** (0.44–0.70)	0.62** (0.51–0.74)
Female	0.71 (0.41–1.24)	0.67* (0.45–0.98)	0.79 (0.58–1.08)
CABG/valve surgery	0.43** (0.26–0.71)	0.54** (0.38–0.75)	0.55** (0.42–0.74)
No CABG/valve surgery	0.58** (0.40–0.84)	0.62** (0.49–0.79)	0.71** (0.58–0.86)
ACS	0.55** (0.39–0.77)	0.61** (0.48–0.76)	0.68** (0.57–0.82)
No ACS	0.42** (0.23–0.74)	0.52** (0.36–0.76)	0.57** (0.41–0.79)

Pre-CABG

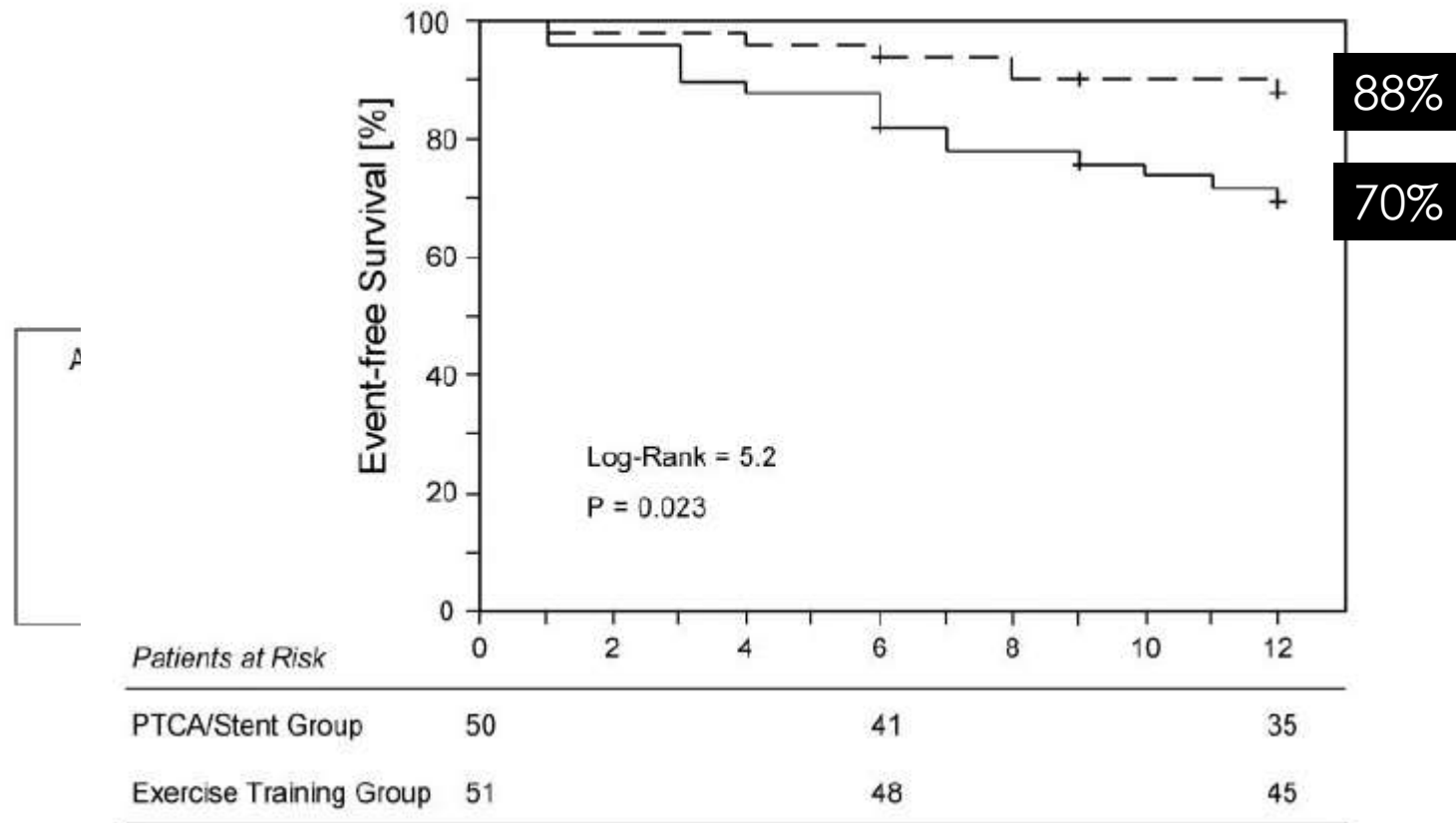
- ▶ Patient mortality in the 12 years following enrolment into a pre-surgical cardiac rehabilitation program.



Stable Angina

1 native coronary artery stenosis of 75% by visual assessment amenable to PCI

Clinical events: stroke, target vessel revascularization, PCI of a de novo lesion, or CABG

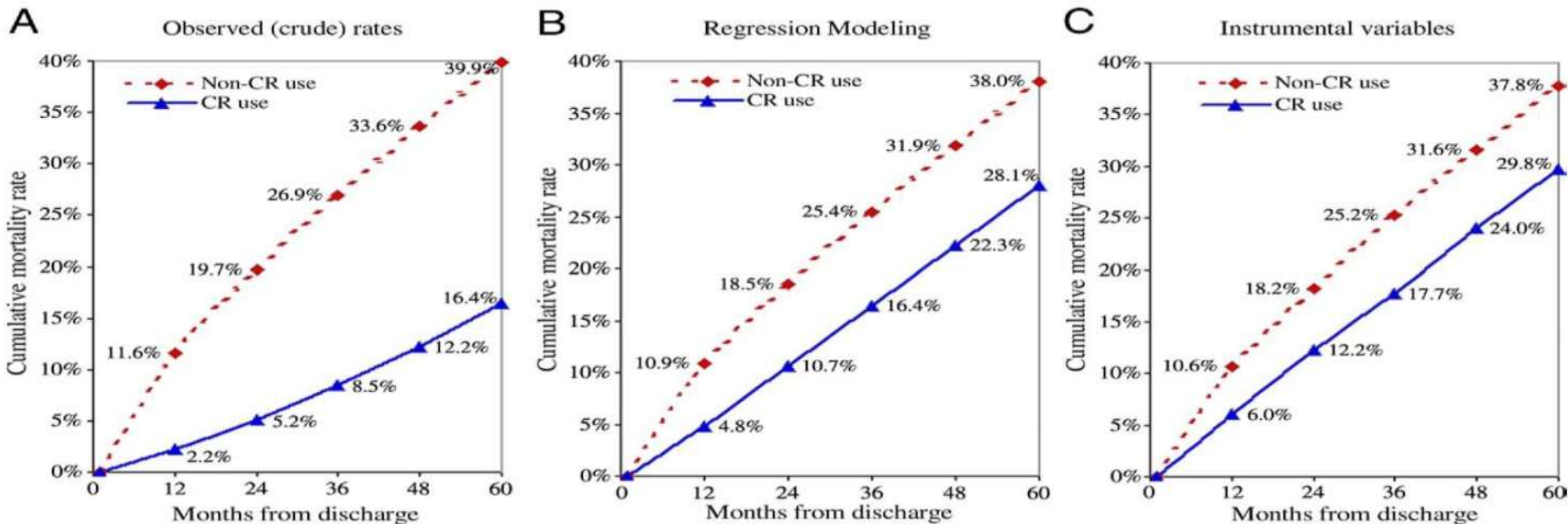


Cardiac Rehabilitation in practice

601,099 U.S. Medicare beneficiaries

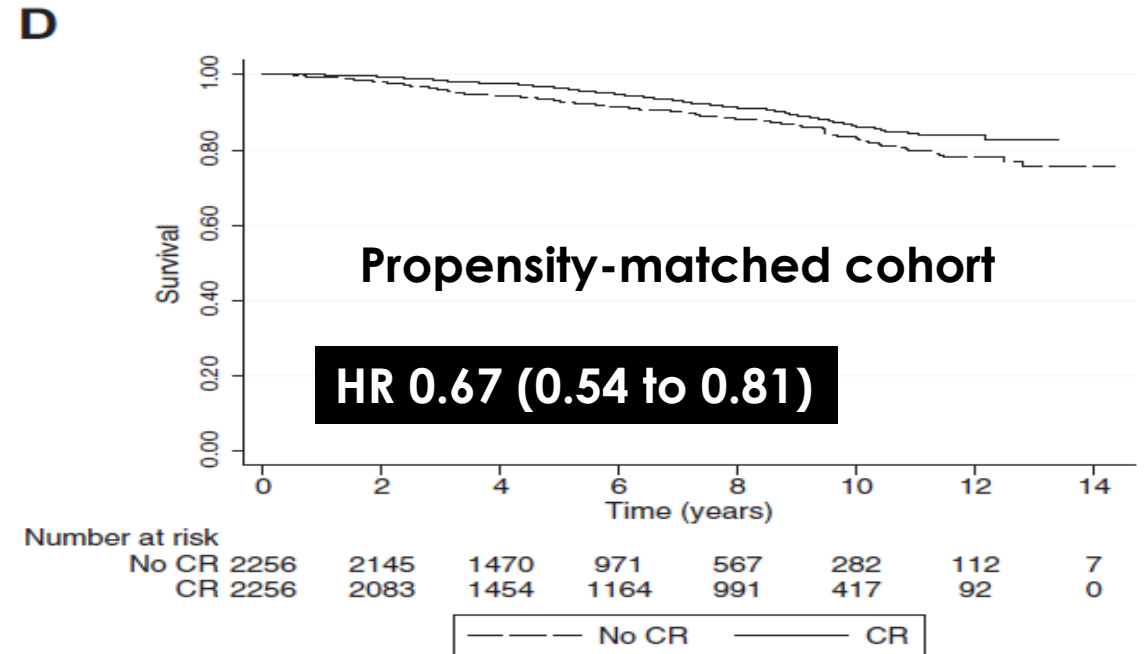
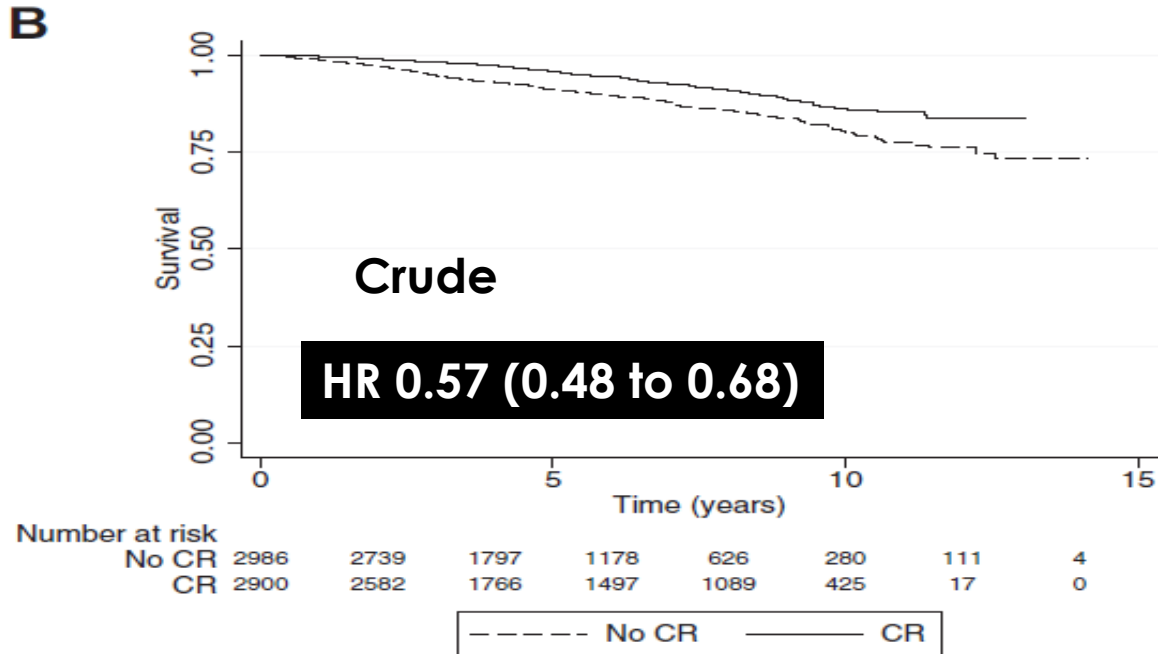
Only 12.2% of the cohort used CR, and those users averaged 24 sessions

1- to 5-year mortality rates



Cardiac Rehabilitation in practice

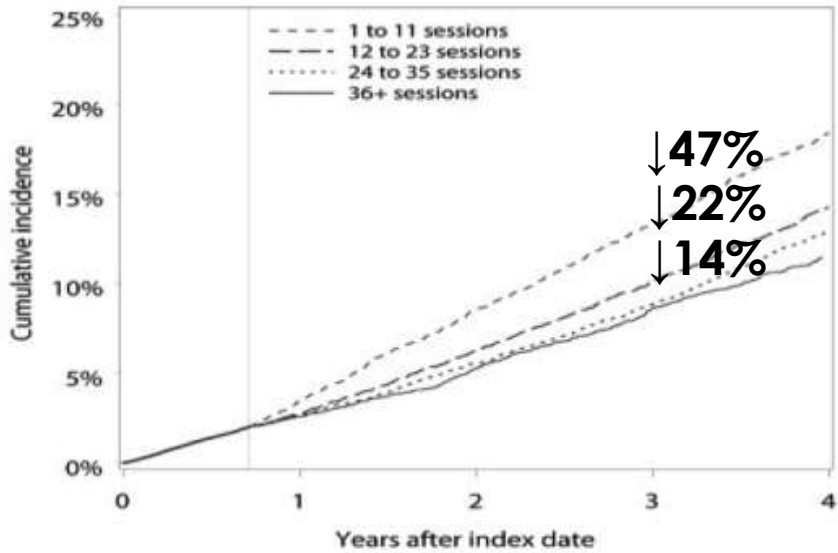
Prospective cohort study of 5886 subjects in coronary artery disease
2900 (49.3%) completed the program [Canada, Calgary.](#)



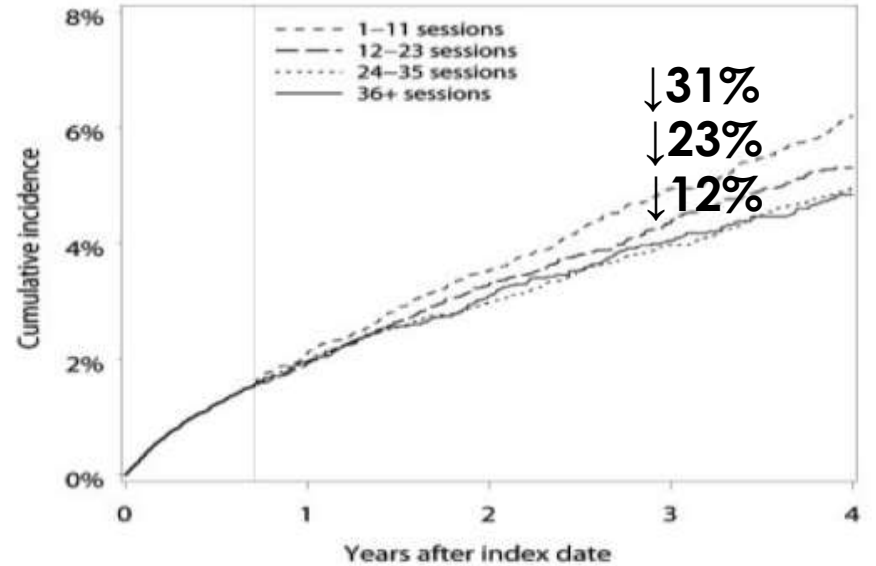
The “dose” of Cardiac Rehabilitation

Death

MI



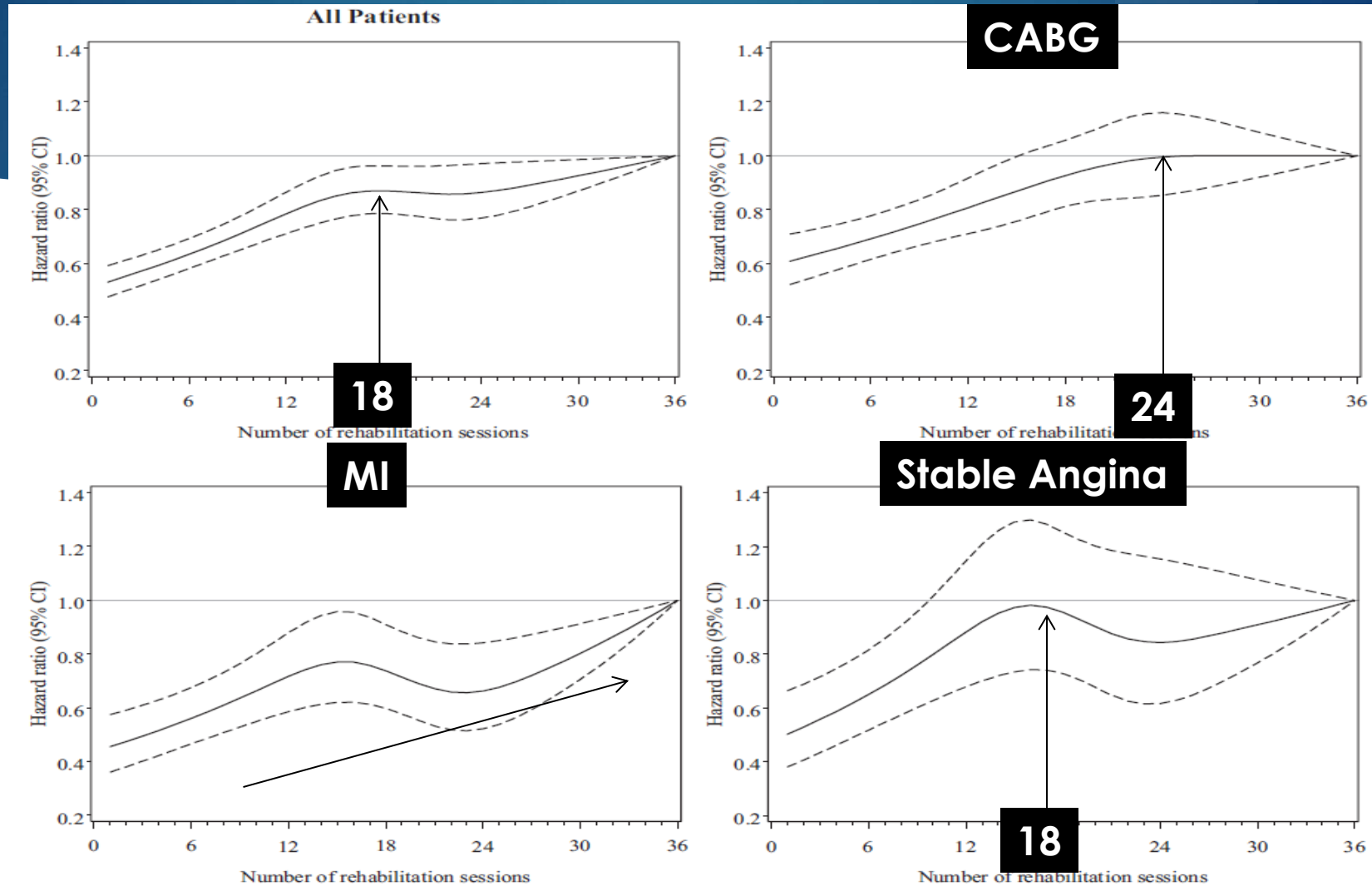
No. at risk	0	1	2	3	4
Overall	30,161				
1 to 11 sessions		5937	4883	3865	2859
12 to 23 sessions		6933	5716	4427	3223
24 to 35 sessions		10,978	8955	6905	4885
36 sessions		5465	4513	3523	2481



No. at risk	0	1	2	3	4
Overall	30,161				
1 to 11 sessions		5693	4573	3572	2582
12 to 23 sessions		6695	5406	4113	2943
24 to 35 sessions		10,708	8546	6516	4514
36 sessions		5314	4286	3297	2271

Dose-response relationship !!

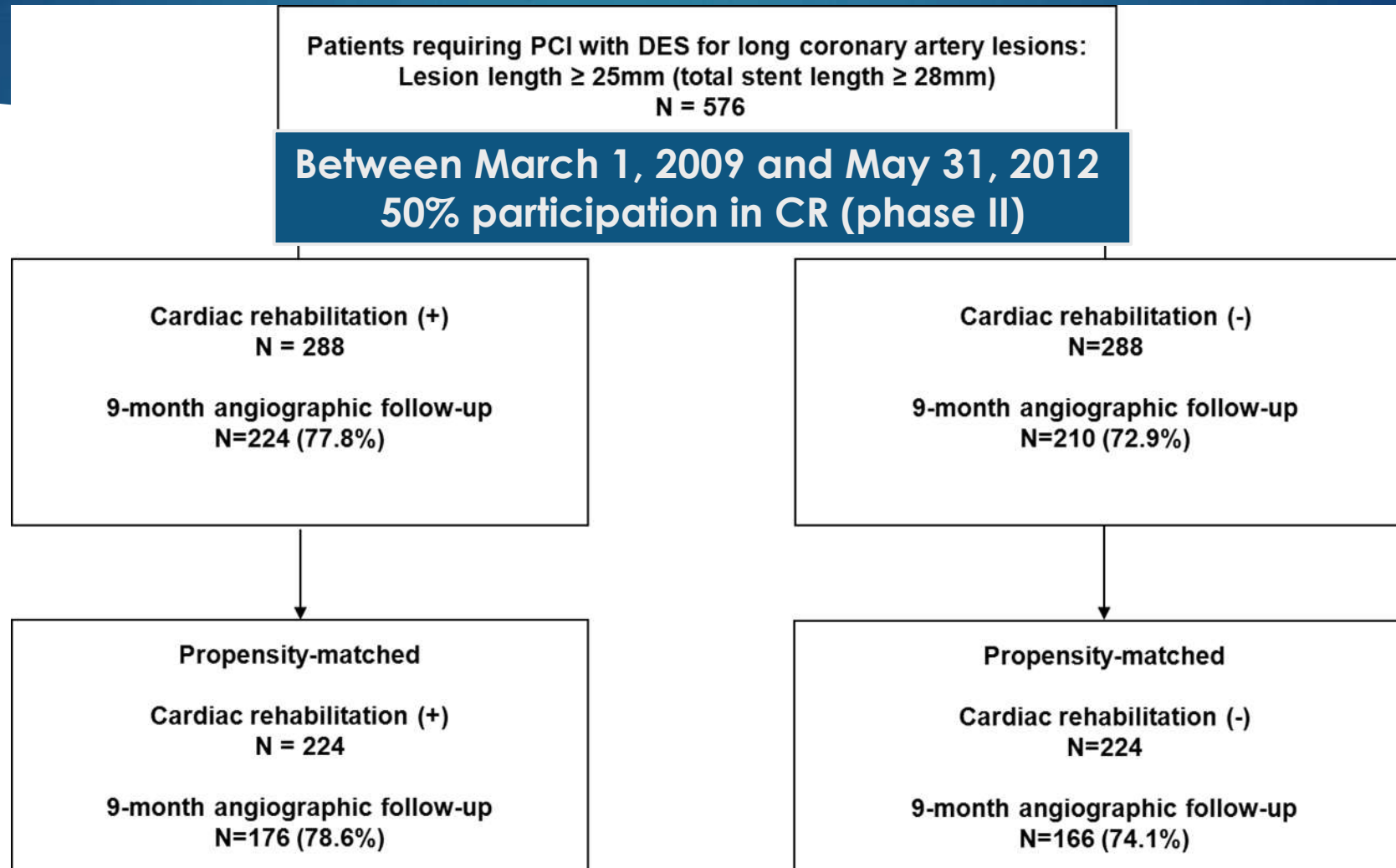
The "dose" of Cardiac Rehabilitation



From efficacy to effectiveness

	Reduction in mortality	Adherence of therapy
Aspirin	20-25%	86-93%
Beta-blockers	20-30%	66-82%
ACE inhibitor	20%	45-71%
Statin	22-35%	58-78%
Cardiac Rehabilitation	25-40%	15-20%

Impact of Cardiac Rehabilitation on Angiographic Outcomes after Drug-eluting Stents in Patients with *De Novo* Long Coronary Artery Lesions

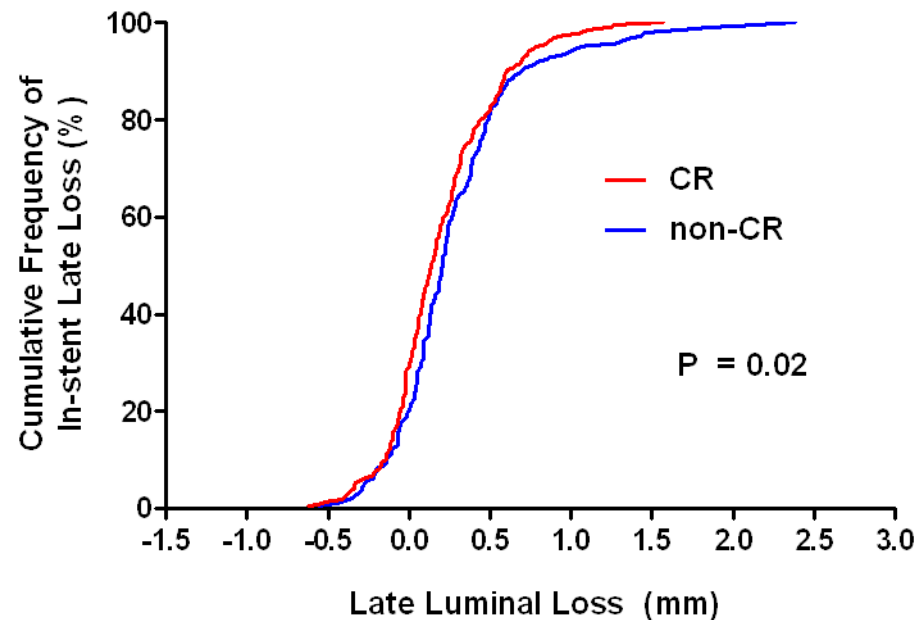


Results on angiographic outcomes after CR

Characteristics	Crude			Propensity-matched		
	Cardiac rehabilitation (288 Patients)	Non-cardiac re habilitation (288 Patients)	P	Cardiac rehabilitation (224 Patients)	Non-cardiac re habilitation (224 Patients)	P
Follow-up at 9 months, no. eligible patients (%)	224 (77.8%)	210 (72.9%)	0.21	176 (78.6)	166 (74.1)	0.26
Late luminal loss (mm)						
In-segment	0.11±0.33	0.17±0.43	0.08	0.10±0.33	0.17±0.46	0.09
In-stent (primary endpoint)	0.19±0.33	0.29±0.45	0.02	0.18±0.31	0.28±0.47	0.02
Proximal margin	0.18±0.46	0.22±0.42	0.45	0.19±0.48	0.21±0.41	0.69
Distal margin	0.06±0.27	0.08±0.33	0.61	0.06±0.28	0.07±0.35	0.70
Angiographic restenosis						
In-segment	12 (5.3%)	14 (6.6%)	0.48	8 (4.5%)	11 (6.6%)	0.47
In-stent	8 (3.5%)	12 (5.7%)	0.24	5 (2.8%)	11 (6.6%)	0.12
Proximal margin	4 (1.8%)	3 (1.4%)	0.82	4 (2.3%)	1 (0.6%)	0.37
Distal margin	1 (0.5%)	2 (0.9%)	0.60	1 (0.6%)	1 (0.6%)	0.99

Impact on Stented Segments

35% relative reduction in late lumen loss



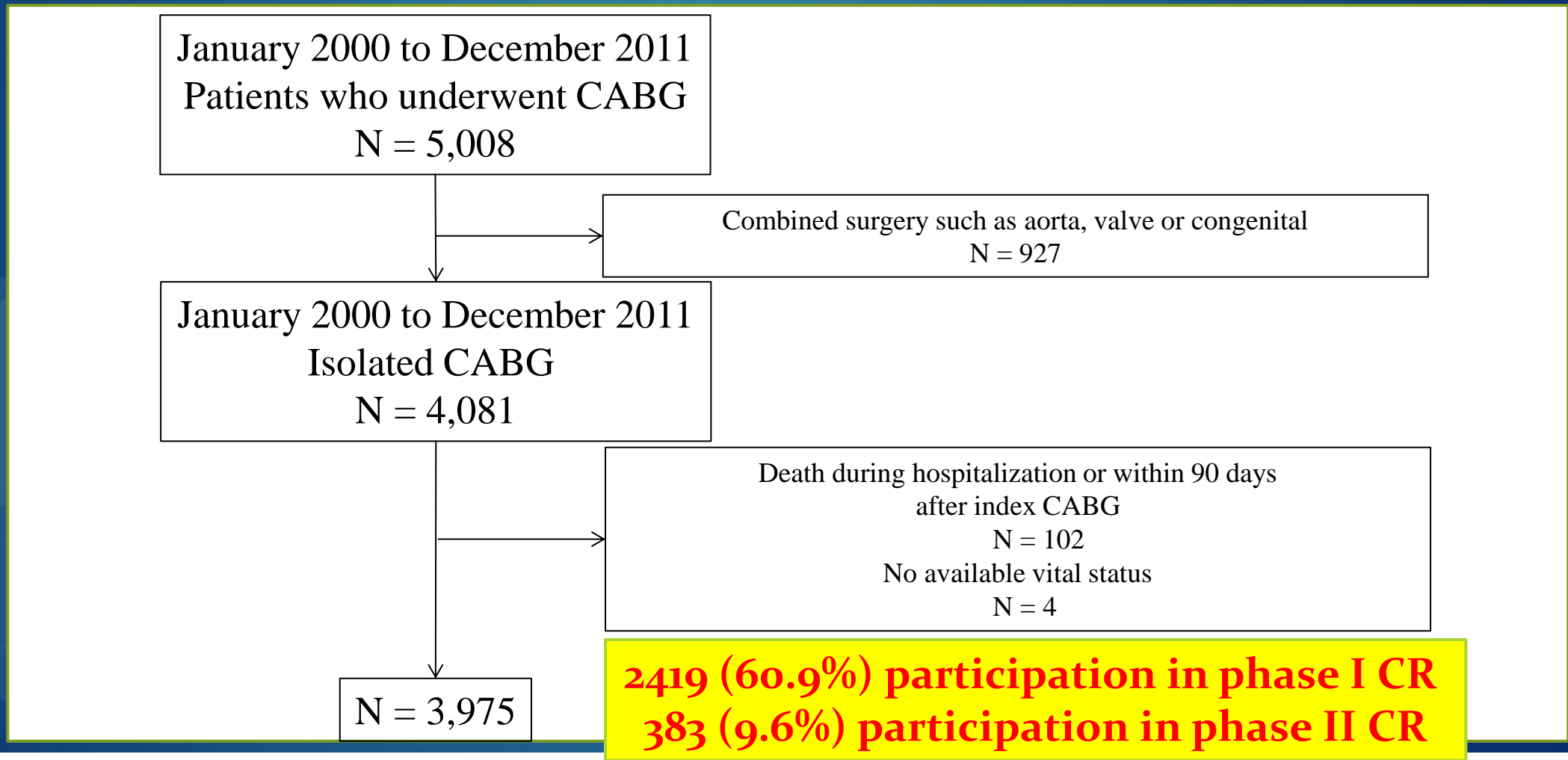
Difference, 0.10 mm; 95% confidence interval, 0.02 to 0.18; P=0.02

Outpatient cardiac rehab after PCI with DES for long lesions reduces in-stent late lumen loss while improving patient risk profile.

Results in physical & biochemical variables

Clinical Outcomes	Change¶	P
	Difference (95% CI)*	
Current smoking	-7.59 (-12.62, -2.56)	0.046
Total cholesterol (mg/dL)	-6.58 (-13.77, 0.60)	0.072
Triglyceride (mg/dL)	-11.71 (-24.05, 0.64)	0.063
HDL-cholesterol (mg/dL)	2.10 (0.48, 3.71)	0.011
LDL-cholesterol (mg/dL)	-1.47 (-7.42, 4.49)	0.629
hsCRP (mg/dL)	-0.08 (-0.16, 0.00)	0.042
HbA1C (%)	-0.93 (-1.47, -0.38)	0.001
Depression, moderate to severe	-11.16 (-17.41, -4.91)	<0.001
Body weight (kilograms)	-0.10 (-1.02, 0.82)	0.831
Obesity (body mass index >25)	-10.27 (-15.29, -5.24)	<0.001
VO₂max (ml/kg/min)	1.47±4.96	<0.001

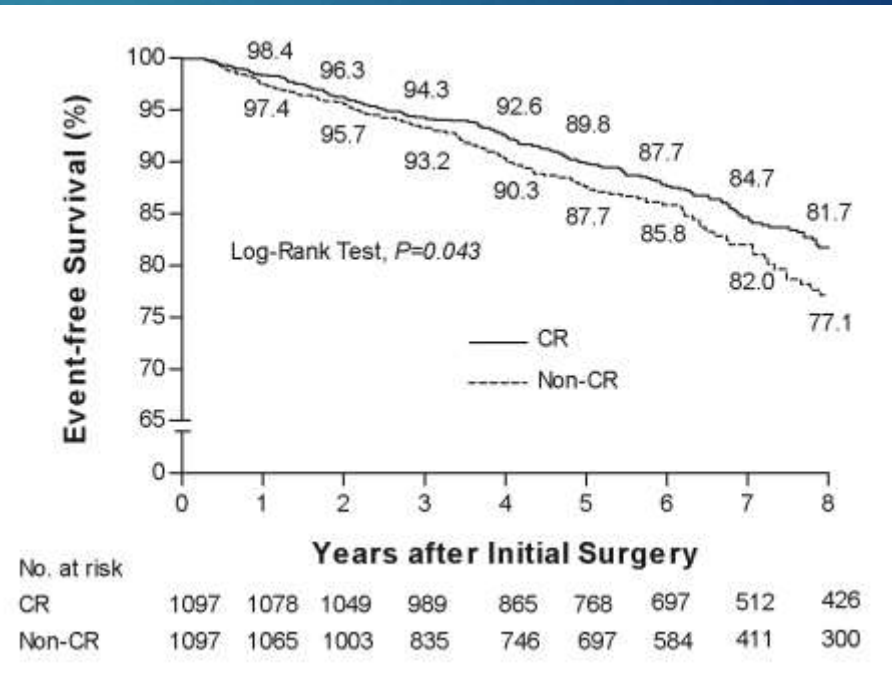
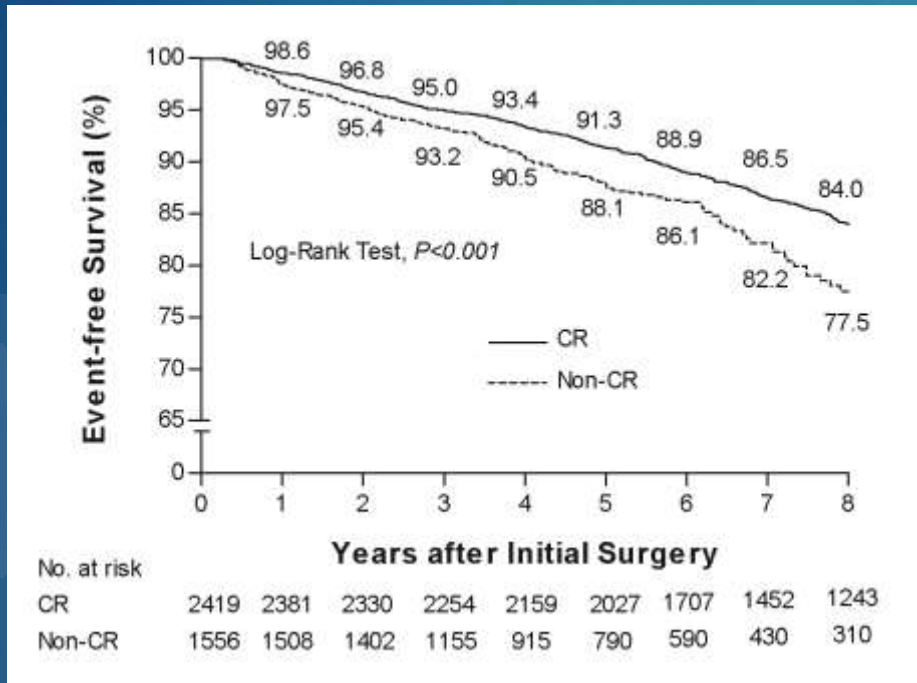
Impact of Participation in Cardiac Rehab After Coronary Artery Bypass Graft Surgery



Impact of Participation in phase I CR for all-cause mortality

Crude cohort

Propensity-matched cohort



Multivariate adjusted HR 0.77 (0.64 to 0.93)

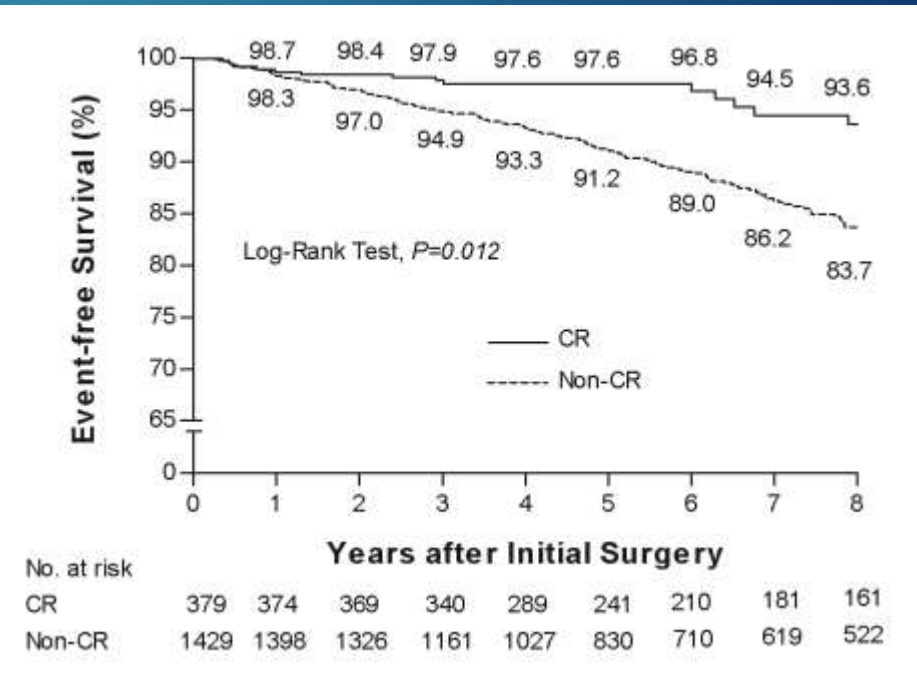
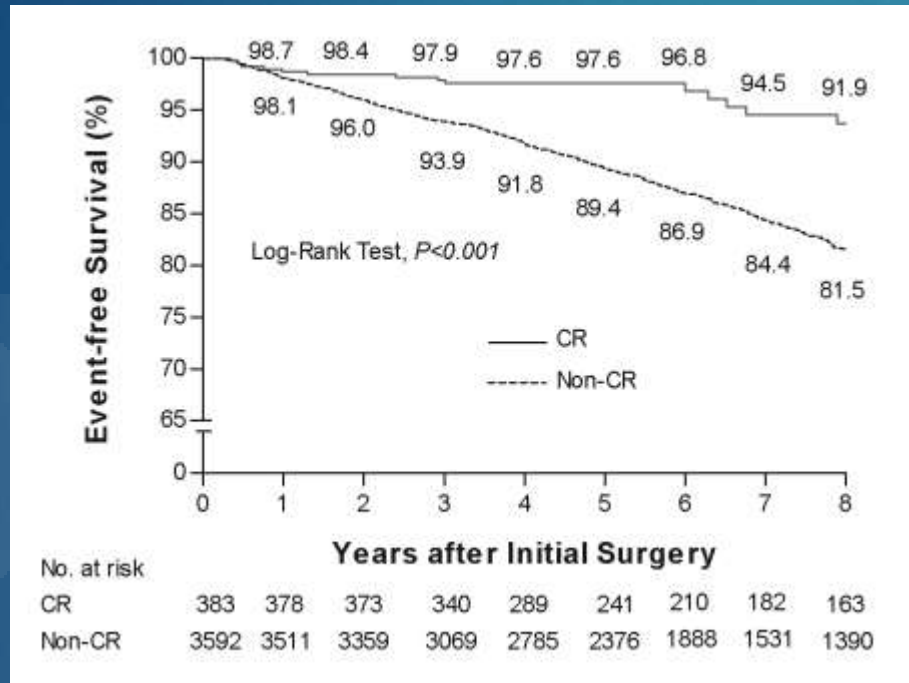
HR 0.80 (0.64 to 0.98)

20% of mortality reduction in phase I cardiac rehab

Impact of Participation in phase II CR for all-cause mortality

Crude cohort

Propensity-matched cohort



Multivariate adjusted HR 0.57 (0.39 to 0.84)

HR 0.60 (0.40 to 0.90)

40% of mortality reduction in phase II cardiac rehab

Conclusions

- ▶ Cardiac Rehabilitation Programs are still underutilized in real practice.
- ▶ Cardiac Rehabilitation Program showed beneficial clinical outcomes, especially in mortality, in patients with ischemic heart disease.
- ▶ Even with dramatic improvement in PCI or CABG,
Comprehensive Cardiac Rehabilitation Program must be implemented for care.