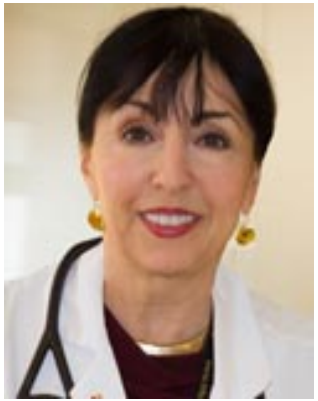
Cardiac Rehab: Does it still work today?

- **Ileana L. Piña, MD, MPH**
- Professor of Medicine, Epidemiology and Population Health
- Albert Einstein College of Medicine
- Associate Chief of Cardiology for Academic Affairs
- Montefiore-Einstein Medical Center
- Bronx, NY
- Senior Staff Fellow FDA, CDRH

Meet Our Presenter:



Ileana L. Piña MD, MPH, FAHA, FACC
Professor of Medicine & Epidemiology and Population Health
Albert Einstein College of Medicine
Associate Chief for Academic Affairs
Division of Cardiology
Staff Heart Failure/Transplant
Montefiore Medical Center

Effects Of Immobilization

- Loss of muscle mass (20-25%)
  - contractile strength
  - Loss of ventilatory muscle, Drop in vital capacity
- Postural changes --response to circulating catecholamines
- Malnutrition and negative nitrogen balance in advanced HF
- Change in peripheral muscle in HF + deconditioning

Potential Benefits of Exercise

Anti-atherosclerotic

Improved lipids
Lower BP's
Reduced adiposity
↑ Insulin sensitivity
↓ Inflammation

Anti-thrombotic

↓ Platelet adhesiveness
↑ Fibrinolysis
↓ Fibrinogen
↓ Blood viscosity

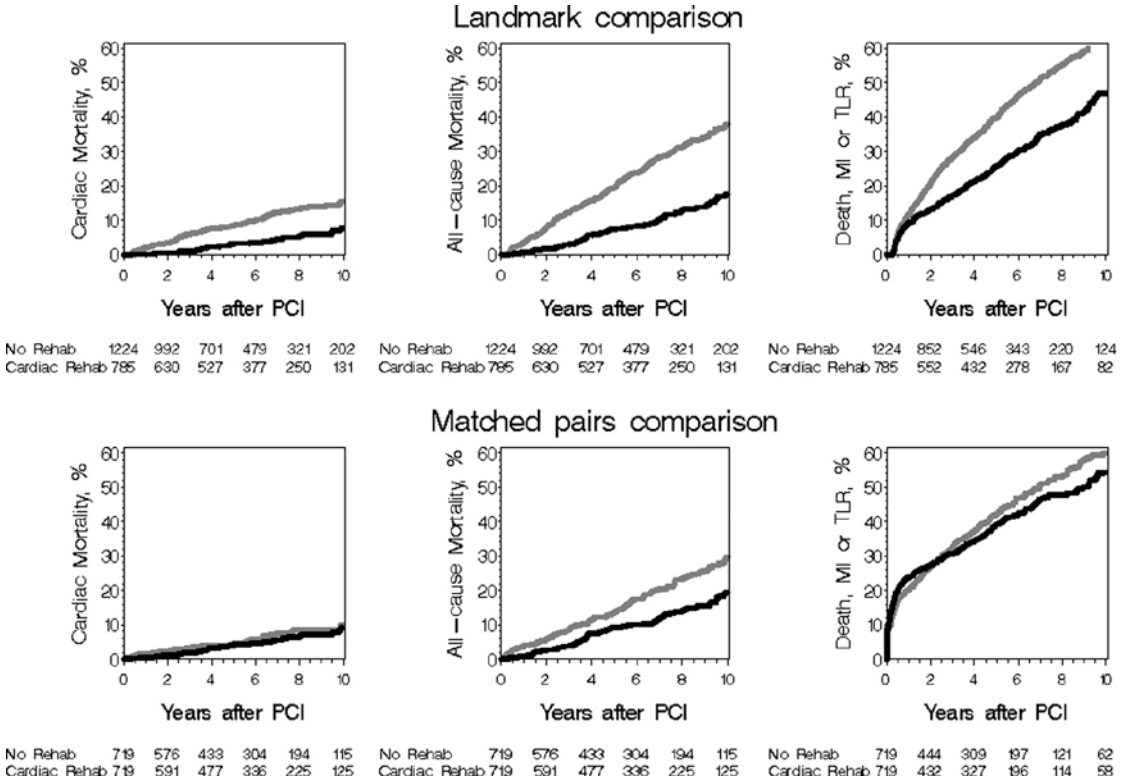
Anti-ischemic

↓ Myocardial O2 demand
↑ Coronary flow
↓ Endothelial dysfunction

Anti-arrhythmic

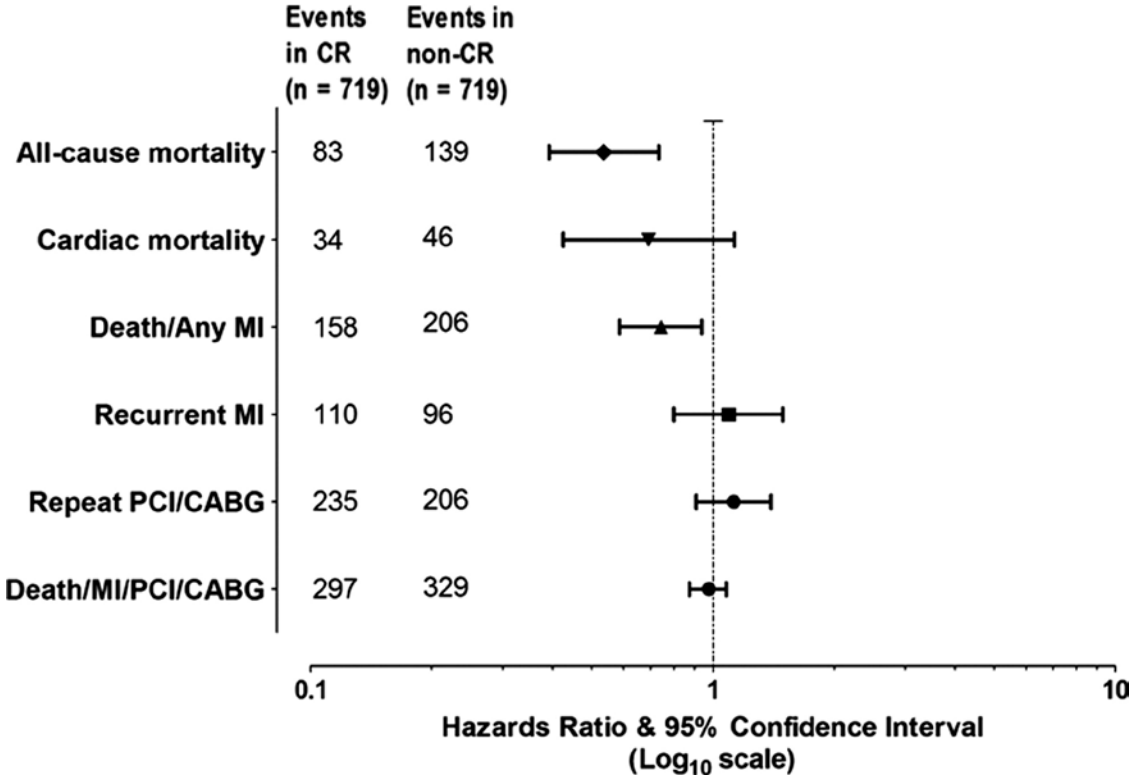
↑ Vagal tone
↓ Adrenergic activity

Kaplan–Meier curves showing the association between cardiac rehabilitation (CR) participation and outcomes.



Kashish Goel et al. Circulation. 2011;123:2344-2352

Association between cardiac rehabilitation (CR) participation and mortality in the propensity score–matched groups.



Kashish Goel et al. Circulation. 2011;123:2344-2352

2014 ACC/AHA/AATS/PCNA/SCAI/STS Focused Update Incorporated Into the 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease

Treatment

Physical Activity

Physical Activity

For all patients, the clinician should encourage 30 to 60 minutes of moderate-intensity aerobic activity, such as brisk walking, at least 5 days and preferably 7 days per week, supplemented by an increase in daily lifestyle activities (e.g., walking breaks at work, gardening, household work) to improve cardiorespiratory fitness and move patients out of the least-fit, least-active, high-risk cohort (bottom 20%).

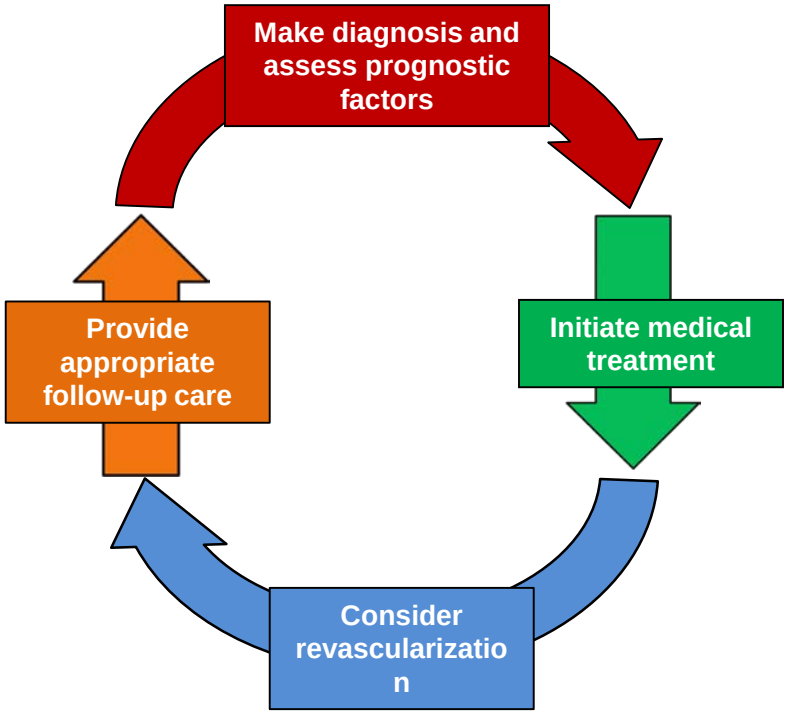
For all patients, risk assessment with a physical activity history and/or an exercise test is recommended to guide prognosis and prescription.

Physical Activity (cont.)

Medically supervised programs (cardiac rehabilitation) and physician-directed, home-based programs are recommended for at-risk patients at first diagnosis.

It is reasonable for the clinician to recommend complementary resistance training at least 2 days per week.

Diagnosis and management of patients with stable ischemic heart disease

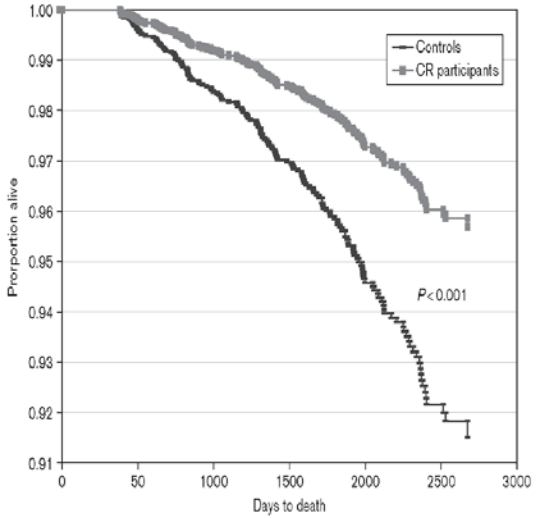


Mancini GBJ, Gosselin G, et al., *Can J Cardiol* 2014

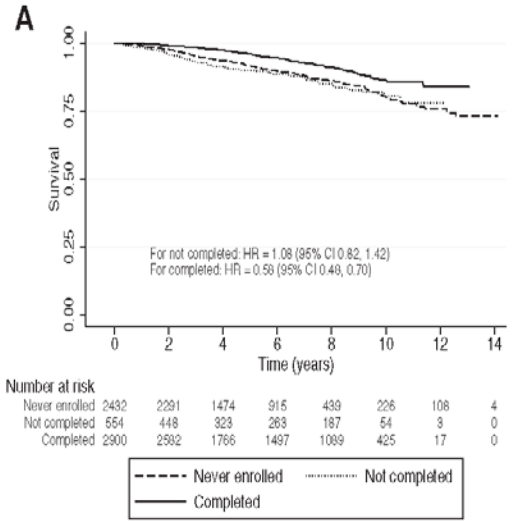
Provision of Appropriate Clinical Follow-Up

Recommendation 2

- Patients with Stable Ischemic Heart Disease
  - Cardiac Rehabilitation Referral



European Journal of Cardiovascular Prevention and Rehabilitation 2009, 16:102–113



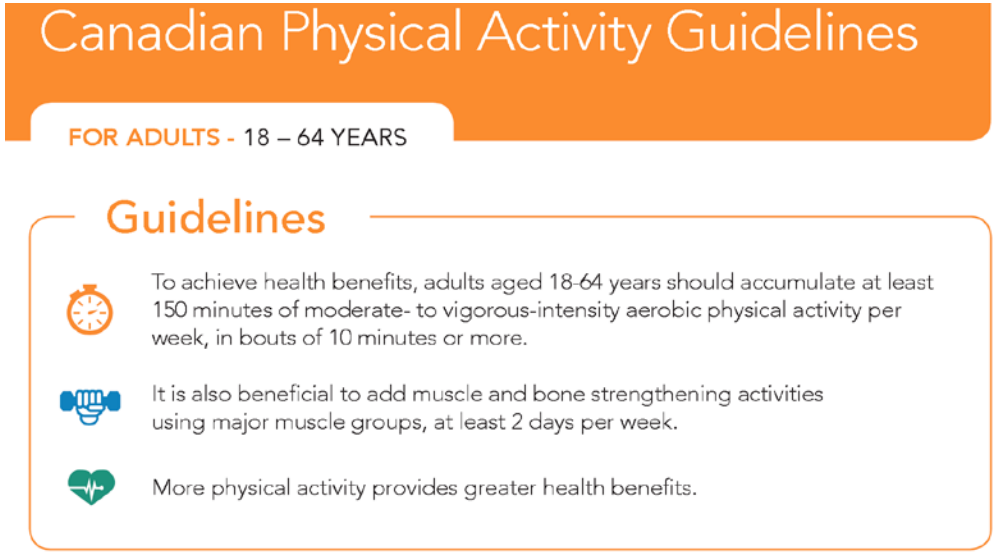
Circulation. 2012;126:677-687

Mancini GBJ, Gosselin G, et al., *Can J Cardiol* 2014

Provision of Appropriate Clinical Follow-Up

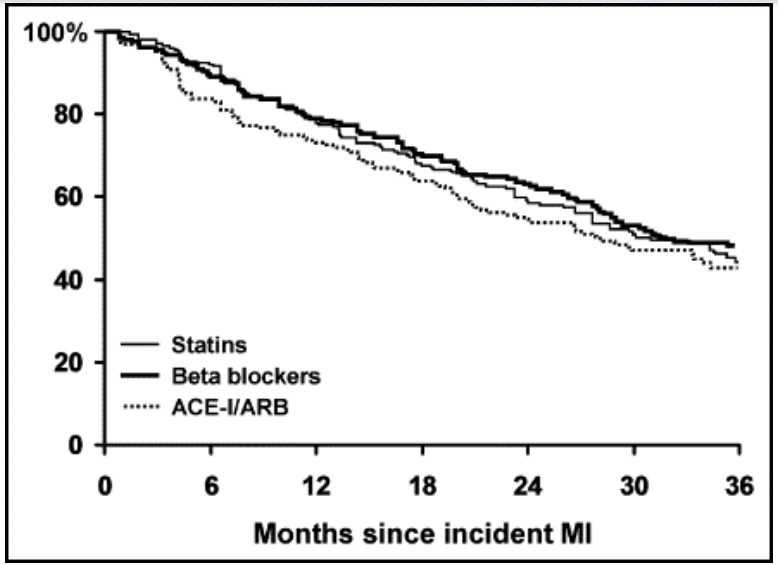
Recommendation 3

- Patients with Stable Ischemic Heart Disease
  - Moderate-Vigorous Physical Activity



Mancini GBJ, Gosselin G, et al., *Can J Cardiol* 2014

Medication Adherence

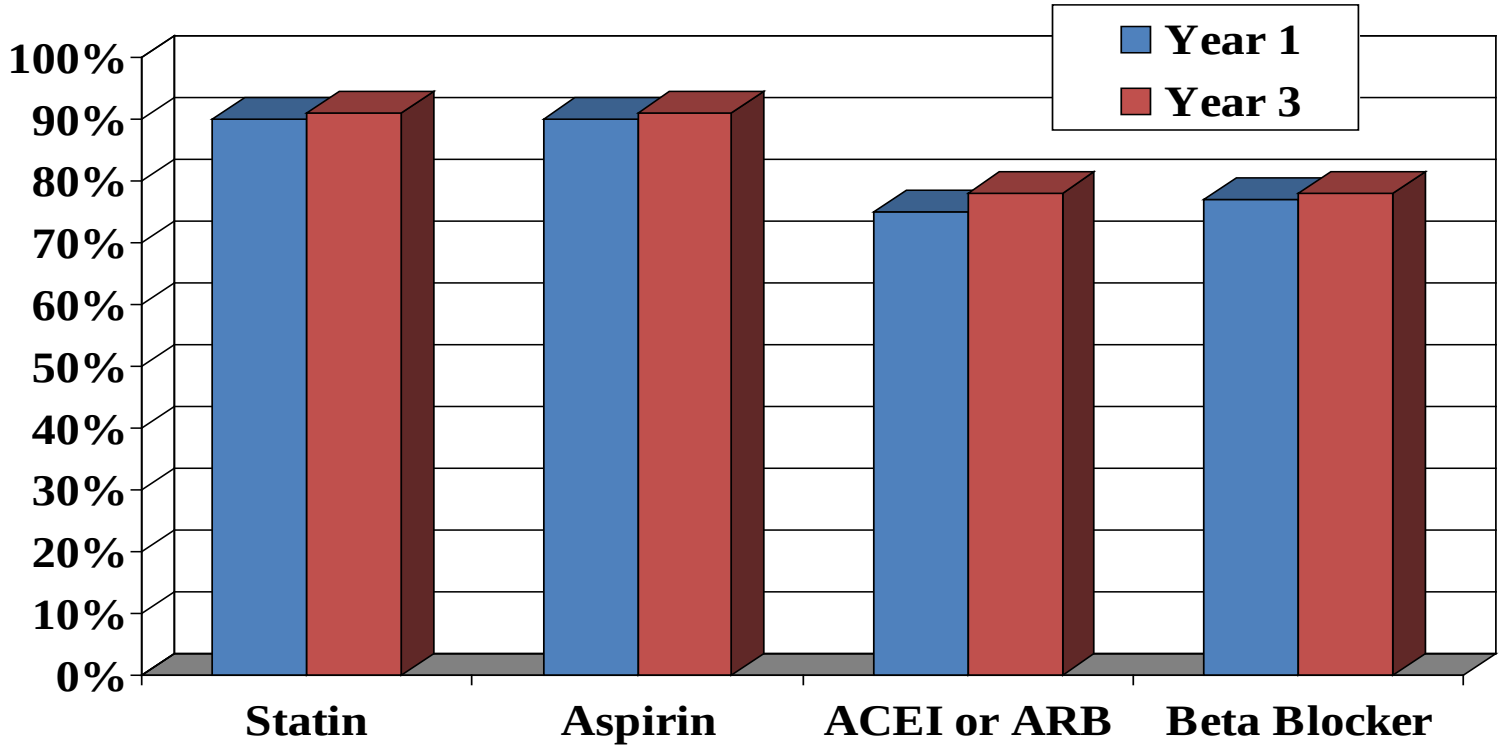


- **Statins: 75% at discharge, 44% 3 years**
- **BB: 84% at discharge, 48% at 3 years**
- **ACE: 62% at discharge, 43% at 3 years**

Am J Med. 2009 Oct;122(10):961.e7-13.

Medication Adherence with Cardiac Rehabilitation

All patients, not just post-MI



Squires et al, *JCRP* 2008;28:180-186

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ORIGINAL INVESTIGATIONS

Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease

Cochrane Systematic Review and Meta-Analysis

Lindsey Anderson, PhD,* Neil Oldridge, PhD,† David R. Thompson, PhD,‡ Ann-Dorthe Zwisler, MD,§ Karen Rees, PhD,‖ Nicole Martin, MA,¶ Rod S. Taylor, PhD*

TABLE 3 Stratified Meta-Analysis by Patient, Intervention, and Study Characteristics at Longest Follow-Up

	All-Cause Mortality	CV Mortality	MI	CABG	PCI	Hospitalization
All studies	0.96 (0.88-1.04)	0.74 (0.64-0.86)	0.90 (0.79-1.04)	0.96 (0.80-1.16)	0.85 (0.70-1.04)	0.82 (0.70-0.96)
Case mix						
100% MI	0.89 (0.78-1.01)	0.75 (0.65-0.87)	0.89 (0.76-1.05)	0.67 (0.45-1.00)	0.87 (0.67-1.15)	0.71 (0.41-1.24)
<100% MI	1.06 (0.92-1.22)	0.63 (0.38-1.06)	0.73 (0.44-1.23)	1.06 (0.86-1.31)	0.82 (0.58-1.15)	0.82 (0.68-0.99)
Dose of exercise*						
<1,000	0.89 (0.26-3.15)	0.47 (0.19-1.15)	0.72 (0.30-1.70)	0.96 (0.35-2.66)	1.22 (0.34-4.34)	0.70 (0.48-1.00)
≥1,000	1.01 (0.89-1.15)	0.75 (0.65-0.86)	0.74 (0.59-0.93)	0.99 (0.78-1.27)	0.80 (0.62-1.03)	0.85 (0.71-1.01)
Type of CR						
Exercise only	0.94 (0.77-1.16)	0.65 (0.50-0.85)	0.76 (0.60-0.98)	0.98 (0.68-1.42)	0.87 (0.35-2.17)	0.61 (0.33-1.14)
Comprehensive CR	0.93 (0.841-1.03)	0.79 (0.66-0.94)	0.90 (0.72-1.14)	0.96 (0.77-1.19)	0.87 (0.71-1.07)	0.85 (0.72-1.00)
Duration of follow-up						
≤12 months	1.08 (0.51-2.33)	0.72 (0.62-0.84)	0.60 (0.39-0.91)	1.03 (0.74-1.44)	0.83 (0.54-1.27)	0.63 (0.46-0.88)
>12 months	0.96 (0.88-1.04)	1.00 (0.63-1.60)	0.92 (0.77-1.09)	0.93 (0.75-1.17)	0.84 (0.64-1.09)	0.92 (0.80-1.05)
Year of publication						
Pre-1995	0.85 (0.75-0.98)	0.78 (0.67-0.91)	0.96 (0.81-1.14)	0.87 (0.59-1.30)	0.80 (0.42-1.51)	0.85 (0.69-1.05)
Post-1995	1.03 (0.903-1.14)	0.56 (0.38-0.83)	0.76 (0.59-0.99)	0.99 (0.81-1.22)	0.86 (0.70-1.06)	0.78 (0.60-1.00)
Setting						
Center	0.91 (0.80-1.04)	0.75 (0.65-0.87)	0.96 (0.83-1.11)	0.97 (0.77-1.23)	0.90 (0.60-1.35)	0.89 (0.76-1.04)
Center + home	0.78 (0.40-1.53)	0.67 (0.30-1.47)	0.40 (0.14-1.11)	0.79 (0.44-1.44)	0.65 (0.37-1.14)	0.83 (0.46-1.50)
Home	1.02 (0.68-1.54)	0.87 (0.34-2.20)	0.48 (0.28-0.83)	1.01 (0.59-1.7)	0.79 (0.53-0.18)	0.60 (0.33-1.05)
Risk of bias						
Low (bias in <5 of 8 domains)	1.01 (0.88-1.17)	0.91 (0.22-3.74)	0.96 (0.69-1.33)	0.92 (0.69-1.21)	0.91 (0.70-1.18)	0.85 (0.61-1.20)
High (bias in >5 of 8 domains)	0.90 (0.80-1.02)	0.74 (0.64-0.86)	0.83 (0.69-1.00)	1.00 (0.79-1.28)	0.79 (0.59-1.06)	0.79 (0.65-0.97)
Study location, continent						
Europe	0.90 (0.80-1.02)	0.73 (0.62-0.87)	0.93 (0.79-1.09)	0.94 (0.74-1.19)	0.85 (0.65-1.13)	0.72 (0.56-0.92)
North America	1.10 (0.94-1.27)	0.89 (0.56-1.43)	0.62 (0.41-0.94)	1.05 (0.78-1.42)	0.78 (0.52-1.16)	0.95 (0.81-1.11)
Australasia	0.85 (0.35-2.07)	0.33 (0.01-7.88)	1.90 (0.33-10.72)	0.32 (0.07-1.55)	0.99 (0.32-3.02)	1.07 (0.74-1.54)
Other	0.62 (0.36-1.07)	0.58 (0.32-1.08)	0.25 (0.01-5.91)	NR	NR	0.27 (0.10-0.74)
Sample size						
≤150	0.81 (0.51-1.29)	0.58 (0.33-1.00)	0.54 (0.35-0.83)	0.78 (0.53-1.16)	0.82 (0.47-1.42)	0.60 (0.46-0.78)
>150	0.95 (0.86-1.05)	0.76 (0.65-0.88)	0.93 (0.78-1.11)	1.02 (0.83-1.26)	0.87 (0.70-1.08)	0.93 (0.83-1.05)

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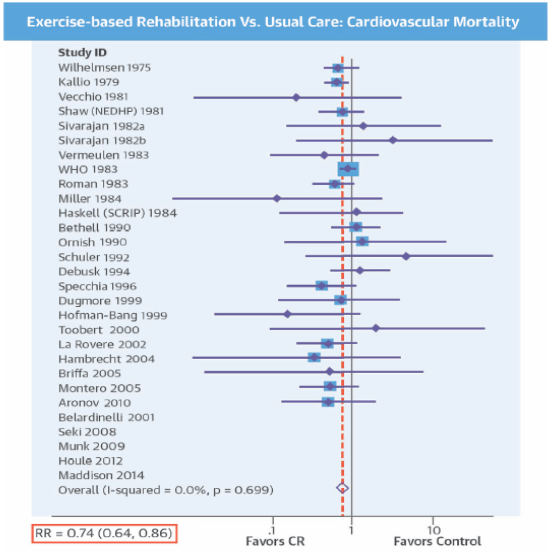
CENTRAL ILLUSTRATION Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease Versus Usual Care: CV Mortality and Hospitalization

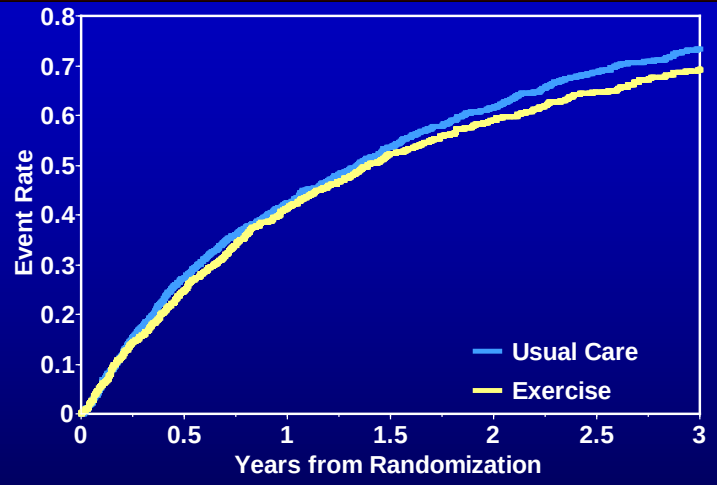


Anderson, L. et al. J Am Coll Cardiol. 2016; 67(1):1-12.

Box sizes are proportional to the weight of each study in the analysis, and the **lines** represent their 95% confidence intervals (CIs). The **open diamond** represents the pooled RR, and its width represents its 95% CI. CV = cardiovascular.

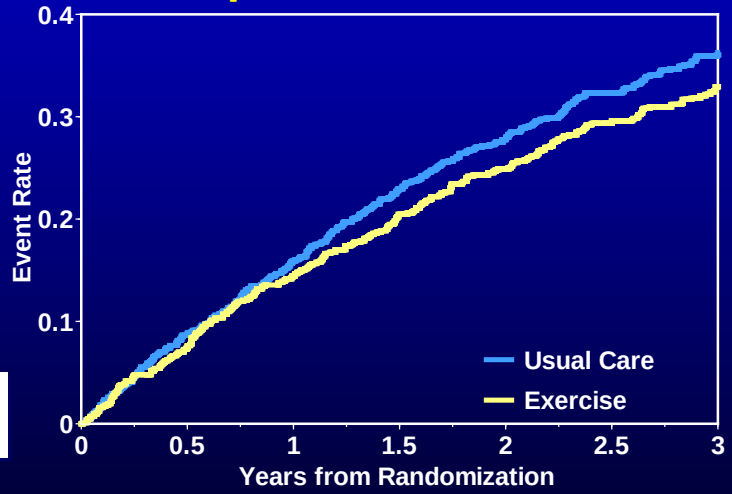
HF-ACTION Trial and Clinical End Points

All-cause Mortality or Hospitalization



(Primary) HR 0.93 (95% CI: 0.84, 1.02), *P = 0.13*
*Adjusted HR 0.89 (95% CI: 0.81, 0.99), *P = 0.03*

CV Mortality or HF Hospitalization

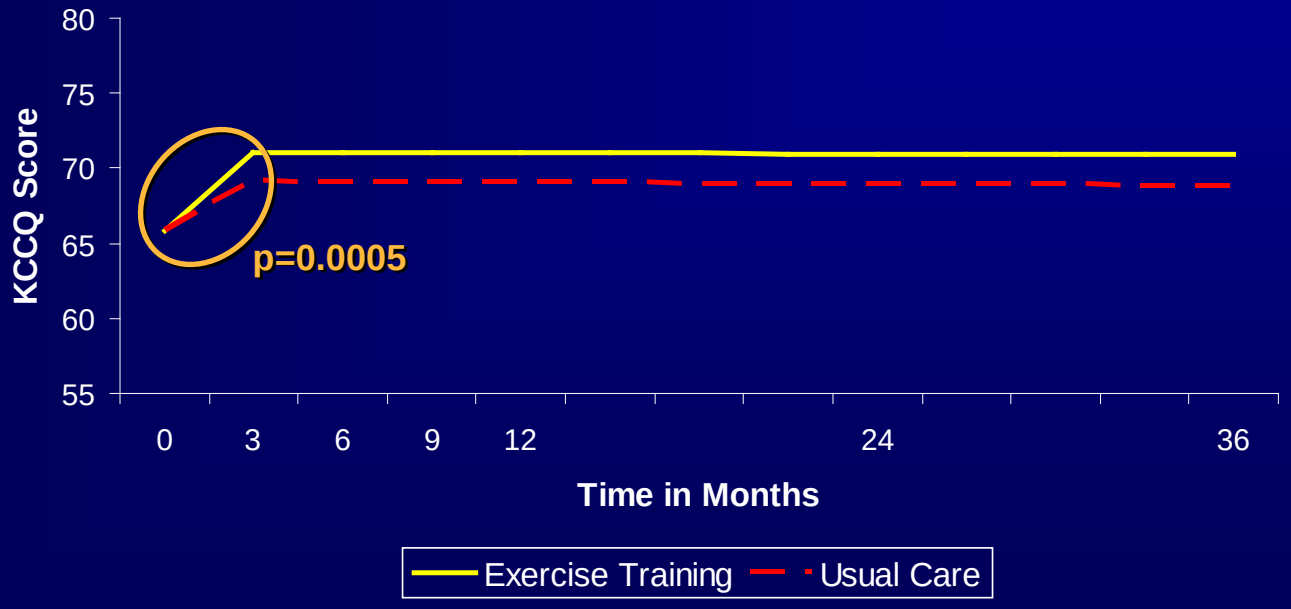


HR 0.87 (95% CI: 0.75, 1.00), *P = 0.06*
*Adjusted HR 0.85 (95% CI: 0.74, 0.99), *P = 0.03*

* Adjusted for: etiology + afib, exerc. duration, depression, EF; n= 2331

Primary Endpoint: Predicted KCCQ Overall Score

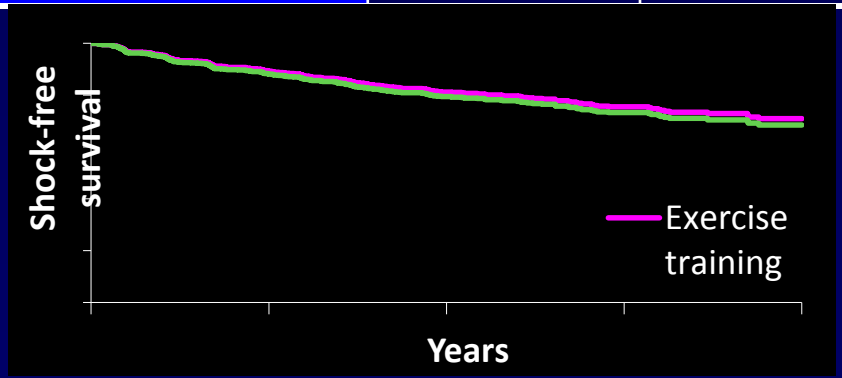
- The 2-point difference in early change was significant



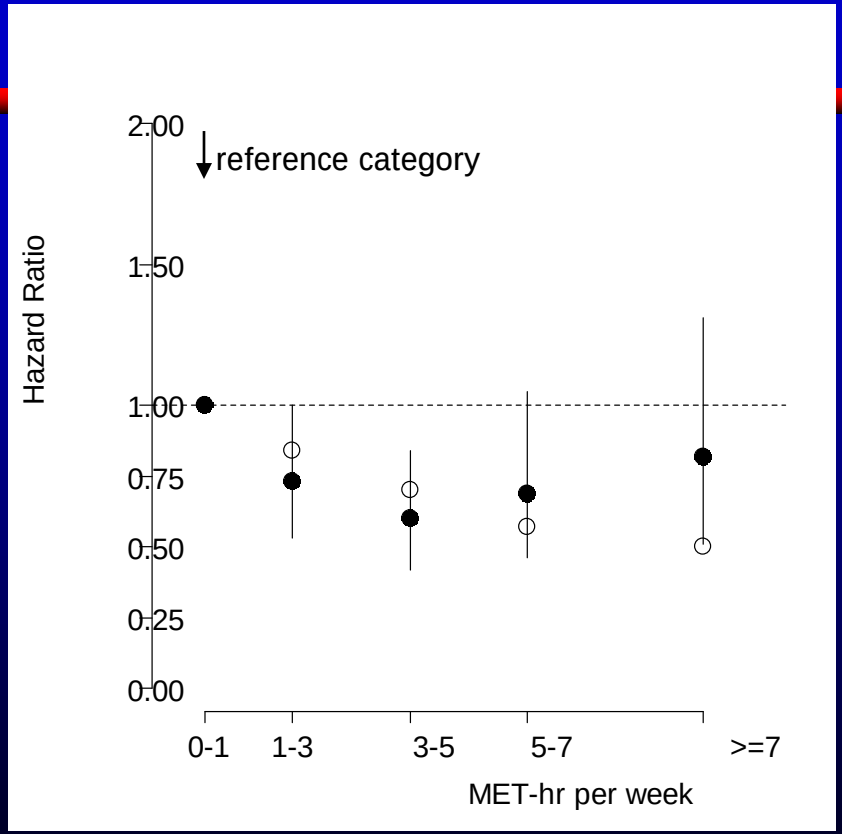
Serious Adverse Events

***** Worsening HF, MI, unstable angina, serious adverse arrhythmia, stroke, TIA

	Usual Care N=1172	Ex Training N=1159
At least one CV event *	40%	37%
At least one ICD firing	23%	22%
Hospitalized after physical activity	2%	3%
Hospitalized for fracture of hip/pelvis	0.6%	0.3%
Deaths identified as possibly occurring within 3 hours of physical activity	0.4%	0.4%



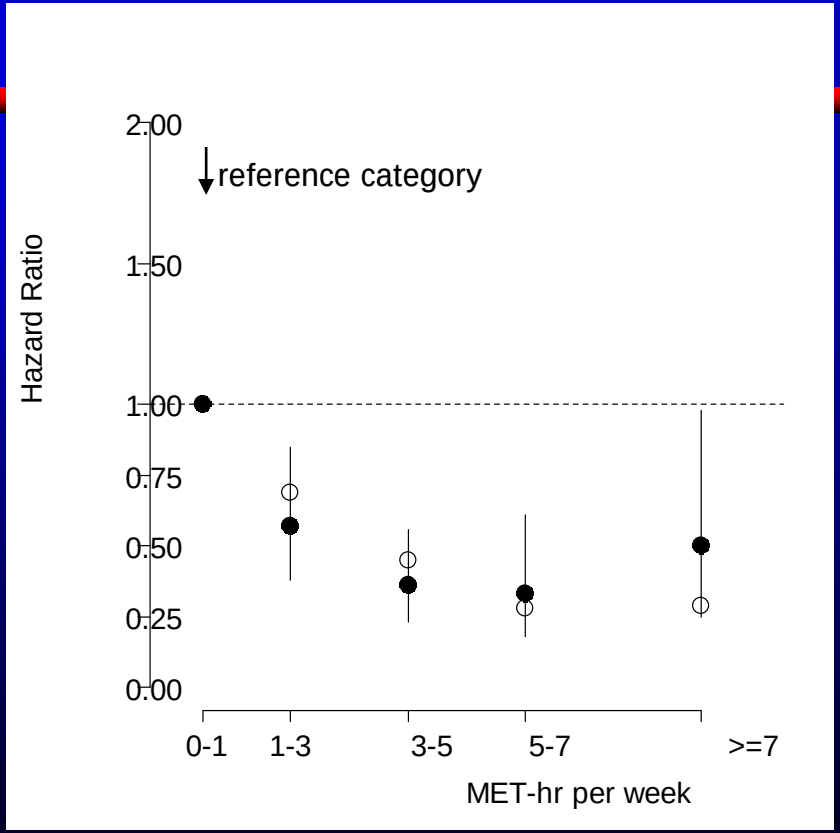
HF-ACTION: Among Patients in Exercise Group Event-Free at 3 months (n-959), All-Cause Death or Hospitalization (Adjusted HR*, 95% CI)



3-5 MET-hr/wk ~ walking 2 mph, 30 min, 4x/wk

*Adjusted for 19 of 60 candidate co-variates, over-all p < 0.03; 28.2 mo of follow-up

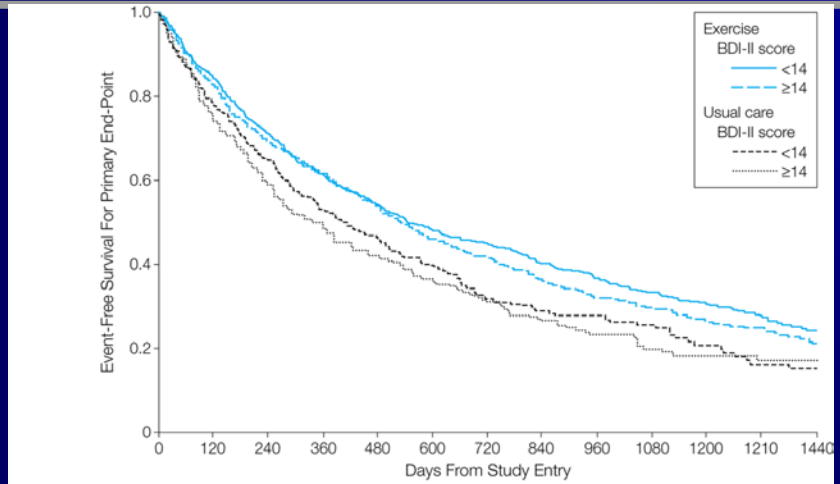
HF-ACTION: Among Patients in Exercise Group Event-Free at 3 months (n-959), CV Mortality or Heart Failure Hospitalization (Adjusted HR*, 95% CI)



3-5 MET-hr/wk ~ walking 2 mph, 30 min, 4x/wk

*Adjusted for 19 of 60 candidate co-variates, over-all p < 0.001; 28.2 mo of follow-up

Effects of Exercise Training on Depressive Symptoms in Patients With Chronic Heart Failure: The HF-ACTION Randomized Trial : Blumenthal et al. *JAMA. 012;308(5):465-74.*



No. at risk							
Exercise							
BDI-II score							
<14	821	574	399	279	169	102	45
≥14	337	216	142	81	56	24	12
Usual care							
BDI-II score							
<14	848	570	412	271	156	86	40
≥14	316	183	121	73	40	21	6

Curves represent sample stratified on treatment group assignment and depressive symptom severity category. The number of participants at risk at selected time intervals for each group is displayed across the bottom of the plot.

Stage C: Nonpharmacological Interventions

Patients with HF should receive specific education to facilitate HF self-care.

Exercise training (or regular physical activity) is recommended as safe and effective for patients with HF who are able to participate to improve functional status.

Sodium restriction is reasonable for patients with symptomatic HF to reduce congestive symptoms.

Stage C: Nonpharmacological Interventions (cont.)

Continuous positive airway pressure (CPAP) can be beneficial to increase LVEF and improve functional status in patients with HF and sleep apnea.

Cardiac rehabilitation can be useful in clinically stable patients with HF to improve functional capacity, exercise duration, HRQOL, and mortality.

Rehab of LVAD Patients

- Among the most deconditioned of HF pts.
- Usually malnourished
- Wound issues
- Infection
- Extubation early is best
- OOB in chair early
- Muscle atrophy (heart failure + disuse)
- Skin breakdown
- Respiratory compromise
- Neurologic or infectious complications
- Psychological component
- Pre-conceived notion by staff in ICU

Rehab of LVAD Patients

- **Ambulate in room**
  - Coupled to learning re:LVAD function
- **Ambulate in hall**
  - Keep RPE 11-12 (Borg scale)
- **Bicycle ergometer**
  - 25rpm without loading
    - Steady torso
    - Minimizes drive line discomfort

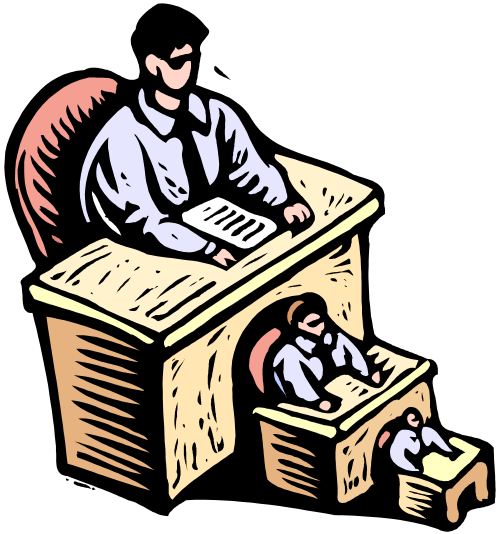
Rehab of LVAD Patients

- **Treadmill**
  - Start 1 mph 0˚ elevation
  - Work toward RPE of 13
- **ETT with VO_2**
  - Peak 15 cc/min/kg
  - Limited by the SV limit of the LVAD (83 cc)
  - Younger patients have higher chronotropic response.

Advice to Heart Failure Patients: General

- **Need to stabilize HF symptoms**
  - Patient euvolemic and well medicated
- **Conservation of energy techniques**
  - Pulling rather than pushing items
  - Work at “waist” level
  - Set up a schedule daily
  - Heavier work in morning hours
- **Avoid extremes of temperature**
- **Avoid physical activity shortly after meals**

Return to Work Activity



- Majority of clerical jobs entail 3-5 METS of work only.
- The greater amount of time sitting at a desk, the lower the MET value
- Heavier activity related jobs may require higher MET levels up to 8-9 METS e.g., construction

Return to Work Activity

- Weight lifting may require testing: Is 50 lbs too much?
- Mental stress induced by an employment is difficult to assess
- Part time work initially, e.g. 4 hours

Return to Work Activity: Financial Considerations

- **Definition of disability may be different between social security and insurance**
- **Loss of wages**
- **Loss of coverage if return to work**
- **Spouse having insurance may be an important part of returning to work**

Return to Work Activity

- Individualize need to return to work vs. desire to return to work
- Emotional benefits to the patient and family may be overriding
- An exercise test may be important
  - Add weight during the test, e.g., briefcase to mimic a work activity

Heart Failure: Recreation Activities

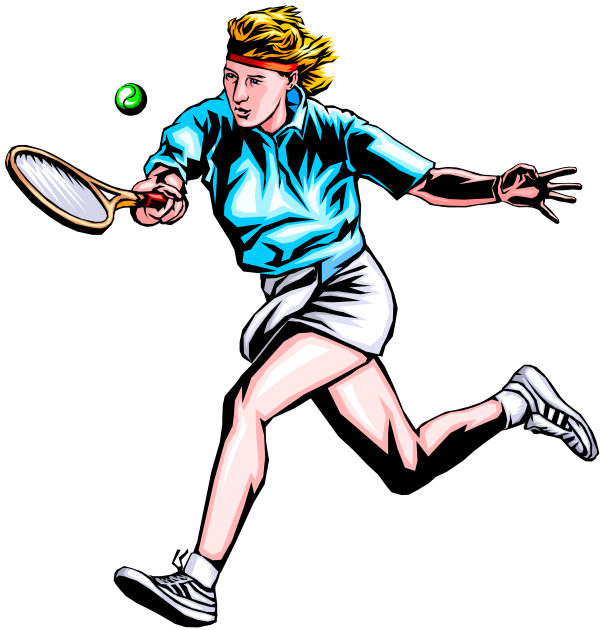
- Can be used as a form of exercise training
- Enjoyable
- Low level—no need for high impact
- Previous experience or participation

Heart Failure: Recreation Activities

- Inverse relation b/w intensity and duration, e.g., the higher the intensity, the shorter the duration
- Warm up and cool down
- Stretching
- Stop if sx occur
- Report if sx occur earlier than on previous occasions

Heart Failure: Recreation Activities

- Should there be a baseline exercise test?
- Pick an intensity below VT
- Give a progression to the exercise sessions, e.g., start with 15 min and progress
- Add resistive exercise if desired
- Evaluate the recreation e.g., doubles tennis = lower MET level



Current Indications for Cardiac Rehabilitation (Medicare)

- Post-MI
- Post-CABG
- Angina
- PCI
- Valve replacement or repair
- Heart transplant
- HFrEF

What about HF-PEF?

Exercise Training in Older Patients With Heart Failure and Preserved Ejection Fraction

A Randomized, Controlled, Single-Blind Trial

Dalane W. Kitzman, MD; Peter H. Brubaker, PhD; Timothy M. Morgan, PhD;

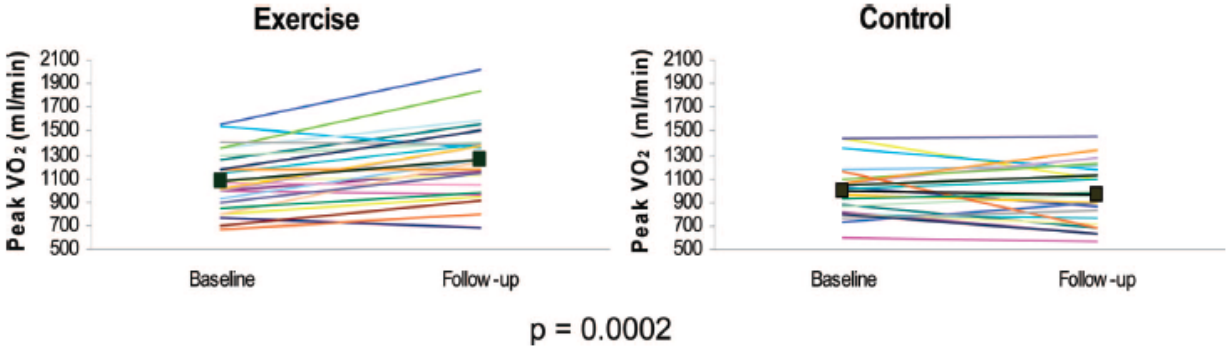
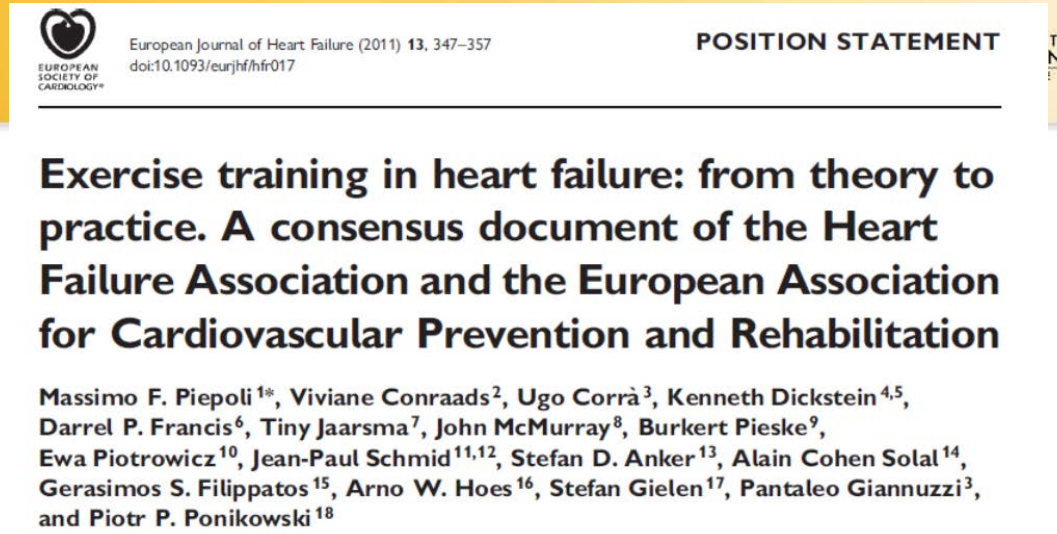


Figure. Individual and mean (■) responses of peak exercise $\dot{V}O_2$ following 16 weeks of supervised exercise training. Results are displayed in raw, nonindexed peak $\dot{V}O_2$, as this is uninfluenced by weight.

Circ Heart Fail. 2010;3:659-667.)

Provider Barriers



European Journal of Heart Failure (2011) 13, 347–357
doi:10.1093/eurjhf/hfr017

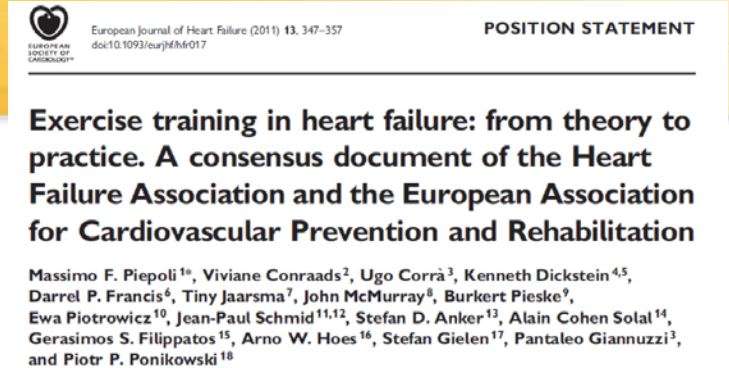
POSITION STATEMENT

Exercise training in heart failure: from theory to practice. A consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation

Massimo F. Piepoli[1*], Viviane Conraads[2], Ugo Corrà[3], Kenneth Dickstein[4,5], Darrel P. Francis[6], Tiny Jaarsma[7], John McMurray[8], Burkert Pieske[9], Ewa Piotrowicz[10], Jean-Paul Schmid[11,12], Stefan D. Anker[13], Alain Cohen Solal[14], Gerasimos S. Filippatos[15], Arno W. Hoes[16], Stefan Gielen[17], Pantaleo Giannuzzi[3], and Piotr P. Ponikowski[18]

- Lack of belief by health care providers on the benefits of ET in heart failure as well as other CVD
- Lack of ET sites and programs
- Lack of educated personnel

Patient Barriers



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POSITION STATEMENT

GET WITH THE GUIDELINES. HEART FAILURE

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- **Social and economic factors: low educational level, low social support, work conflicts, lack of time**
- **Factors related to the health-care system: adequate transportation, no reimbursement, waiting lists**
- **Condition-related factors: severity of symptoms, the level of disability, the rate of progression, and the impact of co-morbidities**
- **Therapy-related factors: duration of exercise treatment, complexity**
- **Patient-related factors: attitudes towards exercise, motivation, personal beliefs, and expectations**

Increasing Cardiac Rehabilitation Participation From 20% to 70%: A Road Map From the Million Hearts Cardiac Rehabilitation Collaborative

Philip A. Ades, MD; Steven J. Keteyian, PhD; Janet S. Wright, MD; Larry F. Hamm, PhD; Karen Lui, RN, MS; Kimberly Newlin, ANP; Donald S. Shepard, PhD; and Randal J. Thomas, MD, MS

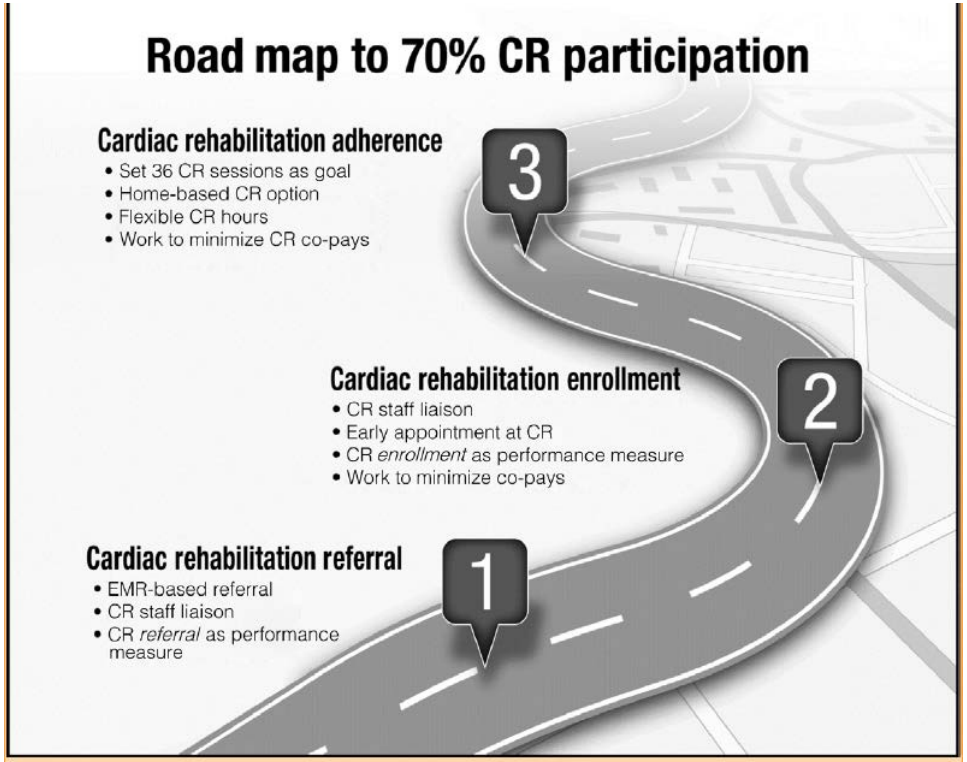

FIGURE. Conceptual framework for increasing cardiac rehabilitation (CR) participation from 20% to 70%. EMR = electronic medical record.

TABLE 1. Strategies That Influence Referral and Enrollment to Cardiac Rehabilitation

Strategy	Brief description	Outcome	Reference
Automatic in-patient CR referral system	CR referral is carried out as an automatic EMR order for all eligible patients	CR referral was 70% (compared with 32% for usual care); enrollment was 61% (compared with 29% for usual care)	38
Inpatient "liaison" to help educate and refer patients to out-patient CR	A liaison or "coach" meets with inpatients who are eligible for CR, educating and guiding them in the CR enrollment process	CR referral was 59% (compared with 32% for usual care); enrollment was 51% (compared with 29% for usual care)	38
Combination of automatic CR referral system and "liaison"	Combination of the 2 strategies listed above	CR referral was 85% (compared with 32% for usual care); enrollment was 74% (compared with 29% for usual care)	38
Limit or eliminate out-of-pocket expenses to patients for CR services	Negotiate with insurance companies to limit or eliminate co-payments and other out-of-pocket expenses for patients enrolled in CR	Studies of preventive medication adherence suggest that reducing or eliminating co-payments improves utilization and adherence	39,40
Inclusion of home-based CR option for patients who are not able to attend a center-based CR program	Protocol-driven, nurse-managed home-based approaches to CR delivery provide CR services to patients at home for low- to moderate-risk patients	Outcomes are similar and participation rates may be higher in home-based CR programs compared with center-based CR programs	41
Flexible hours of operation	Increased flexibility of CR center hours to include early morning, noontime, after work, and weekend hours	10% Improvement in enrollment and participation; will require creative staff scheduling to avoid increasing costs of program delivery	4
Early outpatient appointment established before hospital discharge	Inpatient staff members work and EMR set up an outpatient CR enrollment appointment for each eligible patient within 12 days of hospital discharge	20%-25% Improvement in CR enrollment	42
Use of CR referral performance measures in a quality improvement system	CR referral is assessed, reported, and acted upon in a systematic quality improvement program	CR referral rates improved by 12.5% over 5 years in centers participating in a quality improvement program	43

CR = cardiac rehabilitation; EMR = electronic medical record.


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Contact Us to Learn More

Steve Dentel BSN, RN, CPHQ

National Director, Field Programs and Integration

steve.dentel@heart.org

Tanya Lane Truitt, RN MS

Sr. Program Manager *Quality Systems Improvement*

tanya.truitt@heart.org

Liz Olson, CVA

Program Manager*, Get With The Guidelines – Heart Failure*

liz.olson@heart.org

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