• Pts such as these receive PCI and CABG
• Standard medical therapy with beta blockers, ASA, Plavix, statins, etc
• Traditional post MI and post PCI care
• Traditional post operative care
• f/u in office in 1-2 weeks
• ARE WE DOING ENOUGH?

• ARE WE GIVING THESE PATIENTS ALL THE CLASS I INDICATIONS?
What if I told you there was something else that could:

- Reduce your patient’s mortality by 20-40%
- Reduce readmission rates by 20-30%
- Gain the benefits of exercise training
- Improve adhere to preventive therapy
- Gain psychological benefits of group support and counseling
- Improve control of cardiovascular risk factors
- Help return your patient to work and ADLs sooner
Cardiac Rehabilitation: The forgotten follow up appointment

Marcus L. Brown, MD, FACC
Director, Cardiac Rehabilitation Services
Section Chief, Department of Cardiology
Northside Hospital
Atlanta, Georgia
Cardiac Rehabilitation: The forgotten follow up appointment

- Objectives:
  - Review cardiac rehabilitation (Definition, history, components)
  - Review pertinent literature
  - Discuss some of the barriers to cardiac rehabilitation participation and how we can improve
Definition of Cardiac Rehabilitation

- Originally defined by the U.S. Public Health Service as a comprehensive long-term program involving medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counseling.

- AHA has refined the definition slightly, stating that cardiac rehabilitation refers to coordinated, multifaceted interventions designed to optimize a cardiac patient’s physical, psychological, and social functioning; in addition to stabilizing, slowing or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality.
The theory that early physical activity after a cardiac event is not new.

In 1772, four years after his description of angina pectoris, William Heberden reported a case of a patient who improved by working in the woods half an hour a day.

However, despite evidence that early activity was beneficial, activity restrictions were imposed on patients with acute coronary events.
• In the 1930s, patients with acute coronary events were advised to observe 6 weeks of bed rest.

• In the 1940s, out of bed to chair was allowed.

• In early 1950s, a very short daily walk of 3-5 minutes was allowed 4 weeks after coronary events.

• This led to serious deconditioning problems, decline in functional capacity, prolonged hospital stay and increased morbidity and mortality.
In 1950s there was mounting evidence of the benefits of early ambulation and physical activity.

Herman Hellerstein introduced his methodology for comprehensive rehabilitation of patients recovering from an acute event using a multidisciplinary approach involving modified, supervised exercise.
Since that time, the positive impact of physical exercise on mortality after myocardial infarction has been confirmed by many prevention studies.
S. Goya Wannamethee et al. *Physical Activity and Mortality in Older Men with Diagnosed Coronary Heart Disease*. Circulation 2000

-Large prospective study of CAD involving 5,934 men 40-59 years of age

-After initial and follow up screening for 12-14 years and exclusions, 772 had established CAD; of those, 131 died of all causes
S. Goya Wannamethee et al. *Physical Activity and Mortality in Older Men with Diagnosed Coronary Heart Disease*. Circulation 2000

- They found that lowest risk of all cause and cardiovascular mortality were seen in the light and moderate activity groups.
- Recreational activity >4 hrs week, moderate to heavy gardening, regular walking all associated with deceased mortality.
S. Goya Wannamethee et al. *Physical Activity and Mortality in Older Men with Diagnosed Coronary Heart Disease*. Circulation 2000

Physical activity at Q92 and age-adjusted mortality rates per 1000 person-years in 772 men with diagnosed CHD (CVD in Figure) excluding men reporting “poor health.” Numbers indicate deaths.
Gael et al. *Impact of Cardiac Rehabilitation on Mortality and Cardiovascular Events after Percutaneous Coronary Intervention in the Community.* Circulation 2011

- Retrospective analysis of data from a prospectively collected registry of 2395 patients who underwent PCI in Olmsted County, Minnesota from 1994-2008

- The association of cardiac rehab with all-cause mortality, MI or revascularization was assessed

- During a median follow up of 6.3 yrs, 503 deaths (199 cardiac), 394 MIs and 755 revascularization procedures occurred

- Participation rate in cardiac rehabilitation, noted in 40% of the participants, was associated with a significant decrease in all-cause mortality and a trend toward decreased cardiac mortality and revascularization
Gael et al. *Impact of Cardiac Rehabilitation on Mortality and Cardiovascular Events after Percutaneous Coronary Intervention in the Community*. Circulation 2011

*Figure 3. Kaplan-Meier curves showing the association between cardiac rehabilitation (CR) participation and outcomes. Outcomes include cardiac mortality, all-cause mortality, and the composite end point (death/myocardial infarction/percutaneous coronary intervention [PCI]/coronary artery bypass graft surgery [CABG]). Top, Curves for the landmark study analysis group (excluding patients who had major adverse cardiac events within 3 months after PCI, n=2009). P<0.001 for each of the 3 graphs. Bottom, Curves for the propensity score-matched analysis groups (n=1438). P<0.001 for all-cause mortality; P=0.14 for cardiac mortality; and P=0.71 for composite end point. Black line represents CR participants; gray line, nonparticipants. TLR indicates target lesion revascularization (PCI/CABG).*

- Population based surveillance study of patients discharged from the hospital after their first ever MI from 1987 to 2010 and their participation in cardiac rehab in Olmstead County Minnesota

- Of the 2991 patients with MI, 1569 participated in cardiac rehabilitation (52.5 %). After adjustment, cardiac rehab pts had lower all cause readmission, cardiovascular readmission, non-cardiovascular readmission, and mortality.

- Reduced risk of long term hospital readmission by 25% and death by 42%

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Participation in Cardiac Rehabilitation, Readmissions, and Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risk of Participants vs Nonparticipants Hazard Ratio (95% CI), P value</td>
</tr>
<tr>
<td>All-Cause Readmission</td>
<td>Unadjusted</td>
</tr>
<tr>
<td>Long-term</td>
<td></td>
</tr>
<tr>
<td>All-cause</td>
<td>0.52 (0.47-0.57), &lt;.001</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>0.59 (0.52-0.67), &lt;.001</td>
</tr>
<tr>
<td>Noncardiovascular</td>
<td>0.48 (0.43-0.53), &lt;.001</td>
</tr>
<tr>
<td>Death</td>
<td>0.24 (0.22-0.27), &lt;.001</td>
</tr>
</tbody>
</table>

CI = confidence interval.
*Method 1 is adjusted for propensity to participate.
†Method 2 used inverse probability treatment weighting, which generates weights based on the propensity score.
‡Method 3 matches based on propensity score (maximum matched pair difference in propensity = 0.10). This resulted in 804 matched pairs.

**Figure 3** Readmission and mortality after myocardial infarction for cardiac rehabilitation. Participants and non-participants. The estimated mean number of readmissions over time (A) and Kaplan-Meier curves demonstrating time to death (B) after myocardial infarction are shown for cardiac rehabilitation participants and non-participants. The number of patients at risk is shown below the figures.
COMPONENTS OF CARDIAC REHABILITATION

- The American Heart Association, the American College of Cardiology Foundation and the American Association of Cardiovascular and Pulmonary Rehabilitation have outlined core components of CR programs and produced guidelines.
COMPONENTS OF CARDIAC REHABILITATION

- 3 Phases of Cardiac Rehabilitation
Components of Cardiac Rehabilitation Program

Phase I

- inpatient phase
- initiated while the patient is in the hospital
- consists of brief counseling about the nature of the illness, treatment, risk factors management and follow-up planning; early mobilization to make self care possible by discharge
Components of Cardiac Rehabilitation Program

Phase II

-supervised ambulatory outpatient program of 3 to 6 months duration which consists of outpatient monitored exercise and aggressive risk factor reduction
Components of Cardiac Rehabilitation Program

Phase II

- Patient Assessment
- Exercise Training
- Physical activity counseling
- Tobacco cessation counseling
- Nutritional counseling
- Weight management
- Aggressive coronary risk factor management
- Psychosocial counseling
Components of Cardiac Rehabilitation Program

PATIENT ASSESSMENT

- In order to guide the pt through the different aspects of CR, to meet individual needs and to optimize benefits, an initial individual pt assessment is performed: review pts history and meds, physical exam, disease counseling, establish goals.
Components of Cardiac Rehabilitation Program

**EXERCISE TRAINING**

- Appropriately prescribed and conducted exercise training is a key component of CR

- Meyers *et al* showed that an improvement of 1 metabolic equivalent (MET) in functional capacity imparts a 12% reduction in all-cause mortality

- Jolly *et al* showed that abnormal HR recovery, which is a predictor of mortality, can be normalized with exercise training and reduce mortality
Components of Cardiac Rehabilitation Program

EXERCISE TRAINING

- A baseline symptom limited exercise test is often used to stratify patients’ risk before exercise training. This helps the exercise physiologist develop an exercise prescription.

- Exercise protocols include endurance and resistance training.

- Patients are continuously monitored with telemetry.
Components of Cardiac Rehabilitation Program

EXERCISE TRAINING

- A variety of equipment is used: treadmills, steppers, weights, rowers, elliptical trainers, stationary bikes
Components of Cardiac Rehabilitation Program

COUNSELING SESSIONS

- Tobacco cessation
- Nutritional counseling
- Weight counseling/management
Components of Cardiac Rehabilitation Program

RISK FACTOR MODIFICATIONS

- BP and Diabetes goals; lipid management; tobacco cessation
Components of Cardiac Rehabilitation Program

Phase III

- Lifetime maintenance phase
- Emphasizes home or gym exercise and lifestyle factors modification
### Table 1. Indications for Cardiac Rehabilitation

*Patients with a history of:*

- Atherosclerotic coronary artery disease
  - Acute coronary syndrome
  - Myocardial infarction
- Coronary artery bypass grafting
- Percutaneous coronary intervention
- Stable angina pectoris
- Atherosclerotic peripheral vascular disease
  - Peripheral arterial disease
- Heart transplantation
- Stable congestive heart failure
- Valvular surgery
- Ventricular assist devices

*Information from reference 6.*

Meta analysis of 48 randomized trials with a total of 8,940 patients with CAD

Compared with usual care, patients who participated in cardiac rehab had a significant reduction in all cause mortality and cardiac mortality

### Effects of Exercise-Based Cardiac Rehabilitation on Study End Points*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Mean Difference, %</th>
<th>95% Confidence Limit</th>
<th>Statistical Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total mortality</td>
<td>-20</td>
<td>-7% to -32%</td>
<td>P=0.005</td>
</tr>
<tr>
<td>Cardiac mortality</td>
<td>-26</td>
<td>-10% to -29%</td>
<td>P=0.002</td>
</tr>
<tr>
<td>Nonfatal MI</td>
<td>-21</td>
<td>-43% to 9%</td>
<td>P=0.150</td>
</tr>
<tr>
<td>CABG</td>
<td>-13</td>
<td>-35% to 16%</td>
<td>P=0.400</td>
</tr>
<tr>
<td>PTCA</td>
<td>-19</td>
<td>-51% to 34%</td>
<td>P=0.400</td>
</tr>
</tbody>
</table>

Mean difference is the percentage of difference between exercise-trained and usual-care control group. MI indicates myocardial infarction; CABG, coronary artery bypass graft; and PTCA, percutaneous coronary angioplasty. *Data are derived from Taylor et al.²
Hammill BG et al. *Relationship between cardiac rehabilitation and long term risk of death and myocardial infarction among elderly Medicare beneficiaries.* Circulation 2010

- Medicare database review of 30,161 pts who attended at least 1 session of CR between 2000 and 2005.

- found a strong dose-response relationship existed between the number of CR sessions and long-term outcomes. Attending all 36 sessions was assoc with lower risk of death and MI at 4 years compared with attending fewer sessions
Hammill BG et al. *Relationship between cardiac rehabilitation and long term risk of death and myocardial infarction among elderly Medicare beneficiaries.* Circulation 2010

**Figure 2.** Cumulative incidence of death by number of cardiac rehabilitation sessions attended.
Hammill BG et al. *Relationship between cardiac rehabilitation and long term risk of death and myocardial infarction among elderly Medicare beneficiaries.* Circulation 2010

**Figure 3.** Cumulative incidence of MI by number of cardiac rehabilitation sessions attended.
O’Connor CM et al. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA 2009

- Randomized controlled trial of 2331 medically stable outputs with HF and reduced EF (median 25%)

- Composite primary end point of all-cause mortality or hospitalization and secondary endpoint of hospitalization

- Exercise training was associated with modest reductions for all-cause mortality and HF hospitalization
O’Connor CM et al. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA 2009

<table>
<thead>
<tr>
<th>Event</th>
<th>No. (%) of Patients</th>
<th>HR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality or all-cause hospitalization (primary end point)</td>
<td>Usual Care (n = 1171) Exercise Training (n = 1159)</td>
<td>0.93 (0.84-1.02)</td>
<td>.13</td>
</tr>
<tr>
<td>Cardiovascular mortality or cardiovascular hospitalization</td>
<td>677 (58)</td>
<td>632 (55)</td>
<td>0.92 (0.83-1.03)</td>
</tr>
<tr>
<td>Cardiovascular mortality or heart failure hospitalization</td>
<td>393 (34)</td>
<td>344 (30)</td>
<td>0.87 (0.75-1.00)</td>
</tr>
<tr>
<td>Cardiovascular mortality or heart failure hospitalization or cardiac transplantation or left ventricular assist device</td>
<td>403 (34)</td>
<td>353 (30)</td>
<td>0.87 (0.75-1.00)</td>
</tr>
<tr>
<td>All-cause mortality, all-cause hospitalization, emergency department visit, or urgent clinic visit for heart failure exacerbation</td>
<td>906 (77)</td>
<td>885 (76)</td>
<td>0.99 (0.90-1.08)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>198 (17)</td>
<td>189 (16)</td>
<td>0.96 (0.79-1.17)</td>
</tr>
<tr>
<td>Cardiovascular mortality</td>
<td>143 (12)</td>
<td>131 (11)</td>
<td>0.92 (0.74-1.15)</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; HR, hazard ratio.
*Follow-up data forms were not available for 1 patient.
Despite the wealth of evidence supporting the proven benefits of cardiac rehabilitation, the services are greatly underused.

Of eligible patients, only about 25% of heart attack survivors and 30% of CABG patients participate in cardiac rehabilitation services; some studies show even less participation.
• Suaya et al. Cardiac Rehabilitation and Survival in Older Coronary Patients. JACC 2009
  • only 12.2% of the cohort used CR

• Hammill BG et al. Relationship between cardiac rehabilitation and long term risk of death and myocardial infarction among elderly Medicare beneficiaries. Circulation 2010
  • only 18% of patients completed all sessions of CR
Several clinical and psychosocial factors are associated with participation in CR after MI

- Clinical characteristics: younger age, male sex, lack of diabetes, STEMI, in-hospital cardiologist provider, no prior MI, no prior CR attendance, and referral to CR in the hospital

- Psychosocial predictors: pts who place high importance of exercise, better perceived health prior to MI, ability to drive, post-secondary education.
Dunlay et al. Barriers to participation in Cardiac Rehabilitation. Am Heart J 2009

Figure 1. Clinical Characteristics of Cardiac Rehabilitation Participants and Non-Participants
Caption: Selected patient clinical characteristics by cardiac rehabilitation participation status are shown. STEMI= ST segment elevation myocardial infarction; MI= myocardial infarction
Generally, research has found that patients who do not adhere to CR exercise programs include:

- those who are older, lack spousal or family support, those with lower income and education, and those of lower socioeconomic and psychological status
- convenience factors such as distance and availability of transportation
<table>
<thead>
<tr>
<th>Patient-oriented factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td></td>
</tr>
<tr>
<td>Older age</td>
<td></td>
</tr>
<tr>
<td>Racial/ethnic minority group</td>
<td></td>
</tr>
<tr>
<td>Lack of or limited healthcare insurance</td>
<td></td>
</tr>
<tr>
<td>Low socioeconomic status</td>
<td></td>
</tr>
<tr>
<td>Low educational attainment</td>
<td></td>
</tr>
<tr>
<td>Low self-efficacy</td>
<td></td>
</tr>
<tr>
<td>Low health literacy</td>
<td></td>
</tr>
<tr>
<td>Lack of perceived need for CR/SP</td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td></td>
</tr>
<tr>
<td>Cultural beliefs and understanding of disease and treatment</td>
<td></td>
</tr>
<tr>
<td>Work-related factors (job flexibility, loss of salary, self-employment, and lack of healthcare/disability benefits)</td>
<td></td>
</tr>
<tr>
<td>Limited social support</td>
<td></td>
</tr>
<tr>
<td>Home responsibilities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medical factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple comorbidities, including depression and musculoskeletal conditions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Healthcare system factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of referral</td>
<td></td>
</tr>
<tr>
<td>Limited facilitation of enrollment after referral</td>
<td></td>
</tr>
<tr>
<td>Strength of the endorsement of CR/SP by the patient's physician</td>
<td></td>
</tr>
<tr>
<td>Patient-provider relationship</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program availability and characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of programs that serve specific geographic areas, including rural areas and low-income communities</td>
<td></td>
</tr>
<tr>
<td>Distance of CR/SP from the patient's home</td>
<td></td>
</tr>
<tr>
<td>Hours of operation</td>
<td></td>
</tr>
<tr>
<td>Parking and public transportation access</td>
<td></td>
</tr>
<tr>
<td>Lack of racial/ethnic diversity among the CR/SP workforce</td>
<td></td>
</tr>
<tr>
<td>Gender-dominated programs</td>
<td></td>
</tr>
</tbody>
</table>

CR/SP indicates cardiac rehabilitation/secondary prevention program.
Table 2. Methods to Facilitate Referral and Enrollment in Cardiac Rehabilitation/Secondary Prevention Programs

- Including referral to CR/SPP in the hospital discharge plan
- Automatically referring all eligible patients at the time of hospital discharge
- Having ward clerks/office staff ensure that referrals are completed
- Providing patients with a choice of CR/SPP to attend
- Ensuring that patients are aware of and agree to the referral
- Arranging personal visits from CR/SPP liaison
- Providing written invitations and program brochures in multiple languages
- Informing the CR/SPP of the referral and, when possible, establishing an appointment at the point of care
- Making comprehensive interpreter service available if required
- Providing transportation and parking assistance if required
- Following up with those referred but not yet enrolled

CR/SPP indicates cardiac rehabilitation/secondary prevention program. Adapted from Higgins AR et al.\textsuperscript{22} Copyright 2008. The Medical Journal of Australia—reproduced with permission.
Out of all the predictors (demographic, medical, psychosocial, etc) by far the most powerful predictor of participation was the strength of the physician recommendation. The stronger the recommendation, the greater the participation.
Participation in CR is dependent on a referral from a physician.

80-85% of physicians recommend that their pt exercise after an MI, but only 7% actually refer pt to a formal CR program.

Factors: unaware of guidelines, disagreement with content of guidelines, unaware of referral procedures, unaware of what CR encompasses.
CONCLUSION

- Cardiac rehabilitation is Class I indication after Myocardial infarction and CABG that has proven mortality benefits just as other traditional class I indications (ASA, statin, BB, ACE)

- As physicians and providers, we have to consider cardiac rehabilitation just as important as the other Class I indications.
THANK YOU