The importance of follow-up after a cardiac event:

CARDIAC REHABILITATION
# The National Medicare Experience

## Mortality After Angioplasty
- Patients: 225,915

<table>
<thead>
<tr>
<th>Ages</th>
<th>30 Day</th>
<th>1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>2.1</td>
<td>5.2</td>
</tr>
<tr>
<td>70-74</td>
<td>3.0</td>
<td>7.3</td>
</tr>
<tr>
<td>75-79</td>
<td>4.6</td>
<td>10.9</td>
</tr>
<tr>
<td>&gt;80</td>
<td>7.8</td>
<td>17.3</td>
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## Mortality After Bypass Surgery
- Patients: 357,885

<table>
<thead>
<tr>
<th>Ages</th>
<th>30 Day</th>
<th>1 Year</th>
</tr>
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<tbody>
<tr>
<td>65-69</td>
<td>4.3</td>
<td>8.0</td>
</tr>
<tr>
<td>70-74</td>
<td>5.7</td>
<td>10.9</td>
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<tr>
<td>75-79</td>
<td>7.4</td>
<td>14.2</td>
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<tr>
<td>&gt;80</td>
<td>10.6</td>
<td>19.5</td>
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</table>
## Determinants of Survival After Cardiac Event

<table>
<thead>
<tr>
<th>Model term</th>
<th>Complete cases</th>
<th>Imputed data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95% CI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HR</td>
<td>Lower</td>
</tr>
<tr>
<td><strong>Fitness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High baseline</td>
<td>1.00</td>
<td>–</td>
</tr>
<tr>
<td>Mid baseline</td>
<td>1.83</td>
<td>1.20</td>
</tr>
<tr>
<td>Low baseline</td>
<td>4.06</td>
<td>2.58</td>
</tr>
</tbody>
</table>

## Determinants of Survival After Cardiac Event

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<td></td>
<td>95% CI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HR</td>
<td>Lower</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50</td>
<td>1.00</td>
<td>–</td>
</tr>
<tr>
<td>50–59</td>
<td>1.58</td>
<td>0.76</td>
</tr>
<tr>
<td>60–69</td>
<td>2.63</td>
<td>1.30</td>
</tr>
<tr>
<td>&gt;70</td>
<td>4.00</td>
<td>1.93</td>
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</table>
## Determinants of Survival After Cardiac Event

<table>
<thead>
<tr>
<th>Diagnostic category</th>
<th>Complete cases</th>
<th>Imputed data</th>
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<tbody>
<tr>
<td></td>
<td>95% CI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HR</td>
<td>Lower</td>
</tr>
<tr>
<td>MI</td>
<td>1.00</td>
<td>–</td>
</tr>
<tr>
<td>CABG</td>
<td>0.60</td>
<td>0.42</td>
</tr>
<tr>
<td>PCI</td>
<td>0.26</td>
<td>0.09</td>
</tr>
<tr>
<td>MI+PCI</td>
<td>1.05</td>
<td>0.42</td>
</tr>
<tr>
<td>Angina</td>
<td>0.85</td>
<td>0.46</td>
</tr>
<tr>
<td>Other cardiac</td>
<td>0.79</td>
<td>0.25</td>
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</table>

## Determinants of Survival After Cardiac Event

The table below shows the hazard ratios (HR) and 95% confidence intervals (CI) for various model terms associated with the survival after a cardiac event. The HR values are calculated using both complete cases and imputed data.

<table>
<thead>
<tr>
<th>Model term</th>
<th>Complete cases</th>
<th>Imputed data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HR</td>
</tr>
<tr>
<td><strong>Statin</strong></td>
<td></td>
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<tr>
<td>Yes</td>
<td>0.45</td>
<td>0.33</td>
</tr>
<tr>
<td>No</td>
<td>1.00</td>
<td>–</td>
</tr>
<tr>
<td><strong>Aspirin</strong></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.47</td>
<td>0.28</td>
</tr>
<tr>
<td>No</td>
<td>1.00</td>
<td>–</td>
</tr>
<tr>
<td><strong>ACE inhibitor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.42</td>
<td>1.04</td>
</tr>
<tr>
<td>No</td>
<td>1.00</td>
<td>–</td>
</tr>
</tbody>
</table>

Survival curves for all-cause and cardiovascular mortality by baseline fitness group

Martine J Barons et al. BMJ Open 2015;5:e007772
Association between cardiac rehabilitation (CR) participation and outcomes

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

<table>
<thead>
<tr>
<th>Event Type</th>
<th>CR (n = 719)</th>
<th>Non-CR (n = 719)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality</td>
<td>83</td>
<td>139</td>
</tr>
<tr>
<td>Cardiac mortality</td>
<td>34</td>
<td>46</td>
</tr>
<tr>
<td>Death/Any MI</td>
<td>158</td>
<td>206</td>
</tr>
<tr>
<td>Recurrent MI</td>
<td>110</td>
<td>96</td>
</tr>
<tr>
<td>Repeat PCI/CABG</td>
<td>235</td>
<td>206</td>
</tr>
<tr>
<td>Death/MI/PCI/CABG</td>
<td>297</td>
<td>329</td>
</tr>
</tbody>
</table>

Plots of the relationship between age and percutaneous coronary intervention date with cardiac rehabilitation participation

“What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?”
Introduction

- Up until the 1950s, strict bed rest was thought to be the best medicine after a heart attack.
- Following discharge moderately stressful activity such as climbing stairs was discouraged for a year or more.
"The patient is to be guarded by day and night nursing and helped in every way to avoid voluntary movement or effort."

Thomas Lewis, 1933
Effects of Prolonged Bed Rest

- 20-25% decrement in physical work capacity after 3 weeks
- 700-800 ml reduction in circulating blood volume after 7-10 days producing orthostatic hypotension and a reflex tachycardia
- Blood viscosity increases, predisposing to thromboembolic events
Effects of Prolonged Bed Rest

• 10-15% reduction per week in muscle mass and muscle contractile strength

• Increases the oxygen demand imposed on an already impaired oxygen transport system and potentially ischemic myocardium
Epidemiology

- Reduction in age-adjusted all-cause mortality rates in the most-fit men and women primarily due to lowered rates of cardiovascular disease and cancer.
- Coronary stenosis regressed in the group 1-year after engaging in low-fat vegetarian diet (10% total fat, 2% sat. fat), stopping smoking, stress management training and moderate exercise.
Epidemiology

- Lower rates of death from all causes and coronary diseases were separately associated with:
  - Moderate physical activity
  - Quitting cigarette smoking
  - Maintaining normal blood pressure
  - Avoiding central obesity
Definition of CR

- Cardiac rehabilitation has been defined as The sum of activities required to ensure cardiac patients the best possible physical, mental and social conditions so that they may, by their own efforts, resume and maintain as normal a place as possible in the community.

- Cardiac rehabilitation has also been described as The combined and coordinated use of medical, psychosocial, educational, vocational and physical measures to facilitate return to an active and satisfying lifestyle.
Definition of CR

- 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 process, thereby reducing morbidity and mortality.

AHA Scientific Statement, Circ 2005;111:369-76
Current Indications for Cardiac Rehabilitation (Medicare)

- Post-MI
- Post-CABG
- Angina
- PCI
- Valve replacement or repair
- Heart transplant
- Indications for CHF continue to be evaluated
Benefits of Cardiac Rehabilitation for Cardiac Patients

- Offset deleterious psychologic and physiologic effects of bed rest during hospitalization
- Provide additional medical surveillance of patients
- Enable patients to return to activities of daily living within the limits imposed by their disease
- Prepare the patient and the support system at home to optimize recovery followed by hospital discharge
Outcomes in Cardiac Rehabilitation

1. Smoking cessation
2. Lipid management
3. Weight control
4. Blood pressure control
5. Improved exercise tolerance
6. Symptom control
7. Return to work
8. Psychological well-being/stress management
Smoking Cessation
Lipid, Glucose & Weight Management
Weight Management

IDEAL BMI

51,251 Singaporeans were surveyed between 1993 and 2008 to study the link between their weight, expressed in BMI, and health. These are some of the findings.

Calculating BMI: \[
\text{Weight (kg)} \div \text{Height (m)} \times \text{Height (m)}
\]

<table>
<thead>
<tr>
<th>Healthy range</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.5 - 22.9</td>
<td>27.5 &amp; above</td>
</tr>
</tbody>
</table>

BMI range with lowest risk of death from cancer and cardiovascular disease

- Non-smokers below 65 years: 18.5 - 21.4
- Non-smokers 65 years and above: 21.5 - 24.4
- Ex-smokers: 23.0 - 24.4
- Current smokers: 26.0 - 27.4

A 67-year-old woman about 1.55m tall should weigh around 54kg. This will give her a BMI of 22.5, within the ideal range.

Sources: THE SINGAPORE CHINESE HEALTH STUDY, PLOS ONE
Stress Management
Work & Leisure
Exercise & Cardiac Rehabilitation
EXERCISE TO HAVE FUN AND BE HEALTHY, NOT JUST TO LOSE WEIGHT
Benefits of Exercise

- Reduces cardiovascular and total mortality
- Does not increase non-fatal reinfarction rate
- Improves myocardial perfusion
- May reduce progression of atherosclerosis when combined with aggressive diet
- No consistent effects on hemodynamics, LV function or visible collaterals
Benefits of Exercise

- No consistent effects on cardiac arrhythmias
- Improves exercise tolerance without significant CV complications
- Improves skeletal muscle strength and endurance in clinically stable patients
- Promotes favorable exercise habits
- Decreases angina and CHF symptoms
Benefits of Exercise

- improves glucose metabolism
- reduces body fat
- lowers blood pressure
- improves musculoskeletal strength
- controls body weight
- reduces symptoms of depression
A Cochrane review in 2004 concluded that exercise only cardiac rehabilitation reduced all cause mortality by 27% and cardiac mortality by 31%.

The Canadian Co-ordinating Office for Health Technology Assessment reported reductions of all cause mortality of 24% and cardiac mortality of 23%.

A study by Witt et al in 2004 found that not only was participation in cardiac rehab associated with decreased mortality after MI but also with lower risk of recurrent MI.
Are You Fit Enough?
Clinical risk stratification is suitable for low to moderate risk patients undergoing low to moderate intensity exercise.

Exercise testing and echocardiography are recommended for high risk patients and/or high intensity exercise.

Functional exercise capacity should be evaluated before and on completion of exercise testing.
Absolute Contraindication to Exercise

- Absolute Acute myocardial infarction (within two days)
- Unstable angina
- Uncontrolled cardiac arrhythmias causing symptoms or haemodynamic compromise
- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Active endocarditis
- Acute aortic dissection
- Acute non-cardiac disorder that may affect exercise performance or be aggravated by exercise
- Inability to obtain consent

Exercise standards for testing and training: a statement for healthcare professionals from the American Heart Association. Circulation 2001; 104:1694
Relative Contraindication to Exercise

- Left main coronary stenosis or its equivalent
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities
- Severe hypertension (systolic 200 mmHg and/or diastolic 110 mmHg)
- Tachyarrhythmias or bradyarrhythmias, including atrial fibrillation with uncontrolled ventricular rate
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Mental or physical impairment leading to inability to cooperate
- High-degree atrioventricular block

Exercise standards for testing and training: a statement for healthcare professionals from the American Heart Association. Circulation 2001; 104:1694;
Phase I
Objectives of Phase I Cardiac Rehab

- Conditioning from acute event/ post-CABG
- To make patient functionally independent
- To adjust with discharge from the hospital
- Psychological counselling
- Nutritional counselling
- Secondary prevention targeting
Phase I

- Phase I relates to the period of hospitalization following an acute cardiac event. The duration of this phase may vary depending on the initial diagnosis, the severity of the event and individual institutions, usually one week acute event/post-operative.
- During this phase,
  - Early mobilization and adequate discharge planning.
  - Individuals typically undergo a risk factor assessment and risk stratification
  - Receiving information regarding their diagnosis, risk factors, medications and work/social issues.
  - Involvement and support of the partner and family is facilitated and encouraged.
Objectives of Phase II Cardiac Rehab

- Functional goals
  - Exercise training under supervision/ at home
- Psychosocial goals
  - Anxiety/depression management
- Secondary preventive targets
Phase II

- **Phase II**: This phase encompasses the immediate post-discharge period, which is typically a period of **four to six weeks**.
- It focuses on:
  - health education and
  - resumption of physical activity, however, the structure of this phase may vary dramatically from centre to centre.
- It may take the format of:
  - telephone follow up,
  - home visits, or
  - individual or group education sessions.
- Either way, some form of contact is maintained with the patient, facilitating ongoing education and exchange of information.
Phase III
Objectives of Phase III Cardiac Rehab

- Functional goals
  - Exercise training under supervision
- Psychosocial goals
  - Return to work
  - Return to hobbies and lifestyle
  - Anxiety/depression management
- Secondary preventive targets
Phase III: This phase is sometimes erroneously referred to as the ‘Exercise’ phase.

It incorporates

- Exercise training in combination with ongoing education and psychosocial and vocational interventions.
- The duration of Phase 3 may vary from six to 12 weeks, with patients required to attend a CR unit two to three times weekly for structured exercise and other lifestyle interventions.
Phase IV
Objectives of Phase IV Cardiac Rehab

- Functional goals
  - Exercise training
- Psychosocial goals
  - Return to work
  - Return to hobbies and lifestyle
  - Anxiety/depression management
- Secondary preventive targets
Phase IV:

- Phase IV: This phase constitutes the components of long-term maintenance of lifestyle changes and professional monitoring of clinical status.
- It is when patients leave the structured Phase 3 programme and continue exercise and other lifestyle modifications indefinitely.
- This may be facilitated in the CR unit itself or in a local leisure centre.
- Alternatively, individuals may prefer to exercise independently and
- Phase 4 may involve helping them set a safe and realistic maintenance programme.
Measurements

- Exercise capacity
- Quality of life surveys (SF-12, SF-36)
- BP
- Weight
- Waist circumference
- Lipids
- Glucose/HbA1C
- Telemetry monitoring occurs during exercise sessions
- Nutritional survey tool
THANK YOU ALL