Cardiac Rehabilitation in Hospital Green Space: Does it make any Difference?

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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

Exercise Training & Counseling
Exercise Training

- Cardiorespiratory (aerobic)
- Resistance (strengthening)
- Flexibility (stretching)
- Neuromotor exercise training

“How many times should I push the elevator buttons to equal the same calories as taking the stairs?”
Exercise prescription

The Principal of F.I.T.T
Exercise prescription

• F – Frequency
• I – Intensity
• T – Type
• T – time
• E - Enjoyment
ENJOYMENT

• The amount of pleasure derived from the activity by the client.
• Often overlooked component of program
• The program and its activities must coincide with the personality, likes, and dislikes of the person.
• This ultimately translates into compliance.
Importance of enjoyment when promoting physical exercise.

Hagberg LA, Lindahl B, Nyberg L, Hellénius ML.

Abstract
The purpose of this study was to investigate the importance of enjoyment of exercise in a health care-based intervention aimed at promoting physical exercise in primary health care patients. In a controlled study design, the intervention group was offered a wide range of group exercises over 3 months, followed by support in designing their own exercise program. The control group received usual care. Enjoyment of exercise and exercise level were measured. Associations between enjoyment and exercise level were analyzed using Spearman's rank correlation coefficients. Changes in enjoyment between and within study groups were analyzed by the independent and paired t-test. Associations were found between enjoyment and exercise level (r=0.36, P<0.01), as well as between changes in enjoyment and changes in exercise level (r=0.34, P<0.01). At the 12-month follow-up, enjoyment of exercise was 25% higher in the intervention group than in the control group (P<0.01). In this group of primary health care patients, enjoyment of exercise was associated with exercise level. Enjoyment of exercise seems to be a mediator of exercise level. Furthermore, health care-based interventions seem to be able to affect enjoyment of exercise. Enjoyment of exercise may be important for the long-term effectiveness of health care-based interventions.
• One of the most important components of a properly designed training program is that it must be **ENJOYABLE**
Table 1. Effect of Exercise Training on Cardiac Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Effect(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>Meta-analysis of exercise programs in diabetic patients demonstrates mean decrease in hemoglobin A1C of 0.8%&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>Meta-analysis of exercise programs demonstrated a mean increase in high-density lipoprotein of 2.5 mg/dL&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Meta-analysis of exercise programs demonstrated a reduction in blood pressure of 3.4/2.4 mm Hg&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>An exercise program resulted in higher levels of abstinence from smoking at 3 and 12 months&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td>Obesity</td>
<td>Lifestyle modification including exercise resulted in a mean 6.7-kg weight loss at 1 year&lt;sup&gt;10&lt;/sup&gt;</td>
</tr>
<tr>
<td>Psychosocial health</td>
<td>A program of cardiac rehabilitation resulted in significant decreases in depression, anxiety, hostility, somatization, and psychosocial stress&lt;sup&gt;11&lt;/sup&gt;</td>
</tr>
<tr>
<td>Type of Exercise</td>
<td>Frequency</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Aerobic: Walking, stair-climbing, elliptical machine, dancing, light swimming,</td>
<td>At least 5 days</td>
</tr>
<tr>
<td>cycling on flat ground</td>
<td>per week</td>
</tr>
<tr>
<td>Aerobic: Running, singles tennis, swimming</td>
<td>At least 3 days</td>
</tr>
<tr>
<td></td>
<td>per week</td>
</tr>
<tr>
<td>Resistance training: Biceps curls, military presses, shoulder shrugs, 1-arm</td>
<td>At least 2 days</td>
</tr>
<tr>
<td>bent rowing, bent-knee pushups, quarter squats, toe raises, and bent-knee</td>
<td>per week</td>
</tr>
<tr>
<td>abdominal crunches</td>
<td></td>
</tr>
</tbody>
</table>

Moderate and vigorous activities can be combined toward the goal amount of activity.
CRP IN SERDANG HOSPITAL

Initial assessment

Case Discussion

Graduation

OT session

Health education

Physio session

‘Therapeutic Break’
Garden Utilization since 2013
Functional/ADL Activities
Clinical Study

The Effect of Park and Urban Environments on Coronary Artery Disease Patients: A Randomized Trial

Regina Grazuleviciene,¹ Jone Vencloviene,¹ Raimondas Kubilius,² Vytautas Grizas,³ Audrius Dedele,¹ Tomas Grazulevicius,¹ Indre Ceponiene,² Egle Tamuleviciute-Prasciene,² Mark J. Nieuwenhuijsen,⁴ Marc Jones,⁵ and Christopher Gidlow⁵

Aim. To test the hypothesis that walking in a park has a greater positive effect on coronary artery disease (CAD) patients' hemodynamic parameters than walking in an urban environment. Methods. Twenty stable CAD patients were randomized into two groups: 30-minute walk on 7 consecutive days in either a city park or busy urban street. Wilcoxon signed-rank test was employed to study short-term (30 min) and cumulative changes (following 7 consecutive days of exposure) in resting hemodynamic parameters in different environments.
# Clinical Study

## The Effect of Park and Urban Environments on Coronary Artery Disease Patients: A Randomized Trial

**Table 4:** The changes (mean (SE)) of hemodynamic parameters between the first and the seventh day exposure in urban and park environments.

<table>
<thead>
<tr>
<th>Measurements at day 1 and day 7</th>
<th>Urban exposure changes in mean (SE)</th>
<th>$P^*$ value</th>
<th>Park exposure changes in mean (SE)</th>
<th>$P^*$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP, mm Hg before test</td>
<td>1.22 (3.9)</td>
<td>0.336</td>
<td>-4.70 (6.0)</td>
<td>0.456</td>
</tr>
<tr>
<td>DBP, mm Hg before test</td>
<td>-0.11 (2.3)</td>
<td>0.453</td>
<td>-4.20 (2.2)</td>
<td>0.031</td>
</tr>
<tr>
<td>HR, b/min before test</td>
<td>-1.56 (1.9)</td>
<td>0.348</td>
<td>-1.3 (3.3)</td>
<td>0.500</td>
</tr>
<tr>
<td>SBP, mm Hg 3 h after test</td>
<td>1.30 (2.8)</td>
<td>0.469</td>
<td>-6.5 (3.7)</td>
<td>0.049</td>
</tr>
<tr>
<td>DBP, mm Hg 3 h after test</td>
<td>1.93 (3.8)</td>
<td>0.422</td>
<td>-6.29 (2.4)</td>
<td>0.014</td>
</tr>
<tr>
<td>HR, b/min 3 h after test</td>
<td>-4.16 (3.5)</td>
<td>0.172</td>
<td>-1.79 (1.6)</td>
<td>0.188</td>
</tr>
<tr>
<td>Peak SBP, mm Hg</td>
<td>5.5 (3.2)</td>
<td>0.156</td>
<td>-3.8 (5.8)</td>
<td>0.262</td>
</tr>
<tr>
<td>Peak DBP, mm Hg</td>
<td>0 (2.3)</td>
<td>0.453</td>
<td>-4.3 (3.3)</td>
<td>0.234</td>
</tr>
<tr>
<td>Peak heart rate, b/min</td>
<td>2.63 (4.0)</td>
<td>0.223</td>
<td>0.33 (3.7)</td>
<td>0.422</td>
</tr>
<tr>
<td>Exercise duration, min</td>
<td>0.26 (0.3)</td>
<td>0.230</td>
<td>1.10 (0.28)</td>
<td>0.004</td>
</tr>
<tr>
<td>Work load, W</td>
<td>9.8 (9.8)</td>
<td>0.500</td>
<td>30.9 (13.0)</td>
<td>0.063</td>
</tr>
<tr>
<td>Heart rate recovery, b/min</td>
<td>6.75 (4.5)</td>
<td>0.121</td>
<td>5.89 (2.6)</td>
<td>0.037</td>
</tr>
<tr>
<td>Pulse wave velocity m/s</td>
<td>0.37 (0.9)</td>
<td>0.410</td>
<td>0.35 (0.8)</td>
<td>0.321</td>
</tr>
</tbody>
</table>

*Exact one-tailed $P$ value of Wilcoxon test.*
Clinical Study

The Effect of Park and Urban Environments on Coronary Artery Disease Patients: A Randomized Trial

These findings support our conclusions that physical activity in the park environment has a greater positive impact on cardiovascular health than physical activity in an urban street and that to increase the efficacy of exercise-based cardiac rehabilitation for urban residents, walking in green environments should be recommended.
# Characteristics of Field Tests

<table>
<thead>
<tr>
<th></th>
<th>Incremental</th>
<th>Constant Work Rate</th>
<th>Self Paced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICT</strong></td>
<td>+</td>
<td>+++</td>
<td>?</td>
</tr>
<tr>
<td><strong>ITT</strong></td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>ISWT</strong></td>
<td>+</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td><strong>CWR (C)</strong></td>
<td>+++</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>CWR (T)</strong></td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>ESWT</strong></td>
<td>+</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td><strong>6MWT</strong></td>
<td>+</td>
<td>++</td>
<td>?</td>
</tr>
<tr>
<td><strong>reproducible</strong></td>
<td>+</td>
<td>?</td>
<td>++</td>
</tr>
<tr>
<td><strong>Discriminative</strong></td>
<td>+++</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>+/-</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td><strong>MID value</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Reference values</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Composite index</strong></td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**Key:**
- ICT = Incremental Cycle ergometry
- ITT = Incremental Treadmill test
- ISWT = Incremental Shuttle Walk Test
- CWR(C) = Constant Work Rate Cycle Test
- CWR(T) = Constant Work Rate Treadmill Test
- ESWT = Endurance Shuttle Walk Test
- 6MWT = 6 Minute Walk Test

*M. Barthels, 2016*
How to use 6MWT results

Walking Training Intensity (speed = distance/time)

To calculate an appropriate walking intensity:
- 6 minute walk distance (6MWD) ÷ 6 = Distance in 1min
- For distance in 30 mins x 30
- For distance in 20 mins x 20

For Training:
80% of this distance in the prescribed time.

M. Barthels, 2016
Walk training: Intensity from 6MWT

- Recommendation: 80% average 6MWT speed (Jenkins 2010)
- Rate in km/hr = (10 x 6 MWD)/1000
  
  E.G. if a patient walks 300 meters in 6 minutes that translates to 3.0 km/hr

Use walk speed to design a program in the community or in the CR program

M. Barthels, 2016
Example

- 45 year old with CAD s/p PCI
- 6MWT distance = 360 metres
- Peak HR 150, RR 28, BP 155/82

- For a CR program: what is starting intensity described in 20 minute walking distance, speed (km/hr) and precautions
- Write as sample prescription
Example:

- 6MWT distance = 360 metres
- Distance in 1 min = 360 ÷ 6 = 60 metres
- For a 20 minute walk training = 60 x 20 = 1200 metres
- **BUT** need 80% for training = 0.8 x 1200 = 960 metres in 20 mins
- Rate in km/hr = \((10 \times 6 \text{ MWD})/1000\)
  = \((10 \times 360)/1000\)
  = 3.6 km/hr
Comparison Of Exercise In A Green Outdoor Environment Versus Indoor Activity Among Cardiac Survivors

- To determine the effect of Green Outdoor Environment (GOE) on cardiac survivors’ HR(bpm), SBP(mmHg) and DBP(mmHg) during exercise training
Methods

• 18 cardiac survivors participated in the study

• Walking on a pathway of 45 meters without obstacles for 20 min = outdoor sessions

• Walking on the treadmill for 20 minutes at the speed of 3.2 miles/hour = the indoor session

• The HR(bpm), SBP(mmHg) and DBP(mmHg) were taken immediately after they have finished the activities
Methods

Inclusion criteria

• 35–75 years of age
• men or women who survived MI or unstable angina pectoris
• signed informed consent to take part in the study

Exclusion criteria

• unstable angina pectoris
• cardiomyopathy
• idiopathic or organic valvular disease
• hypertension with SBP > 160/110mmHg
• diabetes mellitus type 2
• electrocardiostimulation
• neurological diseases
• limited capacity (less than 300m achieved after 6MWT)
Walking on treadmill for 20 min at the speed of 3.2 miles/hr

Walking in the garden at own CWS and prescribed distance for 20 min
Results - HR

The Reading of the Heart Rate (bpm) taken Before and After Rehabilitation Treatments

Setting of Treatment Sessions

- Indoor: $p > 0.05$
- Outdoor: $p < 0.05$
Results - SBP

![Graph showing the comparison of systolic blood pressure (SBP) before and after treatment in indoor and outdoor settings. The y-axis represents the reading of SBP in mmHg, ranging from 115 to 145. The x-axis represents the setting of treatment sessions, with indoor and outdoor settings. The graph shows that the SBP is not significantly different in the indoor setting (p > 0.05), while it is significantly lower in the outdoor setting (p < 0.05).]
Results - DBP

- Indoor: Before Treatment (p>0.05), After Treatment (p>0.05)
- Outdoor: Before Treatment (p>0.05), After Treatment (p>0.05)
Survey

Preference to be in Green Outdoor Environments

Preference for the Outdoor Session

- Yes
- No
- Not sure

Percentage

Respondents
Survey

![Bar chart showing time spent in green outdoor environments](chart_image.png)

- **5 - 10 minutes**: 5% Respondents
- **11 - 20 minutes**: 15% Respondents
- **21 - 30 minutes**: 35% Respondents
- **31 - 40 minutes**: 20% Respondents
- **More than 1 hour**: 15% Respondents
Survey

Frequent Use of Green Outdoor Environments

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyday</td>
<td>35%</td>
</tr>
<tr>
<td>Several times a week</td>
<td>25%</td>
</tr>
<tr>
<td>Every weekend</td>
<td>10%</td>
</tr>
<tr>
<td>Every month</td>
<td>5%</td>
</tr>
<tr>
<td>Rarely</td>
<td>15%</td>
</tr>
<tr>
<td>Never</td>
<td>20%</td>
</tr>
</tbody>
</table>
Type of settings in GOE for rehabilitation

![Bar chart showing preferences for different settings in GOE for rehabilitation. The settings include refreshing scent, fresh air, shaded place, home feeling, landing pad, open area, enclosed area, quiet area, and multipurpose rehabilitation activities. The chart indicates the mean preference of respondents for each setting.](chart.png)
Conclusions

• Enjoyment of exercise should be considered in prescribing exercise in CRP
• Green Outdoor Environments (GOE) have been shown to have positive effects on physiological and psychological to cardiac survivors
• Utilizing nature-based surrounding have been shown to be cardiac survivors preference
Thank you

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