EIM: from theory to practice

Assist. Prof. Visal Kantaratanakul, MD, F.I.M.S.
Director, Rehabilitation Services, Samitivej Groups
Consultant, Cardiac Rehabilitation unit, Faculty of Medicine,
Ramathibodi Hospital.
Expert panel on physical activity and exercise,
Ministry of Public Health

• We start our first cardiac rehabilitation unit in Thailand at Ramathibodi Hospital, Mahidol University on 1994
• H.M. The King had heart attack on 7 of March and underwent PCI on 10 of March 1995
• Interview on 13th of April 1995

SINCE THEN PEOPLE WITH HEART DISEASE UNDERSTOOD CORRECTLY ABOUT HEART DISEASE AND THE IMPORTANCE OF EXERCISE AFTER HEART DISEASE

My covers

• EIM by theory
• EIM in motion
• EIM in individual

Theory: EIM

• a 2007 global initiative launched by the American College of Sports Medicine in collaboration with the American Medical Association.
• the implementation of a physical activity vital sign (PAVS) for each medical visit for every patient
Exercise is Medicine

Hippocrates, c. 460-c. 370 BC

• “All parts of the body which have a function, if used in moderation and exercised in labors in which each is accustomed, become thereby healthy, well developed and age more slowly, but if unused they become liable to disease, defective in growth and age quickly.”

• “If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health.”

• “Walking is man’s best medicine.”

The theory

The average follow-up was 2.8 years. The incidence of diabetes was 11.0, 7.8, and 4.8 cases per 100 person-years in the placebo, metformin, and lifestyle groups, respectively. The lifestyle intervention reduced the incidence by 58 percent (95 percent confidence interval, 48 to 66 percent) and metformin by 31 percent (95 percent confidence interval, 17 to 43 percent), as compared with placebo; the lifestyle intervention was significantly more effective than metformin.

To prevent one case of diabetes during a period of three years, 6.9 persons would have to participate in the lifestyle-intervention program, and 13.9 would have to receive metformin.

Event-free survival after 12 months was significantly superior in the exercise training group versus PCI group (P = 0.023 by log-rank test).

<table>
<thead>
<tr>
<th>Follow up (Months)</th>
<th>PCI Group</th>
<th>Exercise Training Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>53</td>
<td>51</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>38</td>
<td>45</td>
</tr>
<tr>
<td>9</td>
<td>31</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>25</td>
<td>43</td>
</tr>
</tbody>
</table>

**Table 1. Approximate Mortality Reduction Potential of Lifestyle Changes Estimated From Studies in Coronary Artery Disease Patients Compared With Preventive Drug Interventions After Myocardial Infarction**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Mortality Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-dose aspirin</td>
<td>19%</td>
</tr>
<tr>
<td>Moderate alcohol</td>
<td>20%</td>
</tr>
<tr>
<td>Statins</td>
<td>21%</td>
</tr>
<tr>
<td>β-Blockers</td>
<td>23%</td>
</tr>
<tr>
<td>Physical activity</td>
<td>25%</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>26%</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>35%</td>
</tr>
<tr>
<td>Combined dietary changes</td>
<td>46%</td>
</tr>
</tbody>
</table>


**Table 2. Approximate Mortality Reduction Potential of Lifestyle Changes Estimated From Studies in CAD Patients and the General Population**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Mortality Risk Reduction Estimated From Studies in CAD Patients</th>
<th>Mortality Risk Reduction Estimated From Cohort Studies in General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking cessation</td>
<td>35%</td>
<td>50%</td>
</tr>
<tr>
<td>Physical activity</td>
<td>25%</td>
<td>20%–30%</td>
</tr>
<tr>
<td>Moderate alcohol</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>Combined dietary changes</td>
<td>45%</td>
<td>15%–40%</td>
</tr>
</tbody>
</table>

Physical activity and the risk of type 2 diabetes: a systematic review and dose-response meta-analysis

Dagli S. Nejad, Teresa Nejad, Michael Leitzmann, Serena Tenstad, Lars Johan Vatten

Relative Risk

<table>
<thead>
<tr>
<th>Study</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan, 2015</td>
<td>0.55 (0.40, 0.72)</td>
</tr>
<tr>
<td>Kohl, 2014</td>
<td>0.51 (0.40, 0.68)</td>
</tr>
<tr>
<td>Heidtmann, 2012</td>
<td>0.68 (0.62, 0.90)</td>
</tr>
<tr>
<td>Bigalke, 2012</td>
<td>0.95 (0.81, 1.13)</td>
</tr>
<tr>
<td>Longo, 2010</td>
<td>0.71 (0.58, 0.91)</td>
</tr>
<tr>
<td>Leonardi, 2007</td>
<td>0.66 (0.49, 0.90)</td>
</tr>
<tr>
<td>Dehghan, 2007</td>
<td>0.56 (0.43, 0.74)</td>
</tr>
<tr>
<td>Juniper, 2006</td>
<td>0.68 (0.52, 0.90)</td>
</tr>
<tr>
<td>Fredriksen, 2005</td>
<td>0.49 (0.34, 0.70)</td>
</tr>
<tr>
<td>Ronco, 2004</td>
<td>0.90 (0.63, 1.26)</td>
</tr>
<tr>
<td>Nutall, 2004</td>
<td>0.72 (0.54, 0.95)</td>
</tr>
<tr>
<td>Bank, 2003</td>
<td>0.68 (0.53, 0.87)</td>
</tr>
<tr>
<td>Overall</td>
<td>0.67 (0.59, 0.85)</td>
</tr>
</tbody>
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Relative Risk

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<td>Study 1</td>
<td>0.54 (0.42, 0.70)</td>
</tr>
<tr>
<td>Study 2</td>
<td>0.58 (0.47, 0.73)</td>
</tr>
<tr>
<td>Study 3</td>
<td>0.62 (0.51, 0.77)</td>
</tr>
<tr>
<td>Study 4</td>
<td>0.70 (0.59, 0.83)</td>
</tr>
<tr>
<td>Study 5</td>
<td>0.80 (0.69, 0.93)</td>
</tr>
<tr>
<td>Study 6</td>
<td>0.90 (0.79, 1.03)</td>
</tr>
<tr>
<td>Overall</td>
<td>0.69 (0.59, 0.80)</td>
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Exercise and diabetes: relevance and causes for response variability

Anja Röhrs, C. Weigert, H. Steiger, H.-U. Hering

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Targeted exercise against osteoporosis: A systematic review and meta-analysis for optimising bone strength throughout life

Nikander et al. BMC Medicine 2016, 14:7
http://www.biomedcentral.com/1741-7015/14/7

Abstract

Background: Exercise is widely recommended to reduce osteoporosis, falls and related fragility fractures, but its effect on whole bone strength has remained inconclusive. The primary purpose of this systematic review and meta-analysis was to evaluate the effects of long-term supervised exercise (at least 6 months) on estimates of lower-extremity bone strength from childhood to elder age.

Methods: We searched four databases (PubMed, SportDiscus, Physical Education Index, and Embase) up to October 2009 and included 10 randomized controlled trials (RCTs) that assessed the effects of exercise training on whole bone strength. We analysed the results by age groups (childhood, adolescence, and young and older adulthood) and compared the changes to habitual active or sedentary controls. To calculate standardized mean differences (SMDs) effect sizes, we used the follow-up values of bone strength measures adjusted for baseline bone values. An inverse variance-weighted random-effects model was used to pool the results across studies.

Results: Our quality analysis revealed that exercise regimens were heterogeneous; some trials were short in duration and small in sample size, and the weekly training doses varied considerably between trials. We found a small and significant exercise effect among pre- and early pubertal boys (ESM, effect size: 0.17 [95% CI 0.02-0.32]), but not among pubertal girls (-0.01 to 0.18), adolescent boys (0.10 [0.75 to 0.90]), adolescent girls (0.21 [-0.03 to 0.97]), premenopausal women (0.20 [0.04 to 0.36]) or postmenopausal women (-0.11 to 0.15). Evidence based on per-protocol analyses of individual trials in children and adolescents indicated that programmes incorporating regular weight-bearing exercise can result in 7% to 11% improvements in bone strength at the loaded skeletal sites. In premenopausal women with high exercise compliance, improvements ranging from 6.3% to 25% were found.

Conclusions: The findings from our meta-analysis of RCTs indicate that exercise can significantly enhance bone strength at loaded sites in children but not in adults. Since few RCTs were conducted to investigate exercise effects on bone strength, there is still a need for further well-designed, long-term RCTs with adequate sample sizes to quantify the effects of exercise on whole bone strength and its structural determinants throughout life.

What happens during exercise?

[Diagram showing biological processes related to exercise and bone health]
The Nobel Prize in Physiology or Medicine 2016

Harumichi Ohsumi

Prize share 1/7

Physical exercise, reactive oxygen species and neuroprotection

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1 Institute of Sport Sciences, University of Physical Education, Alkotás 4, H-1151 Budapest, Hungary
2 Department of Exercise Science, University of Physical Education and Sport Sciences, Budapest, Hungary
3 Institute of Exercise and Sport Sciences, University of Physical Education and Sport Sciences, Budapest, Hungary
4 Department of Exercise Physiology, Hungarian Academy of Sciences, University of Physical Education and Sport Sciences, Budapest, Hungary
5 Department of Physiological Sciences, Hungarian Academy of Sciences, University of Physical Education and Sport Sciences, Budapest, Hungary

ABSTRACT

Regular exercise has systemic beneficial effects, including the protection of brain function. The adaptive response to regular exercise involves the upregulation of the expression of antioxidant genes and the production of reactive oxygen species (ROS). Reactive oxygen species (ROS) are important regulators of cell signaling, behavior, and neurodevelopmental and adult brain function. ROS, and particularly their production by astrocytes, regulate the cellular redox state of the brain. ROS are also involved in the self-renewal and differentiation of neural stem cells and the exercise-mediated neurogenesis could be partly associated with ROS production. Exercise has strong effects on the immune system and readily alters the production of cytokines. Certain cytokines, especially IL-1, TNF-α, IL-6, and TGF-β, are actively involved in the modulation of synaptic plasticity and neuroprotection. Cytokines can also contribute to ROS production. ROS-mediated activation of intracellular proteins and kinases could directly affect brain function, while exercise training may promote neuroprotection by reducing the production of pro-inflammatory cytokines and enhancing antioxidant signaling pathways, membrane remodelling, and gene transcription. The well-known neuroprotective effects of exercise are partly due to reduced oxidant stress.

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Clinical trial

- **Phase I:** Researchers test a new drug or treatment in a small group of people for the first time to evaluate its safety, determine a safe dosage range, and identify side effects.

- **Phase II:** The drug or treatment is given to a larger group of people to see if it is effective and to further evaluate its safety.

- **Phase III:** The drug or treatment is given to large groups of people to confirm its effectiveness, monitor side effects, compare it to commonly used treatments, and collect information that will allow the drug or treatment to be used safely.

- **Phase IV:** Studies are done after the drug or treatment has been marketed to gather information on the drug’s effect in various populations and any side effects associated with long-term use.
Conclusion for theory

Exercise is medicine and pass
the clinical trial phase IV

The Practice

INVITED COMMENTARY

Exercise — The Medicine We Should All Prescribe

Thomas M. Best, MD, PhD

Introduction

“Walking is the best medicine.”
(Hippocrates, c. 460 LC-370 BC)

Regular exercise and a physically active lifestyle have
unparalleled beneficial effects on health. Compared with
activity, exercise is available at relatively low cost and, for
the most part, free of adverse effects. Exercise produces similar
effects in many cases, greater benefit than prescription drugs in
the secondary prevention of coronary artery disease, treatment
of heart failure, prevention of diabetes, and postpone other
treatment (1). So the question remains — who has it taken an
response to exercise? How does that dose-response
relationship change over time? Help seems to be on the way
with innovative curriculum now present in at least two
medical schools to address medical providers’ deficiencies in
knowledge about exercise and its importance to human
health. How will this translate to more effective exercise
prescription strategies remains uncertain but it is a critical
step in educating all health care providers about the
ever-wafting importance of exercise in our daily lives.

The Practice

Br J Sports Med January 2009 Vol 43 No 1
Physical activity as medicine: time to translate evidence into clinical practice

Mai-Lis Hellénius,1 Carl Johan Sundberg2

Follow-up investigations of large cohorts of men and women in USA demonstrate that a low cardiorespiratory fitness is an independent mortality risk factor for all cause deaths. These findings are highly relevant for a majority of populations all over the world. Sedentary life is a dangerous modern health threat. Physical inactivity is linked to almost all common health problems including cardiovascular disease, type 2 diabetes, obesity, low bone density, cancer, dementia and depression. Furthermore, the great value of physical

The prescription can be used for prevention and/or treatment. All healthcare professionals can prescribe physical activity. It is essential that the prescription be a dialogue between patient and clinician. This would be as accurate and as detailed on a special prescription form. A Swedish study in primary healthcare on patients receiving physical activity on prescription demonstrated a good adherence after 6 months. A majority of patients reported adhering fully to the prescription (87%). Partial adherence was reported by 13% and only 10% reported usual non-adherence.

KPI

• Quantitative KPI
  • DPAC @ General Hospital 100 %
  • DPAC @ Community Hospital 80 %

• Qualitative KPI
  • DPAC Quality
  • NCD Clinic and DPAC Clinic Certified
Program success stories

- EIM initiative
- Exercise assessment and prescription
- The PA Vital Sign
- The exercise prescription
- Providing PA advice in the exam room
- Integrating PA into daily life

Theory ———> Practice

![Diagram: PA Vital Sign in HELP2]

1. On average, how many days a week do you perform physical activity or exercise?
2. On average, how many total minutes of physical activity or exercise do you perform on those days?
   days/week X minutes/day = min/week (PAMS)
3. Describe the intensity of your physical activity or exercise:
   light = casual walk  moderate = brisk walk  vigorous = jogging

![Diagram: Intermountain Healthcare Physical Activity Vital Sign]
**What do we know about physical activity?**

- Exercise can improve heart health, reduce the risk of chronic diseases, and enhance overall well-being.
- Regular physical activity helps in maintaining a healthy weight, reducing the risk of obesity, and improving mental health.
- It is recommended to include a variety of activities, such as aerobic exercises, strength training, and flexibility exercises.

**Aerobic Activity**

Types: Walk, Run, Swim, Bike, Other: ___________

Frequency (days/week): ___________

Intensity: Light, Moderate, Vigorous

Time (minutes/day): ___________

Steps/day: ___________

**Strength Training**

- Muscle strengthening should be done at least two days per week.
- Exercises should be done to strengthen all major muscle groups.
- For each exercise, 8-12 repetitions should be completed.
- Examples include free weight exercises (e.g., squats, lunges), carrying heavy objects, and home gardening.

**Loading Methods**

- The intensity of exercise should be adjusted to keep the person's health in mind.
- Gradually increase the intensity and volume of exercise as the person feels comfortable.
- It is important to listen to the body and adjust the training program as needed.

**Weekly Summary**

- ____________ + ____________ = ____________

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**Diagram**

- [Hand-drawn diagram with labeled parts and connections]

---

**Diagram**

- [Hand-drawn diagram with labeled parts and connections]
How the practice?

- Exercise prescription is not difficult now
- The difficult things are
  - initiate first step
  - adherence
  - compliance

Planning

- Separate people according to their stage of change
- Subgroup in Precontemplation stage by healthy problems
- Subgroup other stages by fitness level.