Exercise and Cardiovascular Disease

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Section of Cardiology
Objectives

- Identify the problem of inactivity
- Cost of inactivity
- General Benefits of exercise
- Benefits of exercise on CHD risk factors
- Exercise prescription- Aerobic
- Exercise prescription- Strength Training
- When to consult a physician
- Helpful tips
Problems in the United States
“Our challenge is to convince the public that heart attacks are sexy.”
Problems in the United States

“My doctor told me to start my exercise program very gradually. Today I drove past a store that sells sweat pants.”
Active Lifestyle- Then & Now

30 years ago (active)
- Iron & vacuum for 30 min
  - 152 kcal
- Wash & cut veggies 15min
  - 13 kcal
- Walk dog for 30 min
  - 125 kcal
- Walk up 3 flights of stairs
  - 15 kcal
- TOTAL= 305 kcal

Today (inactive)
- Hire someone to clean/iron
  - 0 Kcal
- Buy pre sliced veggies
  - 0 Kcal
- Let dog out the back door
  - 2 kcal
- Take the elevator
  - 0.3 kcal
- TOTAL= 2.3 kcal
No Physical Activity for Adults by State, 2003

Note: Data are for ages 18 years and over, age adjusted to the 2000 standard population, for no leisure-time physical activity. Source: Behavioral Risk Factor Surveillance System, NCCDPHP, CDC.
Heart Disease Death Rates, 1996-2000
United States, Ages 35+, Total Population

Age-adjusted Average Annual Deaths per 100,000
- 303 - 471
- 472 - 523
- 524 - 568
- 569 - 613
- 614 - 824
- Insufficient Data

Department of Health and Human Services
Centers for Disease Control and Prevention
National Center for Chronic Disease Prevention and Health Promotion
Physical inactivity

- Prevalence
  - 75% of Americans do not meet the current recommendations of 30 minutes of leisure-time physical activity on most days of the week
  - One-third do not engage in any physical exercise
  - Exercise for children has declined and sedentary activities has dramatically increased
- Data from 40 observational studies demonstrate an inverse dose-response relationship between volume of physical activity and all-cause mortality
- Energy expenditure of 1000kcal/week reduces all-cause mortality by 30%
- CVD risk in sedentary individuals is doubled compared with physically active individuals, when controlled for other CVD risk factors
Physical inactivity

- Activity can be as simple as brisk walking
- Mortality reduction benefits are also present in the elderly who initiate new exercise programs
- Exercise also reduced the risk of stroke and new onset DM
- In secondary prevention, regular exercise reduces mortality by 25%
- Exercise clearly has beneficial effects on other CVD risk factors (increase HDL, reduce LDL, lower BP, increase insulin sensitivity)
- Recommendations: 30-60 minutes of moderate activity on most days of the week (primary and secondary prevention)
Cost of Cardiovascular Disease in the United States*

- Total CVD†: $368 billion
- Heart disease: $239 billion
- Coronary heart disease: $133 billion
- Hypertension: $56 billion
- Stroke: $54 billion
- Congestive heart failure: $29 billion

CVD=Cardiovascular disease

*2004 estimates.
†Totals do not add up because of rounding and overlap.
NHLBI. www.nhlbi.nih.gov
Scope of the Problem

Prevalence of U.S. Heart Disease

ACC/AHA Guidelines 2001, NHLBI Chartbook
2000 and Foot et al (JACC 2000)
Definition

Primordial Prevention: Prevention of CHD risk factors

Primary Prevention: Modification of risk factors in order to prevent or delay the onset of CHD

Secondary Prevention: Initiation of therapy to reduce recurrent CHD events and decrease cardiac mortality in patients with established CHD

CHD=Coronary heart disease
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 and left idle they become liable to disease, defective in growth, and age quickly.

-Hippocrates, the Father of Medicine (460-377 BC)
Exercise

Americans would pay almost any price for a pill that contained all the benefits associated with exercise: increased life expectancy, improved mental health, and decreased disability. Scientific research has shown repeatedly that exercise can benefit both the body and mind.

• Statement of Dr. Terrie Wetle
  Deputy Director,
  National Institute on Aging
  Senate Special Committee on Aging
  Hearing on Healthy Aging
  September 14, 1999
No shortcuts!

"Step 1: apply Miracle Cellulite Cream to problem areas. Step 2: run ten miles."
Benefits of Exercise

- Enhances dietary effects
- Maintains cardiac function as well as skeletal muscle function
- Enhances general well being
- Improves prognosis
- Enables weight control
- Enhances glucose control and insulin sensitivity
- Improves endothelial function
- Reduces inflammation/CRP
Exercise Evidence: Mortality Risk

Observational study of self-reported physical activity in 772 men with established coronary heart disease

Light or moderate exercise is associated with lower risk

### Endurance vs. Resistance Training: Benefits

<table>
<thead>
<tr>
<th>Variable</th>
<th>Aerobic Exercise</th>
<th>Resistance Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone mineral density</td>
<td>↑</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Body composition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat mass</td>
<td>↓↓</td>
<td>↓</td>
</tr>
<tr>
<td>Muscle mass</td>
<td>⇔</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Strength</td>
<td>⇔</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Glucose metabolism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin response to glucose challenge</td>
<td>↓↓</td>
<td>↓↓</td>
</tr>
<tr>
<td>Basal insulin levels</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Insulin sensitivity</td>
<td>↑↑</td>
<td>↑↑</td>
</tr>
<tr>
<td>Serum lipids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-density lipoprotein</td>
<td>↑⇔</td>
<td>↑⇔</td>
</tr>
<tr>
<td>Low-density lipoprotein</td>
<td>↓⇔</td>
<td>↓⇔</td>
</tr>
<tr>
<td>Resting heart rate</td>
<td>↓↓</td>
<td>⇔</td>
</tr>
<tr>
<td>Blood pressure at rest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>↓↓</td>
<td>↓</td>
</tr>
<tr>
<td>Diastolic</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Physical endurance</td>
<td>↑↑↑</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Basal metabolism</td>
<td>↑</td>
<td>↑↑↑</td>
</tr>
</tbody>
</table>

↑ indicates increased; ↓, decreased; and ⇔, negligible effect
Physical Activity and Prevention- Role of the Employer

- Physical activity classes 2 to 3 times per week, for 30 to 45 minutes per session
- For each worker, the intervention program saved $679 in medical claims per year, a return of $6.85 on each dollar invested.
- Other examples of work-site programs have been estimated to cost employers about $100 to $400 per employee, per year. The estimated rate of return is about $513 per employee per year, including reduced health care cost and reduced loss of productivity.
Reducing Health Care Costs by Reducing the Need and Demand For Medical Services

- Widespread implementation of preventive strategies requires a collaboration among business, labor, the insurance industry, government and universities.
- Reducing the need and demand for medical services is a positive solution bringing better health for the individual and ultimately lowering health care costs.
American Heart Association
Risk Classification for Exercise Training:

This classification includes:

1. Children, adolescents, men < 45 years, and women < 55 years who have no symptoms or known presence of heart disease or major coronary risk factors.

2. Men ≥ 45 years and women ≥ 55 years who have no symptoms or known presence of heart disease and with < 2 major cardiovascular risk factors.

3. Men ≥ 45 years and women ≥ 55 years who have no symptoms or known presence of heart disease and with ≥ 2 major cardiovascular risk factors.

Activity guidelines: No restrictions other than basic guidelines.

Supervision required: None*.

ECG and blood pressure monitoring: Not required.
Cardiac Rehabilitation

• The term *cardiac rehabilitation refers to coordinated, multifaceted interventions*

• Designed to optimize a cardiac patient’s physical, psychological, and social functioning,

• Aimed at stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes.

• Thereby reducing morbidity and mortality.
### Benefits of Cardiac rehab

<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*
Exercise Prescription

- Intensity
- Duration
- Frequency
- Modality
“To prevent a heart attack, take one aspirin every day.
Take it out for a jog, then take it to the gym,
then take it for a bike ride...”
WHAT’S THE DIFFERENCE?

• Physical activity refers to any movement produced by muscular contractions that burns extra calories. Examples: raking leaves, gardening, shopping.

• Exercise is a specific type of physical activity that includes any planned, structured, and repetitive bodily movement done specifically to improve or maintain one or more components of physical fitness. Examples: brisk walking, bicycling, running, swimming, hiking, and weight lifting.
EXERCISE

**Aerobic Exercise** - the utilization of oxygen for muscle contraction.

* improves cardiovascular fitness
* Increases endurance
* Enables physical activity for extended periods of time

**Anaerobic** - does not utilize oxygen in contracting muscles.

* Increases muscle strength, flexibility
* Reduces risk for injury
<table>
<thead>
<tr>
<th>Exercise Type</th>
<th>Duration</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-up</td>
<td>5-10 min.</td>
<td>Each day you exercise</td>
</tr>
<tr>
<td>Aerobic</td>
<td>30-60 min.</td>
<td>5-6 d/wk</td>
</tr>
<tr>
<td>Strength Training</td>
<td>12-15 reps</td>
<td>2-3 d/wk</td>
</tr>
<tr>
<td>Cool down</td>
<td>5-10 min.</td>
<td>Each day you exercise</td>
</tr>
</tbody>
</table>
To promote and maintain health, every adult should perform moderate intensity physical activity for 30-60 minutes, 5 days/week OR vigorous intensity activity for 20 minutes, 3 days/week.

Circulation 116:1081; 2007
Modified Borg Scale:
Perceived Exertion (Intensity)

- 0 Nothing at all
- ½ Very, very light
- 1 Very light
- 2 Light
- 3 Moderate
- 4 Somewhat Hard
- 5- 6 Heavy
- 7- 8 Very Heavy
- 9- 10 Very, Very Heavy
**Exercise and Physical Activity Intensity (Mets)**

<table>
<thead>
<tr>
<th>&lt; 3</th>
<th>3-5</th>
<th>5-7</th>
<th>7-9</th>
<th>&gt; 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk work</td>
<td>Painting</td>
<td>Carpentry</td>
<td>Digging ditches</td>
<td>Shoveling wet snow</td>
</tr>
<tr>
<td>Driving car</td>
<td>Electrical work</td>
<td>Shoveling light dirt</td>
<td>Splitting logs</td>
<td>Heavy construction</td>
</tr>
<tr>
<td>Store clerk</td>
<td>Auto repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking &lt; 3mph</td>
<td>Janitorial work</td>
<td>Walking 3-4mph</td>
<td>Jogging 5 mph</td>
<td>Running &gt; 6 mph</td>
</tr>
</tbody>
</table>

**Light:** < 3 METs  
**Moderate:** 3-6 METs  
**Vigorous:** > 6 METs
### METS values for tasks of daily living

<table>
<thead>
<tr>
<th>Activity</th>
<th>METS (Min)</th>
<th>METS (Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed making</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Carrying heavy groceries</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Cleaning windows</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Cooking (standing)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Dressing</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Driving a car</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Eating</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>General housework</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Grocery shopping</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Loading/unloading washing machine</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Lying awake</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Mowing by hand</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Painting / decorating</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Sexual intercourse</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Showering</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Vacuuming</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Walking up stairs</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Washing car</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Washing dishes</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Watching television</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

### METS values for leisure activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>METS (Min)</th>
<th>METS (Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycling</td>
<td>5mph</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>10mph</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>13mph</td>
<td>8</td>
</tr>
<tr>
<td>Dancing</td>
<td>Ballroom</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Aerobic</td>
<td>6</td>
</tr>
<tr>
<td>Skipping</td>
<td>&lt;80/min</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>120 - 140/min</td>
<td>11</td>
</tr>
<tr>
<td>Swimming</td>
<td>Breast stroke</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Freestyle</td>
<td>9</td>
</tr>
<tr>
<td>Tennis</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Walking</td>
<td>1 mph</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2 mph</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3 mph</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3.5 mph</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>4 mph</td>
<td>5</td>
</tr>
</tbody>
</table>
## Absolute Intensity

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Young (20-39)</th>
<th>Middle-aged (40-64)</th>
<th>Old (65-79)</th>
<th>Very Old (80+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Light</td>
<td>&lt;3.0</td>
<td>&lt;2.5</td>
<td>&lt;2.0</td>
<td>&lt;1.25</td>
</tr>
<tr>
<td>Light</td>
<td>3.0 - 4.7</td>
<td>2.5 - 4.4</td>
<td>2.0 - 3.5</td>
<td>1.26 - 2.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>4.8 - 7.1</td>
<td>4.5 - 5.9</td>
<td>3.6 - 4.7</td>
<td>2.3 - 2.95</td>
</tr>
<tr>
<td>Hard</td>
<td>7.2 - 10.1</td>
<td>6.0 - 8.4</td>
<td>4.8 - 6.7</td>
<td>3.0 - 4.25</td>
</tr>
<tr>
<td>Very Hard</td>
<td>&gt;10.2</td>
<td>&gt;8.5</td>
<td>&gt;6.8</td>
<td>&gt;4.25</td>
</tr>
<tr>
<td>Maximal</td>
<td>12.0</td>
<td>10.0</td>
<td>8.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Exercise Prescription-Aerobic

- **F** = Frequency
  - Engage in aerobic exercise 5-6 days per week
- **I** = Intensity
  - 4-5 on Borg Rating of Perceived Exertion
  - This intensity should feel comfortably challenging
  - Target heart rate ranges can be prescribed if a stress test has been performed post event
- **T** = Time
  - 30-60 min. of non-stop, steady exercise in prescribed intensity
Aerobic Exercise Benefits the Cardiovascular System

• Over time it will decrease the demand on your heart by lowering your resting heart rate and blood pressure

• Improves peripheral & collateral blood flow distribution

• Improves your cardiac risk profile
  - cholesterol, blood pressure, blood glucose, weight loss/management
STRENGTH TRAINING

• Benefits:
  • ↑metabolic rate
  • ↑muscle mass, strength, power, endurance
  • Improved balance, flexibility, mobility, stability
  • ↓risk of injury doing other activities
  • ↑, restores bone density
  • ↓risk of coronary artery disease
  • You’ll feel better and look better
  • Helps you *age gracefully!!!!!!!!!!*
STRENGTH TRAINING

- Rx
  - Strength train 2-3 times/week
  - Perform 6-8 exercises using a variety of muscle groups (3 upper body, 3 lower)
  - 12-15 repetitions of each exercise, do 1-2 sets of each exercise
  - Exhale during effort phase of exercise
    - Do not strain
    - Do not hold your breath
    - Maintain proper form
## Cardiovascular Event Rates during Exercise

<table>
<thead>
<tr>
<th></th>
<th>Sudden Death</th>
<th>MI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High school- College age Men</strong></td>
<td>1/133,000 athletes/yr</td>
<td></td>
</tr>
<tr>
<td><strong>High school- College age Women</strong></td>
<td>1/780,000 athletes/yr</td>
<td></td>
</tr>
<tr>
<td><strong>Middle -age/ Older men</strong></td>
<td>1/1.5 million episodes of exertion</td>
<td>1/2500 men/yr</td>
</tr>
<tr>
<td><strong>Middle -age/ Older women</strong></td>
<td>1/36.5 million hours of exertion</td>
<td></td>
</tr>
<tr>
<td><strong>Marathons</strong></td>
<td>1.1/100,000 runners</td>
<td></td>
</tr>
</tbody>
</table>

*314 in 2005, 382,000 finished*
Exercise Intolerance

- Chest discomfort; pressure, squeezing, tightness, pain, heaviness etc.
- Excessive shortness of breath
- Rapid or irregular heart beat that’s new for you
- Excessive fatigue, malaise
- Lightheadedness
Weather Guidelines with Exercise

• Excessive temperatures (hot, cold) can bring on angina. Be prepared…..
  • Hot
    • General recommendations are to avoid outdoor exercise if above 80° with humidity over 60% (brings temp’s to > 90°)
    • Exercise indoors if air conditioning is available
    • Perform your exercise early morning or late evening to avoid hot temp’s
    • Drink plenty of water (every 15min) to sustain hydration
Weather Guidelines with Exercise

• Cold
  • Avoid outdoor exercise if temp’s are < 20° and wind chill bring’s temp’s below zero
  • Dress in layers with sweat absorbing material against your skin. Top layer should be a shell, or wind protective material.
  • Wear warm hat, mittens/gloves, neck gator and insulated boots
  • Drink plenty of water. Hot drinks can help warm you up while hydrating you as well.
  • Have a plan for indoor exercise when you can’t get outdoors… Weather shouldn’t be an excuse.
Nitroglycerin use and Exercise

• **Stop** exercise if you feel any anginal discomfort, excessive shortness of breath, or unusual symptoms
• Sit down or lay down for 2-3 minutes
• If symptom isn’t COMPLETELY gone, place 1 nitro under tongue
• Wait 5 min. If not COMPLETELY gone call 911 immediately.
• CALL 911 Do not drive yourself or have relative or neighbor drive you. This is EMERGENT.
Other helpful hints…

• Wait at least an hour to exercise after a big meal to avoid cramping, indigestion.
• Choose an exercise you enjoy.
• Find a friend or loved one to join you.
• Be safe. Walk facing traffic, flashlights & reflective vests if dark outside, stay on less traveled roads if possible.
ADHERENCE & MOTIVATION

- Plan your week...time management = no excuses!
- Training partner
- Comfortable environment
- Reward yourself
- Goal setting
- Get good guidance (results = motivation)
Avoid rationalization!

“Exercising builds muscle. Muscle makes you want to show off your body. To show off your body, you need a tan. Tanning turns your skin to leather. Cows are made of leather. Cows are fat. Therefore, exercising makes you fat!”
For more information

- www.americanheart.org
- Scientific publications
- Statements and guidelines
- Exercise
EXERCISE BUFFS!
ELEVATOR IS NOW EQUIPPED WITH STAIRCLIMBER EXERCISE MACHINE
"What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?"