Exercise Prescription

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Disclosures
Exercise Prescription

• None
Outline
Exercise Prescription

• Review basic definitions of exercise
• Review current AHA and ACSM guidelines
• Review guidelines for specific populations
DEFINITIONS
Rate of Perceived Exertion

Definitions

- Subjective Measure of physical activity intensity

<table>
<thead>
<tr>
<th>RPE SCALE</th>
<th>RATE OF PERCEIVED EXERTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>MAX EFFORT ACTIVITY</td>
</tr>
<tr>
<td></td>
<td>Feels almost impossible to keep going. Completely out of breath, unable to talk. Cannot maintain for more than a very short time</td>
</tr>
<tr>
<td>9</td>
<td>VERY HARD ACTIVITY</td>
</tr>
<tr>
<td></td>
<td>Very difficult to maintain exercise intensity. Can barely breathe and speak only a few words</td>
</tr>
<tr>
<td>7-8</td>
<td>VIGOROUS ACTIVITY</td>
</tr>
<tr>
<td></td>
<td>Borderline uncomfortable. Short of breath, can speak a sentence</td>
</tr>
<tr>
<td>4-6</td>
<td>MODERATE ACTIVITY</td>
</tr>
<tr>
<td></td>
<td>Breathing heavily, can hold a short conversation. Still somewhat comfortable, but becoming noticeably more challenging</td>
</tr>
<tr>
<td>2-3</td>
<td>LIGHT ACTIVITY</td>
</tr>
<tr>
<td></td>
<td>Feels like you can maintain for hours. Easy to breathe and carry a conversation</td>
</tr>
<tr>
<td>1</td>
<td>VERY LIGHT ACTIVITY</td>
</tr>
<tr>
<td></td>
<td>Hardly any exertion, but more than sleeping, watching TV, etc</td>
</tr>
</tbody>
</table>

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**Borg Scale**

**Definitions**

- A *relative* scale to match fitness level with *perceived* workload
- Multiplying Borg score x 10 = approx. HR for level of activity

<table>
<thead>
<tr>
<th>How you might describe your exertion</th>
<th>Borg rating of your exertion</th>
<th>Examples (for most adults &lt;65 years old)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>6</td>
<td>Reading a book, watching television</td>
</tr>
<tr>
<td>Very, very light</td>
<td>7 to 8</td>
<td>Tying shoes</td>
</tr>
<tr>
<td>Very light</td>
<td>9 to 10</td>
<td>Chores like folding clothes that seem to take little effort</td>
</tr>
<tr>
<td>Fairly light</td>
<td>11 to 12</td>
<td>Walking through the grocery store or other activities that require some effort but not enough to speed up your breathing</td>
</tr>
<tr>
<td>Somewhat hard</td>
<td>13 to 14</td>
<td>Brisk walking or other activities that require moderate effort and speed your heart rate and breathing but don’t make you out of breath</td>
</tr>
<tr>
<td>Hard</td>
<td>15 to 16</td>
<td>Bicycling, swimming, or other activities that take vigorous effort and get the heart pounding and make breathing very fast</td>
</tr>
<tr>
<td>Very hard</td>
<td>17 to 18</td>
<td>The highest level of activity you can sustain</td>
</tr>
<tr>
<td>Very, very hard</td>
<td>19 to 20</td>
<td>A finishing kick in a race or other burst of activity that you can’t maintain for long</td>
</tr>
</tbody>
</table>
Metabolic Equivalent (MET)

Definitions

- 1 MET = 3.5 mL O₂ uptake / kg / min

### At home activities

- **3.3 METs**
  - Sweeping carpet
  - 99-124 cal/30 min

- **4.0 METs**
  - Gardening
  - 120-150 cal/30 min

- **4.0 METs**
  - Playing with dog (moderate)
  - 120-150 cal/30 min

- **4.5 METs**
  - Wash & wax car
  - 135-168 cal/30 min

- **5.0 METs**
  - Playing with Kids (vigorous)
  - 150-188 cal/30 min

- **6.0 METs**
  - Moving furniture
  - 180-225 cal/30 min

### Sports and leisure

- **3.0 METs**
  - Volleyball (casual)
  - 90-113 cal/30 min

- **4.5 METs**
  - Golf
  - 135-169 cal/30 min

- **4.8 METs**
  - Dancing (partner)
  - 144-180 cal/30 min

- **7.0 METs**
  - Backpacking
  - 210-263 cal/30 min

- **8.0 METs**
  - Basketball
  - 240-300 cal/30 min

- **10.0 METs**
  - Soccer
  - 300-375 cal/30 min

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**Light Intensity**

Definitions

- Non-sedentary waking behavior that requires <3 METs.

- **Examples:**
  - Sleeping
  - Sitting quietly
  - Standing in line
  - Walking 2.0mph on firm / level surface
Moderate Intensity

Definitions

• Non-sedentary waking behavior that requires 3.0-6.0 METs
• ACSM Definition: “An intensity that causes noticeable increases in HR and breathing.”
• Commonly defined by the Talk Test
  – RPE: 5-6 / 10
• Examples
  – Walking 2.5mph on firm / level surface
  – Food shopping
  – Skateboarding
  – Scrubbing floor
  – Tennis
Vigorous Intensity

Definitions

- Non-sedentary waking behavior that requires >6.0 METs
- RPE: >7/10

Examples:
  - Chopping wood
  - Running 5 mph (12min/mi)
  - Calisthenics (push-ups)
  - Shoveling
  - Bicycling 16-19mph
VO2 Max
Definitions

• Measure of cardiorespiratory fitness and endurance capacity
• Maximum rate of $O_2$ consumption during exercise
• Calculation: Fick Equation
  - $VO_2\text{Max} = Q \times (C_{aO_2} - C_{vO_2})$
    • $Q$: Cardiac output
    • $(C_{aO_2} - C_{vO_2})$: arteriovenous oxygen difference
• Can be estimated with exercise tests
Lactate Threshold

Definitions

• Level at which exercise intensity increases to point where anaerobic metabolism becomes predominant energy source
  – Typically occurs at 4mmol / L lactate
• Changes with training
• Exercise above lactate threshold results in metabolic acidosis and respiratory alkalosis
Why?

ACSM Guidelines

- Minority of American adults and adolescents meet exercise guidelines
- Evidence for exercise benefits is growing substantially
  - Disease prevention
  - Disease modification
  - Quality of life
  - Changes in cognitive function
  - Improvement in physical function
Key Takeaways - Adults
ACSM Guidelines

• Some physical activity is better than none
  – Less sitting / more moving = some health benefits
  – Aerobic activity should be spread throughout week

• 150-300 min moderate intensity exercise = substantial health benefits
  – >300 min moderate intensity exercise = additional benefits

• >2 days / wk strengthening activities
Adult Exercise Guidelines
ACSM Guideline

• 1. At least 150 minutes of moderate intensity exercise
  – May be obtained:
    • 1 session of 30 min / day x 5 days / wk
    • Multiple shortened sessions
      – Each session at least 10 minutes

OR

• 2. Vigorous intensity exercise x 20 min / day x 3 days / wk
  – AND strength training of major muscle groups 2-3 days / wk
Adults need a mix of physical activity to stay healthy.

Moderate-intensity aerobic activity*
Anything that gets your heart beating faster counts.

Muscle-strengthening activity
Do activities that make your muscles work harder than usual.

- At least 150 minutes a week
- At least 2 days a week

*If you prefer vigorous-intensity aerobic activity (like running), aim for at least 75 minutes a week.

If that’s more than you can do right now, do what you can. Even 5 minutes of physical activity has real health benefits.

Walk. Run. Dance. Play. What’s your move?
Key Takeaways – Children / Adolescents

ACSM Guidelines

• Aerobic:
  – 60+ min / day of moderate to vigorous aerobic activity
    • 3 days of vigorous activity per week

• Muscle Strengthening:
  – 3+ days per week
    • Can be part of 60 min of aerobic activity

• Bone Strengthening:
  – “weight bearing exercise”
  – 3+ days per week
    • Can be part of 60 min of aerobic activity
Goals
Exercise Prescription

• Individualized prescriptions targeting desired outcomes for each patient
  – There is no one universal ExRx

• FITT Principle
  – Frequency
  – Intensity
  – Type
  – Time

• Applies to all patient populations regardless of comorbidity
• ACSM Recommends considering progression
  – How to modify as conditioning improves
Frequency
Exercise Prescription

• Goal: 150 mins spread over 7 days of week
• Ideal to spread time over multiple days per week
  – Consistency in health benefits
  – Decreased injury risk
• Shorter bouts of exercise may contribute to:
  – Better adherence
  – Greater weight loss
  – Similar CV / VO₂Max benefits as 30 min bouts

• Takeaway: even a short 5-10 minute walk break counts as exercise
Intensity
Exercise Prescription

• Moderate Intensity:
  – Remember the talk test
    • You can talk, but you can't sing.
Time
Exercise Prescription

• Frequency + Intensity = Stimulus
  – More vigorous activity requires less time for same benefit

• Be flexible
  – 30-60min bouts vs. 5-10min bouts
    • Every minute counts

• More is not always better
  – Mortality benefit plateaus at 40-50mins daily
Types of Exercise

• Aerobic Exercise:
  – any activity that develops CV / pulm fitness
  – The meat of your exercise prescription

• Strength Exercise:
  – Best exercises utilize multi-joint movements
    • Ex: Squat, deadlift

• Mobility Exercise:
  – Goal: to maintain healthy ROM
  – Important to maintain functional capacity
    • Ex: fall avoidance in elderly
Types of Aerobic Exercise

Exercise Prescription

• Walking
  – 30 min = 4000 steps; Reasonable step goal: ~7000/day
  – 15min/day or 90min/wk = 14% decreased mortality over 8.1 year follow up

• Be creative

Example - Sedentary Beginner

Exercise Prescription

• Frequency: 3 days per week
• Intensity: Moderate
• Time: 20 – 30 minutes
• Type: Brisk walking

• Goal: gradually progress by increasing duration and frequency
Barriers to Exercise and Strategies

Exercise prescription

• “I don’t have enough time” (69%)
  – Discuss modifications to FITT
  – Examine goals of patient

• “I don’t have enough energy” (59%)
  – Discuss modifications to FITT
  – Discuss health beliefs, theories of planned behaviors

• “I’m just not motivated” (52%)
  – Discuss attitudes and expectations
  – Determine stage of change

• “There’s nowhere for me to exercise” (30%)
  – Review opportunities in the environment
  – Discuss different types of activity
Incorporation into Work Day

Exercise Prescription

• Park car further away from door
• Use standing / walking desks
• Frequent walk breaks (q 30-60min)
• Standing or walking meetings
• Replace emails with personal visits
WAIT! CAN EVERYONE JUST START EXERCISING?
Pre-Participation Exercise Testing

Exercise Prescription

- Goal: evaluate for likelihood of adverse outcomes related to CV / pulmonary disease
- Exercise test has greatest use in patients with intermediate pretest probability of CVD
## Risk Stratification

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Typical/Definite Angina Pectoris</th>
<th>Atypical/Probable Angina Pectoris</th>
<th>Nonanginal Chest Pain</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 to 39 yr</td>
<td>Men</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Very low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>40 to 49 yr</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>50 to 59 yr</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td>60 to 69 yr</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
</tbody>
</table>
All individuals wanting to begin physical activity should at least be screened by history for presence of risk factors.

Risk Stratification
Exercise Prescription

- Review Health/Medical History for: Known Disease, Signs/Symptoms, CVD Risk Factors

- Known CV, Pulmonary, Metabolic Disease? (see Table 2.3)
  - Yes: Major Signs or Symptoms Suggestive of CV, Pulmonary, Metabolic Disease?
  - No: Pain, discomfort in the chest, neck, jaw, arms, or other areas that may result from ischemia
  - Shortness of breath at rest or with mild exertion
  - Dizziness or syncope
  - Orthopnea or paroxysmal nocturnal dyspnea
  - Ankle edema
  - Paresthesias or tachycardia
  - Intermittent claudication
  - Known heart murmur
  - Unusual fatigue or shortness of breath with usual activities

- Number of CVD Risk Factors
  - ≥2: High Risk
  - <2: Moderate Risk
  - Low Risk

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Risk Stratification

Exercise Prescription

• Highest risk of CV event in individuals performing unaccustomed physical activity and greatest during vigorous intensity activity.
TABLE 2.3. New ACSM Recommendations for Exercise Testing Prior to Exercise-Diagnosed Cardiovascular Disease

- Unstable or new or possible symptoms of cardiovascular disease (see Table 2.2)
- Diabetes mellitus and at least one of the following:
  - Age >35 yr OR
  - Type 2 diabetes mellitus >10-yr duration OR
  - Type 1 diabetes mellitus >15-yr duration OR
  - Hypercholesterolemia (total cholesterol ≥240 mg · L⁻¹) (6.62 mmol · L⁻¹) OR
  - Hypertension (systolic blood pressure ≥140 or diastolic ≥90 mm Hg) OR
  - Smoking OR
  - Family history of CAD in first-degree relative <60 yr OR
  - Presence of microvascular disease OR
  - Peripheral artery disease OR
  - Autonomic neuropathy
  - End-stage renal disease
  - Patients with symptomatic or diagnosed pulmonary disease including chronic obstructive pulmonary disease (COPD), asthma, interstitial lung disease, or cystic fibrosis.

ACSM, American College of Sports Medicine; CAD, coronary artery disease.
Contraindications to Exercise Testing

Exercise Prescription

• As always, take each individual clinical condition into account when making a decision

<table>
<thead>
<tr>
<th>ABSOLUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A recent significant change in the resting electrocardiogram (ECG) suggesting significant ischemia, recent myocardial infarction (within 2 d), or other acute cardiac event</td>
</tr>
<tr>
<td>• Unstable angina</td>
</tr>
<tr>
<td>• Uncontrolled cardiac dysrhythmias causing symptoms or hemodynamic compromise</td>
</tr>
<tr>
<td>• Symptomatic severe aortic stenosis</td>
</tr>
<tr>
<td>• Uncontrolled symptomatic heart failure</td>
</tr>
<tr>
<td>• Acute pulmonary embolus or pulmonary infarction</td>
</tr>
<tr>
<td>• Acute myocarditis or pericarditis</td>
</tr>
<tr>
<td>• Suspected or known dissecting aneurysm</td>
</tr>
<tr>
<td>• Acute systemic infection, accompanied by fever, body aches, or swollen lymph glands</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Left main coronary stenosis</td>
</tr>
<tr>
<td>• Moderate stenotic valvular heart disease</td>
</tr>
<tr>
<td>• Electrolyte abnormalities (e.g., hypokalemia or hypomagnesemia)</td>
</tr>
<tr>
<td>• Severe arterial hypertension (i.e., systolic blood pressure [SBP] of &gt;200 mm Hg and/or a diastolic BP [DBP] of &gt;110 mm Hg) at rest</td>
</tr>
<tr>
<td>• Tachy dysrhythmia or brady dysrhythmia</td>
</tr>
<tr>
<td>• Hypertrophic cardiomyopathy and other forms of outflow tract obstruction</td>
</tr>
<tr>
<td>• Neuromotor, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise</td>
</tr>
<tr>
<td>• High-degree atrioventricular block</td>
</tr>
<tr>
<td>• Ventricular aneurysm</td>
</tr>
<tr>
<td>• Uncontrolled metabolic disease (e.g., diabetes, thyrotoxicosis, or myxedema)</td>
</tr>
<tr>
<td>• Chronic infectious disease (e.g., HIV)</td>
</tr>
<tr>
<td>• Mental or physical impairment leading to inability to exercise adequately</td>
</tr>
</tbody>
</table>
Pediatrics
Special Populations

• Tailor ExRx to normal growth / development of young athlete
• No need for HR prescription
• “Can my kid lift?”
  – Safe if properly designed and supervised
  – Primarily targeting neuromuscular adaptations
  – Avoid powerlifting, bodybuilding and maximal lifts until skeletal maturity is reached
  – Weight should be low enough to allow 8-15 reps at submaximal effort
Geriatrics

Special Populations

• Higher rate of CAD = more need for exercise testing
  – Also be wary of Rx and Ex induced arrhythmia that might interfere with testing
• Safer to increase duration rather that intensity
• Type:
  – Consider activity without excessive orthopaedic stress
    • Aquatic exercise / stationary cycling may be advantageous
• Consider neuromuscular exercise for fall prevention
  – Build balance, agility and proprioception
Diabetics

Special Populations

• **Effect of exercise: improved glycemic control** (increased insulin sensitivity / improved glucose tolerance)
  – Modification of CVD risk factors
• **No more than 2 consecutive days of inactivity per week**
• **Hypoglycemia:**
  – Concern for insulin dependent
    • Can occur up to 4-6 hours post exercise
  – Decrease insulin or increase CHO load prior to exercise
    • Monitor BG before / following exercise
    • Avoid exercise in periods of peak insulin activity
• **Autonomic neuropathy**
  – Blunted HR response, silent ischemia, postural hypotension
CV Disease
Special Populations

• Intensity: HR below ischemic threshold
• Take medications at usual time
  – BB may have decreased exercise capacity
• Cardiac rehabilitation is indicated as in/outpatient to guide ongoing exercise program
Summary
Exercise Prescription

• Every minute counts
• Be creative
  – Not all exercise has to be at the gym
  – Try to implement changes at work / in daily activities
• Teach patients to listen to their bodies
• This is a dynamic process
  – Schedule follow up visits to check in