Exercise Considerations For Persons With Metabolic Syndrome: A Case Study Approach

Peter Ronai, M.S. CSCS-D, NSCA-CPT-D, CSPS, FACSM
Clinical Associate Professor
Sacred Heart University
Fairfield, CT. 06825 ronaip@sacredheart.edu
Exercise Considerations For Persons With Metabolic Syndrome: A Case Study Approach

Peter Ronai, M.S. CSCS-D, NSCA-CPT-D, CSPS, FACSM

Clinical Associate Professor
Sacred Heart University
Fairfield, CT. 06825

ronaip@sacredheart.edu
Learning Objectives

• Examine methodologies for working with clients possessing Metabolic Syndrome and co-morbid medical conditions and risk factors

• Explore resources to help personal trainers best serve clients with Metabolic Syndrome and co-morbid conditions

• Examine exercise indications/contraindications for specific conditions

• Apply exercise recommendations to specific client populations (Metabolic Syndrome)
SCOPE OF THE CERTIFIED EXERCISE PROFESSIONAL

• Exercise professionals can help clients with a number of controlled medical conditions who have been cleared by their MDs meet the current physical activity guidelines.

• Additional education certification and training is often warranted!!!

• Clients are best served by exercise professionals who can work with all of the healthcare providers who care for them (MD, PT, RD, DC, ETC..)!!!

• Open communication with each of these professionals (if applicable) enhances the quality of services personal trainers can offer their clients and also provides personal trainers with support and guidance!!!

• Exercise Specialists and Personal Trainers should use general Exercise Program Guidelines Utilizing the F.I.T.T. Principle and Variables with Their Clients!!! (ACSM GETP 9, 2014 pp. 180 & 185)
Exercise Professional’s Scope of Practice

- Work with Asymptomatic/Medically stable clients with adequate functional capacity

- Work with Client medically cleared and able to self-monitor exercise intensity and/or symptoms

- Progressing client strength, flexibility, balance, endurance, speed, agility

- Helping Client set new goals and take their fitness program to a new level

- Helping client improve functional capacities for specific hobbies, tasks, etc...
PRE-ACTIVITY SCREENING: RISK FACTOR AND CATEGORY DETERMINATION

- Client safety and risk can best be determined by following these steps and the American College of Sports Medicine Guidelines for Exercise Testing and Prescription 9th Edition are industry standards for performing best practices!!!

- Pre-activity screening will help to determine if at present, exercise is appropriate for your client and help you to determine what type and how much!!! The Algorithms on this and the previous slide help reduce “GUESS-WORK” and can direct your exercise program decisions!!!

- When working with clients that have a number of co-morbid conditions, determine, “Who you can contact to discuss my client’s needs, his or her progress and ask questions”?

- Determine client risk factors for C-V, Pulmonary & metabolic diseases as well as signs and symptoms and special considerations warranting additional precautions

- Determine if any special considerations might warrant additional investigations, exercise modifications and strategies, monitoring scales or education for either you or your client

- AVOID TUNNEL VISION!!! Analyze each condition or risk which a client has and model the program so EVERY factor is addressed appropriately
Pre-Activity Screening & CAD Risk Factors

- Age
- Family History
- Cigarette smoking
- HTN
- Dyslipidemia
- Pre-diabetes
- Obesity
- Sedentary
- Negative Risk Factor: high HDL

- Signs & Symptoms

- Source: ACSM GETP 9, 2014
LWW (American College of Sports Medicine)
Purpose For Pre-activity Screening

- Identify individuals w/medical contraindications for exclusion from exercise until conditions are abated or under control (figure 2.4, p. 28 ACSM Guidelines)
- Recognize persons w/clinically significant disease(s) who should be in a medically supervised exercise program (figure 2.4 p. 28 and Box 2.4 p. 34 & 35 ACSM Guidelines)
- Detect individuals at increased risk for diseases because of, symptoms, and/or risk factors who should undergo medical evaluation and exercise testing before initiating an exercise program or progressing their current program. (Figure 2.3 p.26, Figure 2.4 p.28, Box 2.2, p.31 ACSM Guidelines)
- Recognize special needs of individuals that may effect exercise testing and programming: (Frailty, Sarcopenia, Arthritis, Neuropathies, COPD, Diabetes, Cancer, Hypertension, Stroke, Osteopenia/Osteoporosis, PAD/PVD, Dyslipidemia, Obesity, etc...)

![Diagram showing risk classification and exercise test recommendations](image)
THE CASE STUDY OF MRS. J.

Mrs. J is a sedentary 48 year old administrative secretary and married mother of two college age boys. Her physician has cleared her to work with you to develop a comprehensive exercise program. She was diagnosed two years ago with hypertension and has dyslipidemia and impaired fasting glucose (MetS). She states wanting to take her six month old Labrador retriever puppy Bailey on long walks at her beach but, “I cannot last for more than 10 minutes without stopping because I get so tired and my muscles feel weak”. She achieved eight metabolic equivalents (8 METs) during a maximal treadmill stress test (Bruce Protocol), a maximal heart rate of 155 beats/minute (90% of age-predicted maximal heart rate) and a rating of perceived exertion (RPE) of 18 out of 20 on the Borg scale. Her peak blood pressure was 180/80 and the treadmill stress test was stopped because of general fatigue. She reported no signs or symptoms of exercise intolerance or physical discomfort and displayed no electrocardiographic abnormalities. Her physician considered the test to be “normal” and “unremarkable”.

(CONTINUE ON NEXT SLIDE)
CASE: Continued

- Her current medications include Atenolol, Lisinopril, Metformin and Atorvastatin. Additional tests revealed the following results:
  - **Height**: 5’2” (157.5 cm)  **Weight**: 165 pounds (75 kg)
  - **Waist Circumference**: 36” (91.4 cm)
  - **Body Mass Index (BMI)**: 30kg/m²
  - **Total Cholesterol**: 260 mg/dL
  - **HDL-Cholesterol**: 45 mg/dL
  - **LDL-Cholesterol**: 181 mg/dL
  - **Triglycerides**: 170 mg/dL
  - **Fasting Glucose**: 96 mg/dL
  - **Resting Blood Pressure**: 118/70 mm Hg
  - *One Repetition Maximum (1-RM) Bench Press*: 90 pounds (40th percentile) She reported an RPE of 18 out of 20!!!
  - **One Repetition Maximum (1-RM) Leg Press**: 180 pounds (30th percentile) She reported an RPE of 18 out of 20!!!
QUESTIONS

• What if she also has a BMD 2.2 SD < the mean for normal younger women at the femoral neck and 2.0 < the mean for normal younger women at the lumbar spine?

• What if she is also taking Alendronate Phosphate (Fosamax)?

• *** After reviewing her medical and health history, what Cardiac, pulmonary and metabolic disease risk factors are present?

• What other disease processes are operating here?

• What types of medications is she on?
QUESTIONS:

• Is exercise appropriate for her at this time?

• What special precautions and monitoring are warranted when she exercise?

• What types of exercises might be indicated and contraindicated for her.

• What special education do you want to give her? Are there any other things she needs to know?

• What might be appropriate exercise program goals?
Metabolic Syndrome According to ATP III

Note: New screening/treatment guidelines for Hypertension & Dyslipidemia have recently been released JNC 8 and ATP 4!!!
FITT RECOMMENDATIONS FOR INDIVIDUALS WITH OVERWEIGHT AND OBESITY

Aerobic, Resistance, and Flexibility Exercise

**Frequency:** \( \geq 5 \text{ d} \cdot \text{wk}^{-1} \) to maximize caloric expenditure.

**Intensity:** Moderate-to-vigorous intensity aerobic activity should be encouraged. Initial exercise training intensity should be moderate (i.e., 40%–60% \( \dot{V}O_2 \) R or HRR). Eventual progression to more vigorous exercise intensity (i.e., \( \geq 60\% \dot{V}O_2 \) R or HRR) may result in further health/fitness benefits.

**Time:** A minimum of 30 min \( \cdot \text{d}^{-1} \) (i.e., 150 min \( \cdot \text{wk}^{-1} \)) progressing to 60 min \( \cdot \text{d}^{-1} \) (i.e., 300 min \( \cdot \text{wk}^{-1} \)) of moderate intensity, aerobic activity. Incorporating more vigorous intensity exercise into the total volume of exercise may provide additional health benefits. However, vigorous intensity exercise should be encouraged in individuals who are both capable and willing to exercise at a higher than moderate intensity levels of physical exertion with recognition that vigorous intensity exercise is associated with the potential for greater injuries (182). Accumulation of intermittent exercise of at least 10 min is an effective alternative to continuous exercise and may be a particularly useful way to initiate exercise (116).

**Type:** The primary mode of exercise should be aerobic physical activities that involve the large muscle groups. As part of a balanced exercise program, resistance training and flexibility exercise should be incorporated (see Chapter 7 on the FITT principle Ex \( R_x \) recommendations for resistance training and flexibility).

FITT RECOMMENDATIONS FOR INDIVIDUALS WITH DYSLIPIDEMIA

Aerobic Exercise

The FITT principle of Ex \( R_x \) recommended for individuals with dyslipidemia:

**Frequency:** \( \geq 5 \text{ d} \cdot \text{wk}^{-1} \) to maximize caloric expenditure.

**Intensity:** 40%–75% \( \dot{V}O_2 \) R or HRR.

**Time:** 30–60 min \( \cdot \text{d}^{-1} \). However, to promote or maintain weight loss, 50–60 min \( \cdot \text{d}^{-1} \) or more of daily exercise is recommended (54). Performance of intermittent exercise of at least 10 min in duration to accumulate these duration recommendations is an effective alternative to continuous exercise.

**Type:** The primary mode should be aerobic physical activities that involve the large muscle groups. As part of a balanced exercise program, resistance training and flexibility exercise should be incorporated. Individuals with dyslipidemia without comorbidities may follow the resistance training and flexibility guidelines for healthy adults (see Chapter 7).
Hypertension Exercise Program Guidelines-ACSM GETP 9, 2014

FITT RECOMMENDATIONS FOR INDIVIDUALS WITH HYPERTENSION

Aerobic and Resistance Exercise

Frequency: Aerobic exercise on most, preferably all days of the week; resistance exercise 2–3 d · wk⁻¹.

Intensity: Moderate intensity, aerobic exercise (i.e., 40%–<60% VO₂R or HRR; RPE 11–13 on a 6–20 scale) supplemented by resistance training at 60%–80% 1-RM.

Time: 30–60 min · d⁻¹ of continuous or intermittent aerobic exercise. If intermittent, use a minimum of 10 min bouts accumulated to total 30–60 min · d⁻¹ of exercise. Resistance training should consist of at least one set of 8–12 repetitions for each of the major muscle groups.

Type: Emphasis should be placed on aerobic activities such as walking, jogging, cycling, and swimming. Resistance training using either machine weights or free weights may supplement aerobic training. Such training programs should consist of 8–10 different exercises targeting the major muscle groups (see Chapter 7).

Progression: The FITT principle of Ex Rx relating to progression for healthy adults, generally apply to those with hypertension. However, consideration should be given to the level of BP control, recent changes in antihypertensive drug therapy, medication-related adverse effects, and the presence of target organ disease and/or other comorbidities, and adjustments should be made accordingly. Progression should be gradual, avoiding large increases in any of the FITT components of the Ex Rx especially intensity for most individuals with hypertension.

FITT RECOMMENDATIONS FOR INDIVIDUALS WITH DIABETES MELLITUS

Aerobic, Resistance, and Flexibility Exercise

The aerobic exercise training FITT principle of Ex Rx recommendations for those with DM are the following:

Frequency: 3–7 d · wk⁻¹.

Intensity: 40%–<60% VO₂R corresponding to an RPE of 11–13 on a 6–20 scale (27). Better blood glucose control may be achieved at higher exercise intensities (≥60% VO₂R), so individuals who have been participating in regular exercise may consider raising the exercise intensity to this level of physical exertion.

Time: Individuals with Type 2 DM should engage in a minimum of 150 min · wk⁻¹ of exercise undertaken at moderate intensity or greater. Aerobic activity should be performed in bouts of at least 10 min and be spread throughout the week. Moderate intensity exercise totaling 150 min · wk⁻¹ is associated with reduced morbidity and mortality in observational studies in all populations. Additional benefits are accrued by increasing to ≥300 min · wk⁻¹ of moderate-to-vigorous intensity, physical activity.

Type: Emphasize activities that use large muscle groups in a rhythmic and continuous fashion. Personal interest and desired goals of the exercise program should be considered.

Progression: Because maximizing caloric expenditure will always be a high priority, progressively increase exercise duration (either continuous or accumulated). As individuals improve physical fitness, adding higher intensity physical activity to promote beneficial adaptations and combat boredom may be warranted.

Resistance training should be encouraged for individuals with DM or prediabetes in the absence of contraindications (see Chapters 2 and 3),
retinopathy, and recent treatments using laser surgery. The recommendations for healthy individuals generally apply to individuals with DM (see Chapter 7). Given that many patients may present with comorbidities, it may be necessary to tailor the resistance Ex $R_x$ accordingly.

There is some evidence that a combination of aerobic and resistance training improves blood glucose control more than either modality alone (50). Whether the added benefits are caused by a greater overall caloric expenditure or are specific to the combination of aerobic and resistance training has not yet been resolved.

No more than two consecutive days of physical inactivity per week should be allowed. A greater emphasis should eventually be placed on vigorous intensity exercise if CRF is a primary goal. On the other hand, greater amounts of moderate intensity exercise that result in a caloric EE of ≥2,000 kcal · wk$^{-1}$ (>7 hr · wk$^{-1}$), including daily exercise, may be required if weight loss maintenance is the goal, as is the case for most individuals with Type 2 DM (54) (see this chapter and other relevant ACSM position stands [6,54]).
FITT Recommendations for Individuals at Risk for and With Osteoporosis

Aerobic and Resistance Exercise

Individuals at Risk for Osteoporosis

In individuals at risk for osteoporosis, the following FITT principles of Ex Rx are recommended to help preserve bone health:

**Frequency**: Weight-bearing aerobic activities 3–5 d·wk⁻¹ and resistance exercise 2–3 d·wk⁻¹.

**Intensity**: Aerobic: Moderate (e.g., 40%–<60% VO₂R or HRR) to vigorous ≥60% (VO₂R or HRR) intensity; resistance: moderate (e.g., 60%–80%
1-RM, 8–12 repetitions with exercises involving each major muscle group) to vigorous (e.g., 80%–90% 1-RM, 5–6 repetitions with exercises involving each major muscle group) intensity in terms of bone loading forces.

**Time:** 30–60 min • d⁻¹ of a combination of weight-bearing aerobic and resistance activities.

**Type:** Weight-bearing aerobic activities (e.g., tennis, stair climbing/descending, walking with intermittent jogging), activities that involve jumping (e.g., volleyball, basketball), and resistance exercise (e.g., weight lifting).

**Individuals with Osteoporosis**

In individuals with osteoporosis, the following FITT principle of Ex Rx is recommended to help prevent disease progression:

**Frequency:** Weight-bearing aerobic activities 3–5 d • wk⁻¹ and resistance exercise 2–3 d • wk⁻¹.

**Intensity:** Moderate intensity (i.e., 40%–<60% \( \dot{VO}_2 \text{R} \) or HRR) for weight-bearing aerobic activities and moderate intensity (e.g., 60%–80% 1-RM, 8–12 repetitions of exercises involving each major muscle group) in terms of bone loading forces, although some individuals may be able to tolerate more intense exercise.

**Time:** 30–60 min • d⁻¹ of a combination of weight-bearing aerobic and resistance activities.

**Type:** Weight-bearing aerobic activities (e.g., stair climbing/descending, walking, other activities as tolerated) and resistance exercise (e.g., weight lifting).
Exercise Considerations: Osteopenia/Osteoporosis

- 1RM testing is generally not recommended. 10 RM testing may be better!

- Trunk flexion is not recommended due to the increased incidence of vertebral wedge fractures and (in standing) the increased risk of falling!!!(OSTEOPOROSIS)

- Extreme kyphosis can alter the center of gravity, gait and balance.

- Extreme kyphosis may alter breathing function and increase fatigue!

- Back pain may be an issue due to excessive back extensor muscle weakness.

- Extreme kyphosis may make seeing in front difficult!

- Many individuals have an extreme fear of falling!!!
Osteopenia/Osteoporosis

- In General, All modes of exercise should minimize forward trunk flexion!!!

- Time Frame-Any long term effect on conservation of bone mass will require at least 9 to 12 months of effort before change (or lack of change) can be ascertained)!!!

- Impact loading and jumping is contraindicated in Osteoporosis but Modified, Controlled and Supervised versions may be appropriate in early stages of Osteopenia!!!

- Osteoporosis and may contribute to increased fracture incidence!!!

- Bending and twisting is contra-indicated!!!

- Resistance training is indicated but proper exercise selection prescription and supervision are extremely important!!!
## TABLE 10.11. Summary of the Aerobic Exercise Frequency, Intensity, and Type Recommendations for a Single Disease, Health Condition, or Cardiovascular Disease (CVD) Risk Factor

<table>
<thead>
<tr>
<th>Condition</th>
<th>Frequency</th>
<th>Intensity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis</td>
<td>3–5 d · wk⁻¹</td>
<td>40%–59% HRR or VO₂R</td>
<td>20–30 min · d⁻¹</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>4–7 d · wk⁻¹</td>
<td>40%–80% HRR or VO₂R</td>
<td>20–60 min · d⁻¹</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>≥5 d · wk⁻¹</td>
<td>40%–75% HRR or VO₂R</td>
<td>30–60 min · d⁻¹</td>
</tr>
<tr>
<td>Hypertension</td>
<td>≥5 d · wk⁻¹</td>
<td>40%–59% HRR or VO₂R</td>
<td>30–60 min · d⁻¹</td>
</tr>
<tr>
<td>Obesity</td>
<td>≥5 d · wk⁻¹</td>
<td>40%–59% HRR or VO₂R</td>
<td>30–60 min · d⁻¹</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>3–5 d · wk⁻¹</td>
<td>40%–59% HRR or VO₂R</td>
<td>30–60 min · d⁻¹</td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>3–7 d · wk⁻¹</td>
<td>50%–80% HRR or VO₂R</td>
<td>20–60 min · d⁻¹</td>
</tr>
</tbody>
</table>

"Moderate intensity resistance exercise is generally recommended 2–3 d · wk⁻¹ in addition to the amount of aerobic exercise specified previously for each chronic disease, health condition, and CVD risk factor (see Chapter 7)."

HRR, heart rate reserve; VO₂R, maximal oxygen consumption reserve.
Mrs. J’s Endurance Training Program

- Mrs. J will use her son’s treadmill and stationary bicycle for 10 minutes, twice each day.
- She will exercise five days a week.
- Her initial goal will be to perform between 30 and 60 minutes of moderate (40%–<60% Heart Rate Reserve or VO\(_2\)R) exercise at least (150 -300 minutes/week). >500 -1,000 Met-min \(\cdot\) Week \(^{-1}\)
- This initial exercise volume goal will be as tolerated and progressed according to how she handles the initial exercise sessions.
- Ultimately, she wants to incorporate treadmill walking, stationary cycling and walking Bailey for a total of 60 to 90 minutes daily.
- To avoid injuries, she will increase her exercise time gradually and alternate (cross train) her daily exercise modes.
- She will add additional exercise modes like the elliptical trainer and the recumbent arm and leg ergometer (i.e., NuStep).
- She can also perform these activities in an interval training format and use an RPE Scale to Monitor Intensity and Manipulate Work-to- Recovery Ratios!!!
- (Adapted from Sorace P., Ronai P. and Churilla J.: Resistance Training and Metabolic Syndrome: Decrease the Risk with Increased Strength. ACSM’s Health & Fitness Journal. Not Yet Published). SEE NEST SLIDE!!!
### Basic Generic Beginner’s Interval Protocols For Multiple Exercise Modes

<table>
<thead>
<tr>
<th>MINUTES</th>
<th>ACTION</th>
<th>Rate of Perceived Exertion Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>warm-up</td>
<td>4 – 5</td>
</tr>
<tr>
<td>5 – 8</td>
<td>small bump in intensity</td>
<td>6</td>
</tr>
<tr>
<td>8 - 10</td>
<td>small bump in intensity</td>
<td>7</td>
</tr>
<tr>
<td>10 - 11</td>
<td>small bump in intensity</td>
<td>8</td>
</tr>
<tr>
<td>11 - 14</td>
<td>recover</td>
<td>5</td>
</tr>
<tr>
<td>14 - 20</td>
<td>repeat min 5 - 11</td>
<td>repeat min 5 - 11</td>
</tr>
<tr>
<td>20 - 25</td>
<td>steady quick pace</td>
<td>7</td>
</tr>
<tr>
<td>25 - 30</td>
<td>cool down</td>
<td>4 - 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIME (MINUTES)</th>
<th>WHAT TO DO</th>
<th>RPE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–3</td>
<td>warm up</td>
<td>5</td>
</tr>
<tr>
<td>3–4</td>
<td>hill</td>
<td>7</td>
</tr>
<tr>
<td>4–5</td>
<td>recover</td>
<td>5</td>
</tr>
<tr>
<td>5–6</td>
<td>hill</td>
<td>8</td>
</tr>
<tr>
<td>6–7</td>
<td>recover</td>
<td>5</td>
</tr>
<tr>
<td>7–8</td>
<td>hill</td>
<td>9</td>
</tr>
<tr>
<td>8–10</td>
<td>cool down</td>
<td>5</td>
</tr>
</tbody>
</table>
### Very Basic Beginner Walking Program

<table>
<thead>
<tr>
<th>What to do</th>
<th>For how long</th>
<th>Intensity 1-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm up</td>
<td>5 minutes</td>
<td>3.5</td>
</tr>
<tr>
<td>Walk briskly</td>
<td>1 minute</td>
<td>6.5</td>
</tr>
<tr>
<td>Walk at a moderate pace</td>
<td>2 minutes</td>
<td>5</td>
</tr>
<tr>
<td>Walk as fast as possible</td>
<td>1 minute</td>
<td>7</td>
</tr>
<tr>
<td>Walk slowly</td>
<td>2 minutes</td>
<td>4</td>
</tr>
<tr>
<td>Walk briskly</td>
<td>1 minute</td>
<td>6.5</td>
</tr>
<tr>
<td>Walk at a moderate pace</td>
<td>2 minutes</td>
<td>5</td>
</tr>
<tr>
<td>Walk as fast as possible</td>
<td>1 minute</td>
<td>7</td>
</tr>
<tr>
<td>Walk slowly</td>
<td>2 minutes</td>
<td>4</td>
</tr>
<tr>
<td>Walk at a moderate pace</td>
<td>1 minute</td>
<td>3.5</td>
</tr>
<tr>
<td>Walk as fast as possible</td>
<td>2 minutes</td>
<td>7</td>
</tr>
<tr>
<td>Walk slowly</td>
<td>1 minute</td>
<td>4</td>
</tr>
<tr>
<td>Cool down</td>
<td>5 minutes</td>
<td>3.5</td>
</tr>
</tbody>
</table>
Monitoring Exertion Safely

### Borg Scale of Perceived Exertion

<table>
<thead>
<tr>
<th>RPE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>complete rest</td>
</tr>
<tr>
<td>1</td>
<td>very, very easy</td>
</tr>
<tr>
<td>2</td>
<td>easy</td>
</tr>
<tr>
<td>3</td>
<td>moderate</td>
</tr>
<tr>
<td>4</td>
<td>somewhat hard</td>
</tr>
<tr>
<td>5</td>
<td>hard</td>
</tr>
<tr>
<td>6</td>
<td>very hard</td>
</tr>
<tr>
<td>7</td>
<td>extremely hard (almost maximal)</td>
</tr>
<tr>
<td>8</td>
<td>exhaustion</td>
</tr>
</tbody>
</table>

* TeleRehab™ Advantage Cardiopulmonary Monitoring System
* NICORE™ External Counterpulsation (ECP) Therapy System

# Absolute and Relative Contraindications to Resistance Training and Testing

## Absolute
- Unstable CHD
- Decompensated HF
- Uncontrolled arrhythmias
- Severe pulmonary hypertension (mean pulmonary arterial pressure >55 mm Hg)
- Severe and symptomatic aortic stenosis
- Acute myocarditis, endocarditis, or pericarditis
- Uncontrolled hypertension (>180/110 mm Hg)
- Aortic dissection
- Marfan syndrome
- High intensity RT (80% to 100% of 1-RM) in patients with active proliferative retinopathy or moderate or worse nonproliferative diabetic retinopathy

## Relative (Should Consult a Physician Before Participation)
- Major risk factors for CHD
- Diabetes at any age
- Uncontrolled hypertension (>160/100 mm Hg)
- Low functional capacity (<4 METs)
- Musculoskeletal limitations
- Individuals who have implanted pacemakers or defibrillators

---

CHD, Coronary heart disease; HF, Heart failure; METs, Metabolic equivalents; RM, Repetition maximum; RT, Resistance training.

Reprinted with permission from (110). ©2007, American Heart Association, Inc.
Mrs. J’s Resistance Training Program

- Seated Leg Press
- Seated Chest Press
- Seated Leg Extension
- Seated Row (With Chest Pad Support)
- Seated Leg Curl
- Shoulder Press
- Latissimus Pull-downs
- Back Extension
- Abdominal Crunch

She will have her blood pressure taken before, during and after her workout sessions. She will exercise at an RPE of 11 to 13 out of 20. She has been informed to maintain adequate hydration, report any symptoms of either muscle pain or weakness and to avoid exercising too close to going to bed at night.
### SAMPLE RESISTANCE TRAINING PROGRAM

#### WEEKS

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>1 – 2</th>
<th>3 – 4</th>
<th>5 – 6</th>
<th>7 – 9</th>
<th>10 – 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREQUENCY</td>
<td>2x/week</td>
<td>2x/week</td>
<td>2x/week</td>
<td>2x/week</td>
<td>2-3x/week</td>
</tr>
<tr>
<td>TIME</td>
<td>As Needed</td>
<td>As Needed</td>
<td>As Needed</td>
<td>As Needed</td>
<td>As Needed</td>
</tr>
<tr>
<td>TYPE</td>
<td>S.M.</td>
<td>S.M.</td>
<td>S.M.</td>
<td>S.M.</td>
<td>S.M.</td>
</tr>
<tr>
<td>INTENSITY</td>
<td>40% 1-RM</td>
<td>50% 1-RM</td>
<td>60% 1-RM</td>
<td>70% 1-RM</td>
<td>80% 1-RM</td>
</tr>
<tr>
<td>REPETITIONS</td>
<td>8-10</td>
<td>8-10</td>
<td>8-10</td>
<td>8-10</td>
<td>8-10</td>
</tr>
<tr>
<td>SETS***</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2 – 3</td>
<td>3***</td>
</tr>
<tr>
<td>REST****</td>
<td>60 sec.</td>
<td>60 sec.</td>
<td>60 sec.</td>
<td>60 sec.</td>
<td>60 sec.</td>
</tr>
</tbody>
</table>

**PROGRESSION:** Increase repetitions, then weight as tolerated and then sets as time and goals dictate. *=(S.M.) Selectorized Machine  **=(1-RM) One Repetition Maximum  ***=As Time and Tolerance Dictate  ****=Rest periods may be extended (e.g., 90 seconds) if necessary to allow blood pressure to return to near baseline levels.
General Exercise Considerations: POTENTIAL FLEXION INTOLEANCE

Exercise Do’s

• Exercise in “Neutral” Spine Position

• Emphasize gentle extension

• Increase endurance of deep spinal stabilizers

• Maintain upright spine

• Build balanced strength in limbs

Exercise Don’ts

• Exercise in “flexed” spine position

• Bend at waist or touch toes

• Twist spine or trunk

• Perform full sit ups or crunches

• Sit or exercise seated for extended periods
OMNI RESISTANCE -10 RPE Scale For Weights & Machines
Safety

- Exhale On Exertion Avoid Breath Holding
- Maintain Upright Exercise Posture

![Image of man exercising with correct posture]

**Safety Tips:**
- Chin juts out
- Hunched shoulders
- Straight neck
- Level shoulders
- Knees pushed forward
- Knees bent forward
- Feet directly below hips
- Noggin in neutral position
- Upright torso
- Crease of hips below parallel
- Knees tracking over (but not beyond) toes
- Feet shoulder width
- Weight on heels
Exercise Prescription

**Flexibility/ROM:** To Enhance Muscle Function/Posture

- Supine hip flexor and hamstring stretches
- Anterior shoulder and pectoral stretches to improve thoracic and trunk extension
- Daily stretches held for 10 to 30 seconds (2 to 4 repetitions) each
- Chin Tucks to strengthen deep cervical flexors
- Scapular Squeezes for Scapular “Retractors”
Upright Weight-Bearing VS. Upright Non-Weight Bearing Exercise
Seated (Weight Supported) VS. Upright (Weight Bearing) Exercises
Activity Categories

Below are the categories 01 - 21 currently included in the Compendium of Physical Activities. The first two digits of the 5 digit code indicate the general category. For example a code with 06xxx would indicate an activity in the Home Repair category.

- Bicycling (01)
- Conditioning Exercise (02)
- Dancing (03)
- Fishing & Hunting (04)
- Home Activities (05)
- Home Repair (06)
- Inactivity (07)
- Lawn & Garden (08)
- Miscellaneous (09)
- Music Playing (10)
- Occupation (11)
- Running (12)
- Self Care (13)
- Sexual Activity (14)
- Sports (15)
- Transportation (16)
- Walking (17)
The 2011 Compendium of Physical Activities: Tracking Guide

<table>
<thead>
<tr>
<th>Code</th>
<th>METs</th>
<th>Code</th>
<th>METs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01003</td>
<td>14.0</td>
<td>01009</td>
<td>8.5</td>
<td>bicycling, mountain, uphill, vigorous</td>
</tr>
<tr>
<td>01004</td>
<td>16.0</td>
<td>01010</td>
<td>4.0</td>
<td>bicycling, mountain, competitive, racing</td>
</tr>
<tr>
<td>01008</td>
<td>8.5</td>
<td>01011</td>
<td>6.8</td>
<td>bicycling, BMX</td>
</tr>
<tr>
<td>01009</td>
<td>8.5</td>
<td>01011</td>
<td>6.8</td>
<td>bicycling, mountain, general</td>
</tr>
<tr>
<td>01010</td>
<td>4.0</td>
<td>01011</td>
<td>6.8</td>
<td>bicycling, &lt;10 mph, leisure, to work or for pleasure (Taylor Code 115)</td>
</tr>
<tr>
<td>01013</td>
<td>5.8</td>
<td>01013</td>
<td>5.8</td>
<td>bicycling, on dirt or farm road, moderate pace</td>
</tr>
<tr>
<td>01015</td>
<td>7.5</td>
<td>01015</td>
<td>7.5</td>
<td>bicycling, general</td>
</tr>
<tr>
<td>01018</td>
<td>3.5</td>
<td>01018</td>
<td>3.5</td>
<td>bicycling, leisure, 5.5 mph</td>
</tr>
<tr>
<td>01019</td>
<td>5.8</td>
<td>01019</td>
<td>5.8</td>
<td>bicycling, leisure, 9.4 mph</td>
</tr>
<tr>
<td>01020</td>
<td>6.0</td>
<td>01020</td>
<td>6.0</td>
<td>bicycling, 10-11.9 mph; leisure, slow, light effort</td>
</tr>
<tr>
<td>01030</td>
<td>8.0</td>
<td>01030</td>
<td>8.0</td>
<td>bicycling, 12-13.9 mph, leisure, moderate effort</td>
</tr>
<tr>
<td>01040</td>
<td>10.0</td>
<td>01040</td>
<td>10.0</td>
<td>bicycling, 14-15.9 mph, racing or leisure, fast, vigorous effort</td>
</tr>
<tr>
<td>01050</td>
<td>12.0</td>
<td>01050</td>
<td>12.0</td>
<td>bicycling, 16-19 mph, racing/hot drafting or &gt; 19 mph drafting, very fast, racing general</td>
</tr>
<tr>
<td>01060</td>
<td>15.8</td>
<td>01060</td>
<td>15.8</td>
<td>bicycling, &gt; 20 mph, racing, not drafting</td>
</tr>
<tr>
<td>01065</td>
<td>8.5</td>
<td>01065</td>
<td>8.5</td>
<td>bicycling, 12 mph, seated, hands on brake hoods or bar drops, 80 rpm</td>
</tr>
<tr>
<td>01066</td>
<td>9.0</td>
<td>01066</td>
<td>9.0</td>
<td>bicycling, 12 mph, standing, hands on brake hoods, 60 rpm</td>
</tr>
<tr>
<td>01070</td>
<td>5.0</td>
<td>01070</td>
<td>5.0</td>
<td>unicycling</td>
</tr>
</tbody>
</table>

Conditioning Exercise

<table>
<thead>
<tr>
<th>Code</th>
<th>METs</th>
<th>Code</th>
<th>METs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02001</td>
<td>2.3</td>
<td>02010</td>
<td>7.0</td>
<td>activity promoting video game (e.g., Wii Fit), light effort (e.g., balance, yoga)</td>
</tr>
<tr>
<td>02003</td>
<td>3.8</td>
<td>02011</td>
<td>3.0</td>
<td>activity promoting video game (e.g., Wii Fit), moderate effort (e.g., aerobic, resistance)</td>
</tr>
<tr>
<td>02005</td>
<td>7.2</td>
<td>02012</td>
<td>5.5</td>
<td>activity promoting video/arcade game (e.g., Exergaming, Dance Dance Revolution), vigorous effort</td>
</tr>
<tr>
<td>02008</td>
<td>5.0</td>
<td>02013</td>
<td>7.0</td>
<td>army type obstacle course exercise, boot camp training program</td>
</tr>
<tr>
<td>02010</td>
<td>7.0</td>
<td>02012</td>
<td>5.5</td>
<td>bicycling, stationary, general</td>
</tr>
<tr>
<td>02011</td>
<td>3.5</td>
<td>02013</td>
<td>7.0</td>
<td>bicycling, stationary, 30-50 watts, very light to light effort</td>
</tr>
<tr>
<td>02012</td>
<td>6.8</td>
<td>02014</td>
<td>10.5</td>
<td>bicycling, stationary, 90-100 watts, moderate to vigorous effort</td>
</tr>
<tr>
<td>02013</td>
<td>8.8</td>
<td>02015</td>
<td>12.5</td>
<td>bicycling, stationary, 101-160 watts, vigorous effort</td>
</tr>
<tr>
<td>02014</td>
<td>11.0</td>
<td>02015</td>
<td>14.0</td>
<td>bicycling, stationary, 201-270 watts, very vigorous effort</td>
</tr>
<tr>
<td>02017</td>
<td>4.8</td>
<td>02015</td>
<td>14.0</td>
<td>bicycling, stationary, 51-89 watts, light-to-moderate effort</td>
</tr>
<tr>
<td>02019</td>
<td>8.5</td>
<td>02020</td>
<td>8.0</td>
<td>bicycling, stationary, RPM/Spin bike class</td>
</tr>
<tr>
<td>02020</td>
<td>8.0</td>
<td>02020</td>
<td>8.0</td>
<td>calisthenics (e.g., push ups, sit ups, pull-ups, jumping jacks), vigorous effort</td>
</tr>
<tr>
<td>02022</td>
<td>3.8</td>
<td>02022</td>
<td>3.8</td>
<td>calisthenics (e.g., push ups, sit ups, pull-ups, lunges), moderate effort</td>
</tr>
<tr>
<td>02024</td>
<td>2.8</td>
<td>02024</td>
<td>2.8</td>
<td>calisthenics (e.g., situps, abdominal crunches), light effort</td>
</tr>
</tbody>
</table>
MET MINUTES

• A Concept to measure total volume of work and energy expenditure!!!!

• \( \text{MET} \cdot \text{Minutes} = \text{METs} \times \text{Duration} \)

• \( \text{MET} \cdot \text{Hours} = \text{METs} \cdot \text{Hours Divided By 60} \)

• \( \text{Kcals/minute}^{-1} = \text{METs} \times 3.5 \text{ ml/kg/min}^{-1} \times \text{Body Mass (Kgs)} /200^* \)

\[
(200\text{ml}O_2/\text{kcal} \text{ is the same thing as } 1,000\text{ml}O_2/5\text{ Kcals})
\]

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Duration</th>
<th>MET</th>
<th>Formula</th>
<th>Cals burned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking 3.5 mph</td>
<td>60</td>
<td>3.8</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>172</td>
</tr>
<tr>
<td>Swimming 1.2 mph</td>
<td>60</td>
<td>7</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>316</td>
</tr>
<tr>
<td>Cycling 11-12 mph</td>
<td>60</td>
<td>7</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>316</td>
</tr>
<tr>
<td>Running 6 mph</td>
<td>60</td>
<td>10</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>452</td>
</tr>
<tr>
<td>Step aerobics (high)</td>
<td>60</td>
<td>8</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>361</td>
</tr>
<tr>
<td>Weight Training</td>
<td>60</td>
<td>3</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>135</td>
</tr>
<tr>
<td>Yoga</td>
<td>60</td>
<td>2.5</td>
<td>((\text{Met} \times \text{duration}) \times 3.5 \times \text{WT (in kg)} / 200)</td>
<td>90</td>
</tr>
</tbody>
</table>
TAKE AWAY POINTS:

1. Personal trainers should understand the medical/health needs of their clients.

2. New exercise guidelines can facilitate the development of safe, effective exercise programs.

3. New online resources can also help exercise professionals develop safe, effective exercise programs.
QUESTIONS?

Thank You!!!!!
Internet Resources, Tips, Tools, Videos

• Compendium of Physical Activity
  https://sites.google.com/site/compendiumofphysicalactivities/

• Exercise Prescription on the Net. Available at
  http://exrx.net/index.html

• MedlinePlus.gov http://www.medlineplus.gov A service of the National Library of Medicine of the National Institutes of Health

• Lab Tests Online. *An online resource which explains the purpose of, procedures for and the results of commonly performed lab tests!!! Available at http://www.labtestsonline.org/understanding/
Internet Resources, Tips and Tools (Also See Appendix!!!)

General Health & Disease Information (Medline Plus) (National Library of Medicine-NIH)

Drugs, Supplements and Herbal Information Medline Plus Drugs

Bone and Joint Disorders National Institute of Arthritis and Musculoskeletal and Skin Disorders (NIAMS)
http://www.niams.nih.gov/Health_Info/Bone/Bone_Health/Exercise/default.asp

Lab Tests Online. *An online resource which explains the purpose of, procedures for and the results of commonly performed lab tests!!!
Available at:
http://www.labtestsonline.org/understanding/


Exercise Is Medicine.
http://exerciseismedicine.org/


Continued


Additional References


Additional References-Osteoporosis/Osteopenia


Professional Organizations and Certifications

• Clinical Exercise Physiology Association (CEPA)  
  http://www.acsm-cepa.org/i4a/pages/index.cfm?pageid=3277

• American College of Sports Medicine (ACSM)  
  http://www.acsm.org/

• ACSM Certifications and Registry Department  
  http://www.acsm.org/AM/Template.cfm?Section=Get_Certified

• American Association of Cardiovascular Pulmonary Rehabilitation (AACVPR)  
  http://www.aacvpr.org/

• Joslin Diabetes Center  
  http://www.joslin.org/professional_education.html
Internet Resources, Tips and Tools

• American Medical Association CME Library Online: Managing Osteoporosis: http://www.ama-cmeonline.com/cstec_mgmt/

• Mayo Clinic: Exercise and Osteoporosis: http://www.mayoclinic.com/health/osteoporosis/HQ00643

• National Institutes of Health: Osteoporosis and Related Diseases National Resource Center: http://www.niams.nih.gov/bone/

• National Osteoporosis Foundation: http://www.nof.org


• NIH National Osteoporosis and Related Bone Diseases-National Resource Center: http://www.osteo.org
Peter Ronai, M.S. CSCS-D, NSCA-CPT-D, CSPS, FACSM
Clinical Associate Professor
Sacred Heart University
Fairfield, CT. 06825