### Description of Intensity for Muscular Strength, Endurance and Power

<table>
<thead>
<tr>
<th>Moderate Intensity</th>
<th>High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;10 Reps to moderate fatigue (can still do 3 reps at end point)</td>
<td>Set of Reps (using any resistance) until subject can do no more reps</td>
</tr>
<tr>
<td>RPE 12-16 on Borg’s 20 point RPE Scale (Ref: Borg, 1998)</td>
<td>RPE ≥ 17 on Borg’s 20 point scale (Ref: Borg, 1998)</td>
</tr>
<tr>
<td>RPE 4-6 on Borg’s CR-10 Scale (Ref: Borg, 1998)</td>
<td>RPE ≥ 7 on Borg’s CR-10 scale (Ref: Borg, 1998)</td>
</tr>
<tr>
<td>50% to 70% Maximal voluntary isometric contraction</td>
<td>≥ 70% Maximal voluntary isometric contraction</td>
</tr>
<tr>
<td>40-60% 1RM</td>
<td>≥ 80% 1 RM</td>
</tr>
</tbody>
</table>

Sustained Isometric contraction with elevated BP

Moderate and high risk subjects must not be allowed to perform the Valsalva maneuver, increase BP by sustained gripping, or sustained upper body static contractions. It is safer to use machines versus free weights for persons who have joint, bone, neuropathy or neurological issues.

*Note:* The Williams et al. (2007) resource includes guidelines specifically for resistance training in individuals with cardiovascular disease. See the references below for apparently healthy adults, older adults, and cardiac patients.

*Ref: ACSM (2010, 2014); Cress et al. (2004); Ratamess (2009); Williams et al. (2007)*

### PAR-Q

*Ref: Canadian Society for Exercise Physiology (2002)*

The PAR-Q use is restricted to the format available from http://uwfitness.uwaterloo.ca/PDF/par-q.pdf

Use the standard form when screening subjects.

According to Howley and Franks (2007), question 5 on the PAR-Q: “Do you have a bone or joint problem (for example, back, knee, hip) that could be made worse by a change in your physical activity?” elicits a large number of false positives.

In some instances the PAR-Q may elicit insufficient information to assess risk associated with the protocol (e.g., a participant with an implanted electronic device must not be tested using bioelectric impedance) or a targeted population (e.g., participants who have asthma are at greater risk during vigorous activity). In these instances use the Health History Questionnaire.

### Health History Questionnaire (HHQ)

Refer to ACSM (2010, p. 21) for an example of a health history questionnaire. This questionnaire is used to determine signs and symptoms, coronary artery disease risk (CAD) factors and information relevant to the subject’s safe participation in the research protocol. Refer to ACSM (2014, p. 25) for an example of a health history questionnaire. The health history questionnaire must also include protocol-specific questions to identify additional risks associated with the protocol (e.g., a participant with an implanted electronic device may be at risk in a vibration protocol) or a targeted population (e.g., older adults may be at greater risk for falling in a weight bearing activity).

### Classification of hypertension

Note that either Systolic Blood Pressure (SBP) or Diastolic Blood Pressure (DBP) determines the risk.

<table>
<thead>
<tr>
<th>SBP mmHg</th>
<th>DBP mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal:</td>
<td>&lt;120</td>
</tr>
<tr>
<td>Prehypertension:</td>
<td>120 to 139</td>
</tr>
<tr>
<td>Stage 1 hypertension:</td>
<td>140 to 159</td>
</tr>
<tr>
<td>Stage 2 hypertension:</td>
<td>≥160</td>
</tr>
</tbody>
</table>

*Ref: ACSM (2008); O’ Connor et al. (2007)*
Specific Risks for Resistance Testing or Training

Confirmed or suspected osteoporosis or osteopenia, musculo-skeletal injuries to involved joints, surgery within last year (includes eye surgery), hernia, Marfan syndrome, implanted pacemaker or defibrillator, low functional capacity (<4 METS), uncontrolled hypertension >160/100 mmHg represent a partial list of risks. The researcher must use his or her experience in determining further risk related to a specific protocol. Isometric and dynamic exercise provide a cardiac challenge when sustained. Intensity levels and program design should be modified for those at high risk for CAD. If multiple sets are performed it is recommended to allow >60 seconds between sets for SBP and HR to recover to resting levels in healthy and adults with cardiac disease (Lamotte et al., 2006).

Ref: Pescatello et al. (2004); Williams, 2007

Coronary Artery Disease (CAD) Risk

Low, moderate or high CAD risk is determined through knowledge of Major Signs and Symptoms or Known Disease or Condition (see A below); and number of Coronary Artery Disease Risk Factors (see B below).

<table>
<thead>
<tr>
<th>Low CAD Risk</th>
<th>Moderate CAD Risk</th>
<th>High CAD Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>No major signs or symptoms or known disease and &lt;2 CV risk factors</td>
<td>No major signs or symptoms or known disease and ≥2 CV risk factors</td>
<td>≥1 major sign or symptom or known disease</td>
</tr>
</tbody>
</table>

A. Major Signs and Symptoms or Known Disease or Condition

1. Major signs or symptoms suggestive of CV, Pulmonary or Metabolic Disease:
   a. Pain, discomfort in the chest, neck, jaw, arms or other areas that may result from ischemia.
   b. Shortness of breath at rest or with mild exertion.
   c. Dizziness or fainting
   d. Difficulty breathing when lying down or during sleep
   e. Swelling in one or both ankles
   f. Heart rate irregularities
   g. Acute cramp like pain in muscles when exercising that subsides when exercise is stopped
   h. Known heart murmur
   i. Unusual fatigue or shortness of breath with usual activities

2. Known Disease or Condition
   a. Cardiovascular: cardiac, peripheral vascular, or cerebrovascular disease
   b. Pulmonary: COPD, asthma, interstitial lung disease, or cystic fibrosis
   c. Metabolic: Diabetes mellitus (Types 1 and 2) or renal disease
   d. Thyroid or Liver disease
   e. Other considerations (e.g., pregnancy)
B. Coronary Artery Disease Risk Factors  
Ref: ACSM (2010, 2014)

1. Age: men ≥45 years, women ≥55 years.
2. Family History of heart disease: Sudden death, heart attack or coronary revascularization surgery in one or more close relative. Father or brother younger than 55 yr; mother or sister younger than 65 yr.
3. Cigarette Smoking: Current smoker or having quit within the last 6 months, or exposed to environmental tobacco smoke.
4. Sedentary lifestyle: Not participating in at least 30min of moderate intensity physical activity on at least three days of the week for at least three months.
5. Obesity: BMI ≥30 kg/m² or waist girth > 102 cm (40 inches) for men and > 88 cm (35 inches) for women. Allied health professionals ought to use clinical judgment when evaluating this risk factor as thresholds for obesity vary. Individuals with large muscle mass may have a high BMI and waist circumference in the absence of obesity.
6. *High Blood Pressure: On medication for blood pressure OR blood pressure at or above 140/90 mmHg (either number high) on ≥2 occasions.
7. *Blood lipids: On medication for lowering blood lipids OR one of the following: LDL (bad) cholesterol over ≥130 mg/dl; or HDL (good) cholesterol <40 mg/dl. If only total cholesterol level available: use ≥200mg/dl;
8. *Prediabetes. Impaired fasting glucose ≥100 mg/dl but <126 mg/dl or impaired glucose tolerance test ≥140 mg/dl but <200 mg/dl on ≥2 occasions. Note: glucose >126 mg/dl represents a symptom of metabolic disease, not a risk factor.

Notes:
   a) *Blood pressure, blood lipids and glucose should be confirmed on ≥ 2 occasions.
   b) If HDL cholesterol ≥ 60 mg/dl, subtract one risk factor from total.
   c) If information for a risk factor is not available it should be counted as a risk except for prediabetes. Count missing glucose as a risk factor for men and women ≥45 years w/ BMI ≥25 kg/m²; and for men and women under 45 who have a BMI ≥25 kg/m² and have one or more additional risk factors for prediabetes (e.g. excess abdominal fat, inactivity, family history of diabetes mellitus).
   d) Missing values are not considered a risk factor if the person has had an assessment of the risk factor (e.g., blood pressure, cholesterol, etc.), does not know his or her numbers, but was told they were acceptable.

The Exercise Decision Trees serve as guidelines for the Institutional Review Board. If a researcher wishes to deviate from the guidelines s/he must provide justification for any modifications.

Additional screening and monitoring of subjects during and after exercise is required for protocols that include greater stress than is found in traditional resistance strength and testing protocols (e.g., extreme plyometrics, eccentrically induced muscle soreness, programs that could induce exertional rhabdomyolysis etc.).

Last modified September 2013
REFERENCES FOR IRB STRENGTH/RESISTANCE DECISION TREES


