HIV & Aging

- In 2005, 24% of people living with HIV (PLWH) in the U.S. are over the age of 50\(^1\)
- 15% of new AIDS cases were in people over the age of 50 in 2005\(^1\)
- By 2015, half of PLWH in the U.S. will be >50 age\(^2\)

**Gaps**

- Can the accelerated aging process in older adults living with HIV be slowed down?
- Can certain health behaviors impact the low grade chronic inflammation?
- How can we motivate older adults living with HIV to stay active and engaged?
- Can regular exercise prevent bone necrosis and osteoporosis in older adults with HIV?
Exercise Benefits

- Cardiovascular function (↓ Blood Pressure)
- Metabolic function (↓ Blood Glucose)
- Pulmonary function (↓ Pulmonary Hypertension)
- Strength and muscle mass (↓ Muscle Atrophy)
- Prevention of Osteoporosis (↓ Bone Loss)

Goal

To establish age-appropriate, evidence-based exercise interventions in HIV adults >50 years

Methods

Compared exercise programs in 3 groups which represent burdensome clinical issues for PLWH

1. Older adults with frailty: Loss of lean muscle mass
2. HIV-Infected adults: ART side effects
3. Older adults with metabolic syndrome: Metabolic changes in glucose and fat metabolism

Frailty Definition

A clinical syndrome in which 3 or more of the following criteria are present:\footnote{Fried, et al., (2001). Frailty in older adults: Evidence for a phenotype. Journals of Gerontology, 56A, M146-M156}

<table>
<thead>
<tr>
<th>Frailty Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional weight loss</td>
<td>&gt;10-pound weight loss in previous year</td>
</tr>
<tr>
<td>Exhaustion</td>
<td>Self-reported exhaustion ≥3 days/week</td>
</tr>
<tr>
<td>Low physical activity levels</td>
<td>Men: &lt;383 kcal/week</td>
</tr>
<tr>
<td></td>
<td>Women: &lt;270 kcal/week</td>
</tr>
<tr>
<td>Slowness</td>
<td>Walking time per 15 feet</td>
</tr>
<tr>
<td>Weakness</td>
<td>Based on grip strength</td>
</tr>
</tbody>
</table>
Metabolic Syndrome

ATP III* Clinical Definition

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Defining Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal Obesity</td>
<td>Waist circumference</td>
</tr>
<tr>
<td>Men</td>
<td>&gt;102 cm (&gt;40 in)</td>
</tr>
<tr>
<td>Women</td>
<td>&gt;88 cm (&gt;35 in)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>≥150 mg/dL</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>&gt;40 mg/dL</td>
</tr>
<tr>
<td>Women</td>
<td>&gt;50 mg/dL</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>≥130/85 mmHg</td>
</tr>
<tr>
<td>Fasting Glucose</td>
<td>≥110 mg/dL</td>
</tr>
</tbody>
</table>

*Note: ATP III= 3rd report by Adult Treatment Panel from the National Cholesterol Education Program

Total Exercise Studies Identified

PubMed Search:
- Frail Older Adults: 322
- HIV-infected Adults: 664
- Older Adults with Metabolic Syndrome: 698

Review Inclusion Criteria

- Frail Older Adults (4 studies):
  (a) >65 years
  (b) Aerobic/resistance exercise conducted
  (c) Cardiopulmonary and/or strength measurements
  (d) Weekly program followed for at least 6 weeks

- HIV-Infected Adults (12 studies):
  (a) >18 years
  (b) Aerobic/resistance conducted
  (c) Cardiopulmonary and/or strength measurements
  (d) Weekly program followed for at least 6 weeks

Inclusion Criteria

- Older Adults with Metabolic Syndrome (4 studies):
  (a) >55 years
  (b) Aerobic/resistance exercise conducted
  (c) Cardiopulmonary and/or strength measurements
  (d) Weekly program followed for at least 6 weeks

- 17 studies in this review were randomized, controlled trials; 2 were non-randomized, controlled trials; 1 was single group cohort
Forms and Outcomes of Aerobic Exercise

**Aerobic Exercise**
Walking, running, swimming, bicycling, stair-stepper

**Outcomes measured**
- Maximum \(O_2\) consumption = VO2 Max: maximal capacity for oxygen consumption by the body during maximal exertion

Forms and Outcomes of Resistance Exercise

**Resistance Exercise**
Weight training, weight bearing, calisthenics

**Outcomes Measured**
- One-repetition maximum: maximum amount of weight that can be lifted at any one time during a lifting exercise
- Maximum heart rate: highest heart rate that can be achieved without exercise stress; age-dependent

Exercise & Frailty

- All studies showed significant improvement in muscle groups with \(p \leq 0.05\)
- Mean age: 62 to 87 yrs
- Exercise intensity:
  - \(30-40\%\) of VO2max for low-intensity
  - \(70-90\%\) of VO2max for high-intensity

Example: Older Adults with Frailty

- **Aerobic Exercise**
  - Treadmill, stationary bicycle, rowing
  - **Duration**
    - 15 min to 20-30 min
  - **Intensity**
    - 60-70% VO2 Peak
  - **Frequency**
    - 6-8 reps to 8-12 reps

- **Resistance Exercise**
  - Upper & Lower Extremity
  - **Intensity**
    - 65% 1 RM
    - 85-100% 1 RM

*Binder et al., 2002*
Exercise & Adults Living with HIV

- Most studies show significant improvements in VO2max with sufficient aerobic exercise compared to sedentary controls.
- Mean Age: 36-47 yrs

Example: Adults Living with HIV

### AEROBIC EXERCISE PROGRAMS

<table>
<thead>
<tr>
<th>Year &amp; Author</th>
<th>Study Duration</th>
<th>Aerobic Exercise Intervention</th>
<th>VO2max Outcomes</th>
</tr>
</thead>
</table>
| Mutimura et al., 2008 | 6 mo | 30 min pre/post, 45 min jogging, running, stair-climbing | Exercise: 4.7 ml/kg/min ↑  
Control: 0.5 ml/kg/min ↑  
(p<.0001) |
| Dolan et al., 2006 | 4 mo | 20 min run (first 2 wks) 30 min run (thereafter) | Exercise: 1.5 ml/kg/min ↑  
Control: -2.5 ml/kg/min (p<.001) |
| Smith et al., 2001 | 6 mo | 20 min walking/jogging, 30 min cycle, stairway, cross-country machine | Exercise: 2.6 ml/kg/min ↑  
Control: 1.0 ml/kg/min (p=.09) |
Why No Improvement?
1. Minimal exercise prescription of 20 minutes
2. Lack of progressive exercise
3. Missed sessions
4. Short length of intervention (Baigis et al.)
5. Participants generally more fit at baseline
6. Disproportionate loss of subjects from exercise group (Smith et al.)

Exercise & Metabolic Syndrome
- All studies in the review found aerobic and resistance exercise to be beneficial in improving metabolic outcomes in the elderly.
- Average age range: 56 to 73 years
- 1-Repetition Maximum range: 50%-80%

Example: Adults Living with HIV

<table>
<thead>
<tr>
<th>Year &amp; Author</th>
<th>Resistance Exercise Intervention</th>
<th>Repetition/Duration</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolan et al., 2006</td>
<td>Knee extensors, 6 sets of 20 reps</td>
<td>4 months</td>
<td>Strength Measure Change at 16 wks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Exercise Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee extensors</td>
<td>33.8 ± 4.4</td>
<td>0.8 ± 1.5</td>
</tr>
<tr>
<td>Pectoralis</td>
<td>13.9 ± 2.2</td>
<td>0.4 ± 0.7</td>
</tr>
<tr>
<td>Knee flexors</td>
<td>8.4 ± 2.0</td>
<td>0.2 ± 0.5</td>
</tr>
<tr>
<td>Shoulder abductors</td>
<td>7.4 ± 3.3</td>
<td>0.3 ± 0.1</td>
</tr>
<tr>
<td>Ankle plantar flexors</td>
<td>31.5 ± 4.0</td>
<td>1.9 ± 1.2</td>
</tr>
<tr>
<td>Elbow flexors, right arm</td>
<td>3.5 ± 0.6</td>
<td>0.5 ± 0.4</td>
</tr>
<tr>
<td>Elbow flexors, left arm</td>
<td>3.6 ± 0.6</td>
<td>0.6 ± 0.4</td>
</tr>
</tbody>
</table>

Example: Older Adults & Metabolic Syndrome

<table>
<thead>
<tr>
<th>Year &amp; Author</th>
<th>Study Duration</th>
<th>Exercise Intervention</th>
<th>HRmax</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrara et al., 2006</td>
<td>3 x wk 6 mo</td>
<td>Aerobic: 45-60 min treadmill, running</td>
<td>75-80%</td>
<td>VO2max imp. by 16% from baseline in aerobic group (p&lt;.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resistance: 8-12 reps of upper and lower extremity</td>
<td>80%</td>
<td>Leg and arm muscle strength increased by 45 ± 5% and 27 ± 5% after exercise (p&lt;.0001)</td>
</tr>
</tbody>
</table>
RESULT: Metabolic Syndrome

Evidence-Based Recommendations: How Did We Arrive?

- We summarized findings from the 3 groups studied
- Took into consideration recommendations from the American College of Sports Medicine
- Consulted with a physical therapist

### Summary of Recommendations

#### AEROBIC EXERCISE

<table>
<thead>
<tr>
<th>Group</th>
<th>Exercise</th>
<th>Frequency</th>
<th>Duration</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frail Older Adults</td>
<td>Walking, treadmill, cycling, rowing, swimming</td>
<td>3-5 days/wk</td>
<td>5-60 min, as tolerated</td>
<td>50-60% VO2 max initially, 85-90% VO2 max gradual increase</td>
</tr>
<tr>
<td>HIV-Infected Adults</td>
<td>Treadmill, jogging, cycling, stair-climbing</td>
<td>3 days/wk</td>
<td>10-15 min warm-up/cold-down, 20-45 min exercise</td>
<td>50-85% HRmax</td>
</tr>
<tr>
<td>Older Adults w/ Metabolic Syndrome</td>
<td>Treadmill, stationary cycle, stair stepper</td>
<td>3-5 days/wk</td>
<td>45 min endurance</td>
<td>60-90% HRmax</td>
</tr>
</tbody>
</table>

#### RESISTANCE EXERCISE

<table>
<thead>
<tr>
<th>Group</th>
<th>Exercise</th>
<th>Frequency</th>
<th>Repetitions</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frail Older Adults</td>
<td>Free weights, weight machines, isokinetic machines, ball machines</td>
<td>3 days/wk</td>
<td>15-20 min session</td>
<td>40% of 1-RM initially, Gradual Increase to 85-100% * Start program without weight and slowly add</td>
</tr>
<tr>
<td>HIV-Infected Adults</td>
<td>Bench press, leg extension, leg curl, shoulder press/abduction, bicep/tricep curls</td>
<td>2-3 days/wk</td>
<td>3 sets of 10 initially, increase to 4 sets of 4-8 reps</td>
<td>60-80% 1-RM</td>
</tr>
<tr>
<td>Older Adults w/ Metabolic Syndrome</td>
<td>Treadmill, stationary cycle, stair stepper</td>
<td>3-5 days/wk</td>
<td>2 sets of 10-15 reps</td>
<td>50% 1-RM</td>
</tr>
</tbody>
</table>
Exercise Program for Older Adults with HIV: Our Aerobic Recommendations

Exercise
- Walking, cycling, swimming, stair climbing, rowing (may use machines such as treadmill, and stationary bicycle).

Frequency/Duration
- At least 3 days per week for 20-40 minutes.
- 5-10 minutes of stretching before and after each session to prevent injury

Exercise Program for Older Adults with HIV: Our Aerobic Recommendations

Duration
- Should last at least 6 weeks

Intensity
- 50%-90% of estimated maximum heart rate
  → Based on age and weight of individual
  → Begin at lower intensity and incrementally increase

Exercise Program for Older Adults with HIV: Our Resistance Recommendations

Frequency/Intensity
- 1-2 sets of 6-8 repetitions at 60% 1-RM initially
- 1 to 3 sets of 8-10 repetitions at 80-90% of 1-RM
  - 20-30 seconds rest period between each set

1-RM Intensity Scale:
→ 1lb = 10% of 1-RM
→ 10lb = 100% of 1-RM

Duration
- 3 days per week for at least 6 weeks

Clinical Considerations
- Health care provider should establish baseline pulmonary and cardiovascular health measures prior to initiating new exercise program
- Previous exercise history of the patient, current medications, stage of disease, co-morbidities, and assessment of functional capacity
- Exercise had no measurable impact on immunological markers (CD4 count, viral load); safe at every level of HIV disease progression and age group
- Avoid prolonged strenuous physical activity for more than 90 minutes
- Training partner/group increases motivation and psychological well-being
New Research/Findings

- De Souza & Colleagues, 2011:
  Effect of progressive resistance exercise on strength evolution of elderly patients living with HIV compared to healthy controls

<table>
<thead>
<tr>
<th>Average Age</th>
<th>Resistance Training</th>
<th>Frequency/Duration</th>
<th>Intensity</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>64</td>
<td>5 muscle groups</td>
<td>2 x week 1 year</td>
<td>-2 sets of 12-15 reps at light, moderate and heavy resistance</td>
</tr>
<tr>
<td>Control</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Strength x 1.52-2.33 x the baseline values for those living with HIV; 1.21-1.48 times for controls (p<0.01)

Future Research

- Future studies are warranted in order to determine dosing and effect of aerobic and resistance exercise in the aging HIV population
- Further studies are needed to study the effect of exercise on the psychosocial aspects in the aging HIV population
- Future studies are needed to study the physiological effects of aerobic and resistance exercise in the aging HIV population

Conclusions

- Aerobic and resistance exercise training is safe and effective and significantly improves aerobic and resistance capacity in older adults with HIV.
- Aerobic and resistance exercises should be performed at a moderate or vigorous level for at least 3 days a week.
- A gradual approach to increase physical activity in HIV-infected older adults minimizes the risk of injury and increases confidence in a participant's abilities.
Thank You!
Ellen McGough
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• University of Washington School of Nursing

QUESTIONS?