EXERCISE: How to Develop Exercise Programs for Frail Elders
Jeffrey L. Alexander, PhD, FAACVPR, ACSM-CES

Slide 1

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Jeffrey L. Alexander, PhD, FAACVPR, ACSM-CES®
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AzGS 2010

Slide 2

Objectives
- Describe and demonstrate simple functional fitness assessment tools used to assess frail elders baseline level of physical functioning as well as improvement following exercise training
- Describe and apply safe and correct exercise training principles (e.g., frequency, intensity, duration, and mode of exercise) to enhance the functional fitness and quality of life of frail elders

Slide 3

Objectives
- Discuss special considerations for frail elders when developing and implementing exercise programs and prescriptions.
Define frail?

“The fit elderly are individuals, over 65 years of age, living independently at home or in
sheltered accommodation. They are free from ambulatory and without significant hepatic, renal,
cardiac, respiratory or metabolic disorders on either clinical examination or laboratory
investigation. They do not receive regular prescribed medication.

The frail elderly are individuals, over 65 years of age, dependent on others for activities of
daily living, and often in institutional care. They do not have overt cardiac, respiratory, hepatic, renal or metabolic disease minor
abnormalities may be revealed on laboratory investigation. They may require regular
prescribed drug therapy. Conditions contributing to frailty commonly include Alzheimer’s
disease, multiinfarct cerebrovascular disease, Parkinsonism, osteoporosis, osteoarthritis,
and healed fracture trauma.”

Editorial, Woodhouse et al. (1988)

Criteria for Defining Frailty*

- Shrinking:
  - Unintentional weight loss (>10 lbs in a year)
  - Sarcopenia or loss of muscle mass
- Weakness (measured by grip strength)
- Exhaustion (self-reported)
- Slow walking speed
  - Low physical activity participation
  - Associated with ADL disability & comorbidity

Fried et al. (2001). Frailty in older adults: Evidence for a Phenotype. The Journals of
Gerontology, 56A, M146-M156

Benefits of Exercise for Frail Elders*

- Enhanced muscular strength, endurance, and power
- Increased aerobic capacity and endurance
- Weight loss, maintenance of muscle mass
- Improved flexibility
- Improved psychological well-being and quality of life
- Improved coordination and balance
  - Better management of chronic
diseases/conditions
  - Reduced risk for falls

Sorace,P. (2010. Exercise recommendations for the frail population. ACMS’s
Certified News, 20 (1), 3-4/
A Brief Peek at the Impact of Aging on the Musculoskeletal System

What is the impact of aging on skeletal muscle strength and power?*


Aging Muscle (in healthy older adults)

Muscle

Mass

Power

Strength

AGE

MUSCLE
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**Slide 10**

**Decrease Muscle Mass**

- **Loss of 1-2% per year** after age 50 (sarcopenia)
- **Why?**
  - Hormonal changes (testosterone, GH, IGF-1)
  - Loss of ½ of all muscle fiber motor units by age 60!
  - 1% per year after age 30


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**Slide 11**

**Decrease in Muscle Mass**

- **Why?**
  - Increase in inflammatory mediators (e.g. tumor necrosis factor), which have a catabolic effect
  - “Disuse atrophy” – lack of physical activity
  - Decreased caloric intake, especially protein

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**Slide 12**

**Decrease in Muscle Strength**

- **Accelerated loss** of muscular strength after age 50
  - 1-2% per year after age 60
  - Up to 15% per decade by the 6th and 7th decade of life
- **Why?**
  - Loss of muscle mass over time
  - Loss of motor neurons
Decrease in Muscle Power

- Loss of muscle power begins earlier and occurs at a greater rate than loss of strength
  - Power loss begins in the 3rd and 4th decade
  - 3-4% loss per year after the age of 60
- Why?
  - Atrophy & loss of muscle mass – Type II fibers!!

Decrease in Muscle Power

- Why?
  - Decrease in specific tension generated by a single fiber
  - Slowed muscle contractile properties (e.g. speed of sliding filaments)
- Others – see Sayers, 2007

Can these changes in muscle characteristics and muscular power be slowed and/or reversed?
Studies have shown that older adults (even 85+ years) can increase muscle mass and strength through training.

What impact does exercise training have on the health and well-being of older adults and functional fitness (ability to perform ADLs)?

Functional Fitness Assessment:
Essential Baseline, Post, and Continuous Measures
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Slide 19

Components of a Comprehensive Assessment
- Upper- and lower-body strength
- Aerobic endurance
- Upper- and lower-body flexibility
- Static and dynamic balance

Slide 20

Senior Fitness Test*
A One Stop Shop
- Comprehensive (all but static balance)
- Appropriate for a broad range of ability levels (healthy to frail)
- Normative data for each component test from a broad range of ages: 60 to 94 years
  - Minimal resources needed (time, equipment)


Slide 21

Senior Fitness Test*
- Upper- and lower-body strength
  - Arm curl
  - 30-second chair stands
- Aerobic endurance
  - 6-minute walk test, OR
  - 2-minute step test


**Senior Fitness Test***
- Upper- and lower-body flexibility
  - Back scratch test
  - Chair sit-and-reach test
- Dynamic balance
  - 8-foot up and go test


**Arm Curl***
- Equipment:
  - 5 and 8 lb dumbbells
  - Sturdy chair with solid back and no armrests
- Procedures:
  - Perform as many arm curls in 30 seconds using the strongest arm (self-determined)
  - Count only curls reaching full flexion


**30-Second Chair Stands***
- Equipment:
  - Sturdy chair with solid back and no armrests
- Procedures:
  - Sit in the middle of the chair with arms crossed
  - Perform as many chair stands in 30 seconds
  - Count only full chair stands (legs completely straight)

**Slide 25**

**6-Minute Walk Test**

- **Equipment:**
  - Stopwatch, lap counter, cones to mark off walking area, chair that can be easily moved

- **Procedures:**
  - Patient walks as quickly as possible as far as possible in 6 minutes
  - Patient may stop and rest as needed


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**Slide 26**

**2-Minute Step Test**

- **Equipment:**
  - Masking tape, wall, step (lap) counter

- **Procedures:**
  - Patient stands up straight next to wall
  - Mark a spot on the wall that is midway between the knee and iliac crest of the hip
  - Patient marches in place bringing knee up to or past mark for 2 minutes


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**Slide 27**

**Back Scratch Test**

- **Equipment:**
  - Ruler or yardstick

- **Procedures:**
  - While standing, patient reaches behind the head towards the middle of the back with palm facing in and behind the back; palm facing out, up towards the middle attempting to touch fingers
  - Measure distance (nearest 1/8 inch) of middle fingers apart (negative) or overlapping (positive)
  - Perform for both sides

Chair Sit-and-Reach Test*

**Equipment:**
- Ruler, sturdy chair without armrests

**Procedures:**
- Patient seated on the edge of the chair extending one leg straight out, heel on the floor, foot flexed
- Other leg rests at a 90º at the knee, foot flat on the floor
- Patient places one hand over the other and stretches towards the toes of the extended leg
- Measure distance (nearest ½ inch) between tip of fingers and toes (negative) or overlap (positive)


8-Foot Up and Go*

**Equipment:**
- Stopwatch, sturdy chair without armrests, measuring tape, cone

**Procedures:**
- Place chair against a wall and measure exactly 8 feet from the edge of the chair and place a cone to mark the distance
- Patient seated on the edge of the chair
- On the signal, patient stands from chair, walks as quickly as possible around the cone, and sits back on the chair
- Time, to the nearest .10 of a second, from the signal until the patient is seated back in the chair


Static Balance*

**Static Balance Test**
- Patients stand as long as possible (up to 30 seconds) in the following stances:
  - Comfortable stance (feet shoulder width apart)
  - Narrow stance (feet together)
  - Tandem stance (left in front of right then vice versa)
- If unable to hold for 30 seconds, a second attempt is allowed and the performance times are averaged


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Special Considerations for the Frail

- Obtain physician clearance prior to testing
- Consider co-morbidities that would suggest avoiding certain tests (e.g., known balance disorder)
- Modify tests as needed

Special Considerations for the Frail

- Obtain physician clearance
- Individualize the exercise prescription
  - A cookie cutter approach is not suitable
  - Consider co-morbidities (e.g., diabetes, heart disease, lung disease, osteoporosis, balance disorders, arthritis)

What are the foundational principles of exercise prescription and how can they be applied to frail older adults?
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Slide 34

Special Considerations for the Frail

- Individualize the exercise prescription
  - Consider patients previous activity levels and state of physical condition
  - Modify prescription as needed (day to day, week to week . . .)
- Consider patients goals, and
- Likes/dislikes (let them find the fun in exercise)

Slide 35

Foundational Principles

- Frequency
- Intensity
- Time
- Type

Slide 36

Aerobic Exercise*

- Frequency – 3-5 days/week
- Intensity – 5-8 on the Borg scale (1-10)
- Time – accumulate 20-60 minutes
- Type – as per tolerated by patient and patient’s co-morbidities (e.g. seated, weight bearing, non-weight bearing)

Resistance Exercise*

- Frequency – 2-3 days/week
- Intensity
  - # of exercises: 8-10 focusing on multi-joint, whole body
  - # of repetitions: 10-15 to failure
  - # of sets: 1-3 sets
- Type – machine, free weights, elastic bands, canned food . . .


Flexibility Exercise*

- Frequency – 3-6 days/week
- Intensity – to the point of mild tension
  - Exercises: all major muscle groups
  - # of repetitions: 2-3 per muscle group
  - Hold each stretch for 15 – 60 seconds
- Type – static
  **avoid ballistic stretching as it increases risk for injury**


Balance Training*

- Incorporate balance training into other forms of exercise – aerobic (e.g. tandem walking) and resistance exercise (e.g. sitting on exercise ball, standing in various positions)
- Yoga and tai chi have been shown to be a safe and effective means to improve balance and reduce the fear of falling in older adults

The Art of Progression

- Overload principle dictates the need for progression of training
- Progress frequency, intensity, and time as tolerated by the patient
- Re-assess functional fitness measures periodically (e.g., every 12 weeks) to assess improvement and gauge progression

Did we meet our objectives?

- Describe and demonstrate simple functional fitness assessment tools used to assess frail elders baseline level of physical functioning as well as improvement following exercise training
- Describe and apply safe and correct exercise training principles (e.g., frequency, intensity, duration, and mode of exercise) to enhance the functional fitness and quality of life of frail elders

Did we meet our objectives?

- Discuss special considerations for frail elders when developing and implementing exercise programs and prescriptions.
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References

1. Woodhouse et al. (1988). Who are the Frail Elderly? Quarterly Journal of Medicine, New Series 68, 255, 505-506

Thank You!
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