# Strengthening Review

For Older and Geriatric Adults

## Goals

Advance therapists skills in the APPLICATION of strengthening/power principles to assessment and analysis of functional movements and activities to provide direction in forming and modifying individual treatment sessions as well as plans of care.

## Objectives

Theory: Strengthening Principles for Adults, Older Adults, Geriatric Adults

**Demonstrate and Apply**

Analyze, Isolate, Integrate

Analyze: Lower Extremity Strength Assessment (Hips and Knees)

Isolate: Gravity Resisted Program, Supine Program (Hips and Knees)

Analyze: Ankle and Foot (standing, sitting, supine)

Isolate: Ankle and Foot (standing, sitting, supine)

## Why do an inservice?

## To review--Medicare Requirements

Services must be:

- **Reasonable and necessary**
- **Considered as accepted standards of medical practice**
- **Require the skills of a therapist**

## Medicare Requirements

Services must be:

- **Reasonable and necessary/Considered as accepted standards of medical practice**

  Would another therapist consider your interventions reasonable and necessary/accepted standards on the date in question and for the plan of care as a whole?

  Repeating the same intervention may not be necessary for several visits in a row. There needs to be progression and regression depending on the patient' s condition and circumstances. Maybe repetition is necessary. If so then it needs to be explained. Medicare targets note cloning.

## Requires the Skills of a Therapist

**What is this dependent on?**

## "Requires the Skills of a Therapist"

Is dependent on the skills of the Therapist

This inservice is to remind, improve, and/ or stimulate thinking about strengthening strategies for older and geriatric adults

## Disclaimer

**Quality of Evidence/Quality Description of Research**

1 a Systematic reviews (meta-analyses) of randomized controlled studies with high homogeneity
b Individual randomized controlled studies with narrow confidence intervals
c Randomized controlled studies, in which a disease was eradicated by a drug, or a disease, where formerly all patients failed treatment, is successful in some patients

2 a Systematic reviews of cohort studies with high homogeneity
b Individual cohort studies including randomized controlled studies of lesser quality (short follow-up, large confidence intervals)
c Studies with statistically significant differences between compared Treatments

3 a Systematic reviews of case-control studies of high homogeneity, b Individual case-control studies

4 Cohort and case-control studies of poor quality

5 Expert opinion

Functional Reserves

Functional Reserves

Functional Reserves

Functional Reserves

## Functional Reserves

What you have when you are young and what you lose *gradually* as you get older.

The rate at which you lose functional reserves is modifiable to a certain extent by exercise and activity at a frequency and intensity great enough to intermittently reach near maximal performance levels.



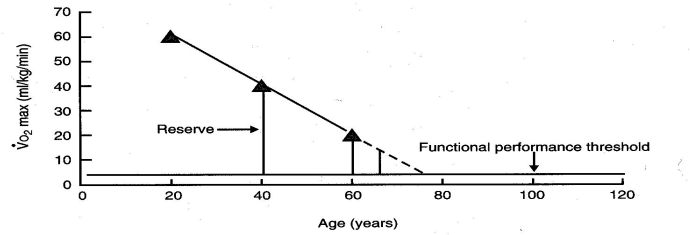
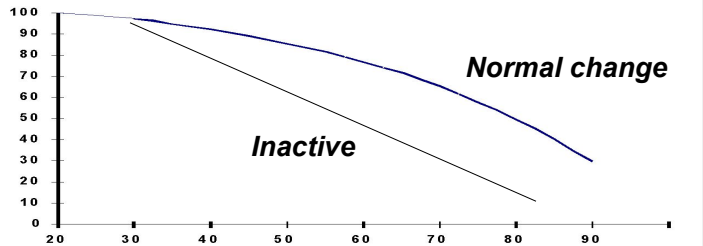
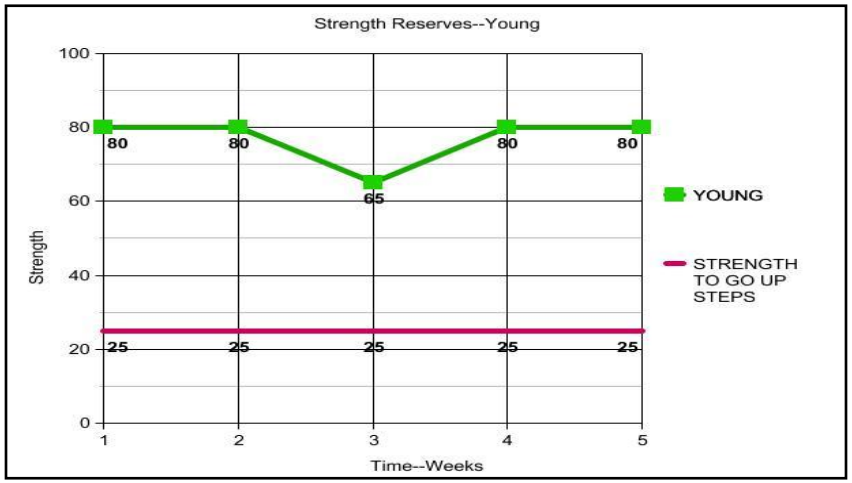



FIG. 3-1 Functional capacity, measured as $\dot{V}O_2$max, declines with aging. The functional performance threshold is the minimum criterion required to perform activities of daily living. The amount of reserve decreases with age, such that the older individual functions closer to the minimal threshold.

*From Guccione A. Geriatric Physical Therapy 2nd edition, 2002.*

## MUSCLE STRENGTH DECREASE




Strength Reserves--Young
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0
Strength
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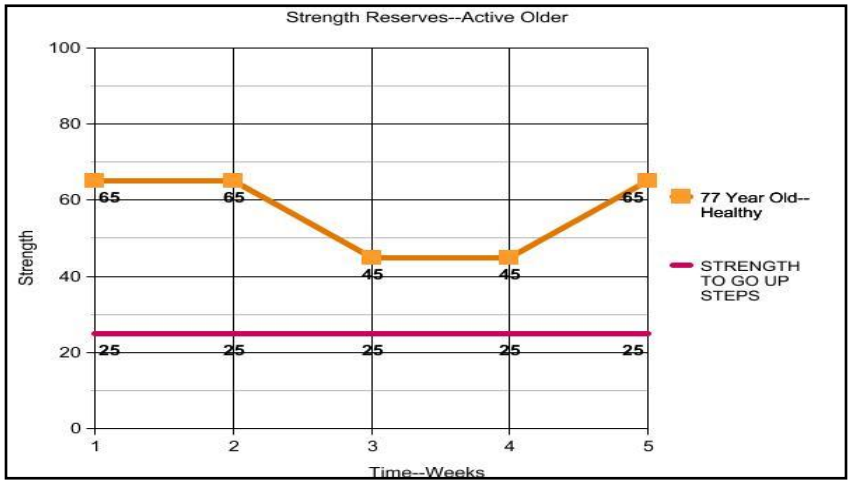
4
5
Time--Weeks
YOUNG
STRENGTH TO GO UP STEPS


Strength Reserves--Active Older
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60
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Strength
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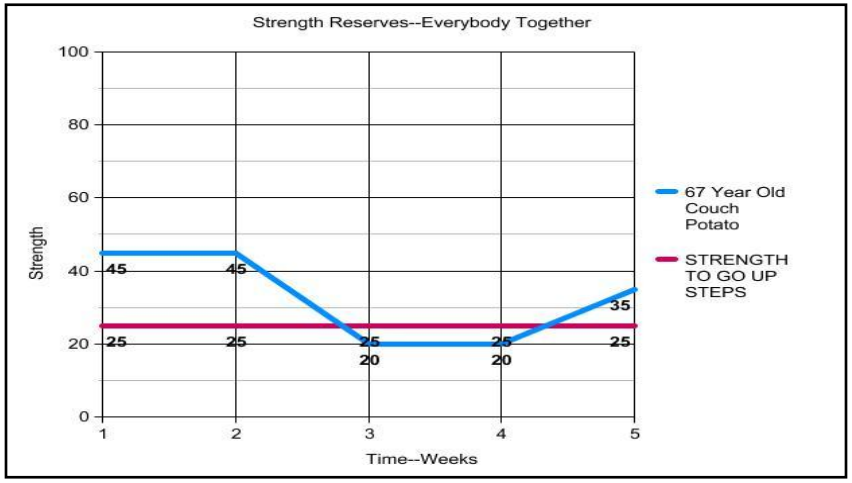
Time--Weeks
77 Year Old--Healthy
STRENGTH TO GO UP STEPS


Strength Reserves--Everybody Together
100
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Strength
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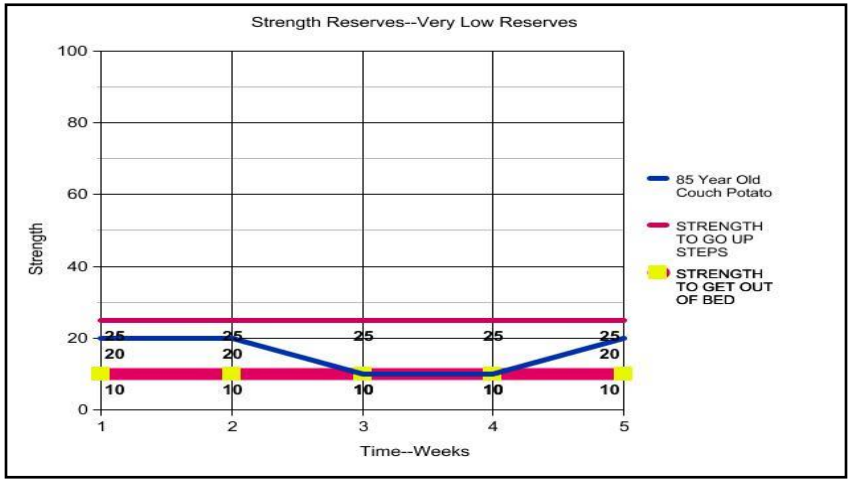
Time--Weeks
67 Year Old Couch Potato
STRENGTH TO GO UP STEPS


Strength Reserves--Very Low Reserves
100
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Strength
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20
10
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1
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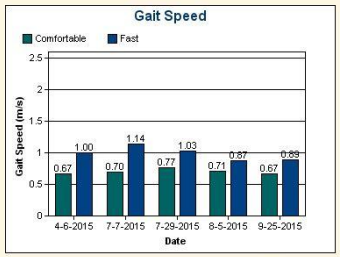
4
5
Time--Weeks
85 Year Old Couch Potato
STRENGTH TO GO UP STEPS
STRENGTH TO GET OUT OF BED

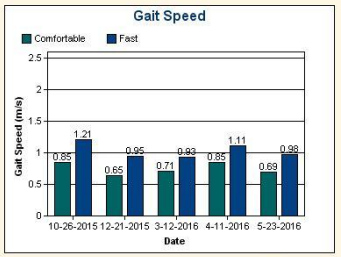
## Low Functional Reserves

Warning Signs before an activity is lost is inconsistent performance. Can be described by client as “I think it's in my head”, or “maybe I’m imagining it” or “it's just psychological, I just need to try harder”.

Can be described by families as “they are getting lazy” or “she acts like she can't do it sometimes but she did it yesterday”.

## Low Reserves Patient Example--Mary age 62

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Norms for her age are 1.89 m/s Fast and 1.44 m/s morm.
2 Minute Walk Test was 300 feet and norm for CDOA is 475 feet.

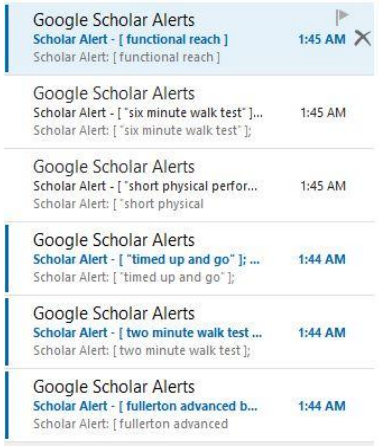
## Consider Motivation as last resort reason for poor performance or participation...

Energy Expenditure as an OT once explained it to me…

Believe the client/patient perception…

Are there factors that you are not aware of…?

## Google Scholar Alerts



Associations Between Inflammation and Physical Function in African Americans and European Americans with Prevalent Cardiovascular Risk Factors
BG Windham, SR Wilkening, ST Lirette, IJ Kullo… - Journal of the American …, 2016
**...** Simonsick EM, Ferrucci L et al. A **short physical performance battery** assessing lower

Integrative Examination of Motor Abilities in Dialysis Patients and Selection of Tests for a Standardized Physical Function Assessment
M Bučar Pajek, B Leskošek, T Vivoda, K Svilan, I Čuk… - Therapeutic Apheresis and …, 2016
Skip to Main Content. Wiley Online Library. Log in / Register. Log In E-Mail

[HTML] Acute myeloid leukemia in the older adults
AM Almeida, F Ramos - Leukemia Research Reports, 2016
**...** [15] and [16], is shown in Table 1 and requires that the clinical team becomes familiar with some

Interventions incorporating physical and cognitive elements to reduce falls risk in cognitively impaired older adults: a systematic review
V Booth, V Hood, F Kearney - JBI Database of Systematic Reviews and …, 2016
Background: Cognitive impairment is a risk factor for falls. Older adults with cognitive impairment.

Elevated Soluble Vascular Cell Adhesion Molecule-1 Is Associated With Cerebrovascular Resistance and Cognitive Function
AE Tchalla, GA Wellenius, FA Sorond, M Gagnon… - The Journals of Gerontology …, 2016

## Back to Strengthening

## Aging and Strength

Muscle Weakness is normal age related phenomenon

30+: 1 to 5% decrease in strength annually (force production)

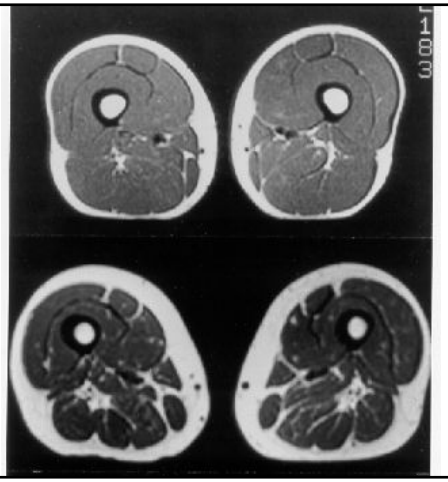
(by 70 years could have 40-70% less than age 30)

60+: 3 to 5% decrease in power annually (speed + force production)

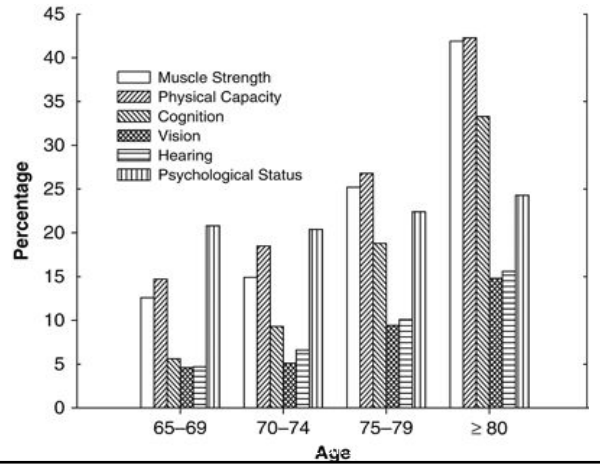
## Thigh MRI

31 year old male

66 year old male



*Prevalence of Geriatric Impairments by Age Group from CHS*




## Why Strength for Older Adults?

**Strength Assessments--Young vs Old**

Young (avg age 22) and Old (avg age 74)

**Objective Measures**

- Old: 60% lower maximal leg press moments
- Old: 53% slower knee angular velocity and peak torque
- Old: 27% lower knee joint moments in ADLs

## Aging and Perceived Exertion (Young vs Old)

**Subjective Measures--Relative Effort/Perceived Exertion**

Ascend Stairs: Young 54% Old 78%

Descend Stairs: Young 42% Old 88%

Chair Rise: Young 42% Old 80%

Older adults are performing near maximal strength capabilities with stairs and chair rise.

Borg Rating of Perceived Exertion Review--Reliable and Valid Tool

## Strength Training Facts

Using reasonable clinical judgement, all studies indicate that strength can safely increase

No reports of serious injuries

No significant exacerbations of medical problems

Consistent reports of improved function and **decreased pain** (when present--include counseling and rationale for intervention--function will improve and pain MAY decrease)

## Training in Old Old

Individuals 100+ undergoing “simple” progressive muscle power exercise training increased functional activity performance (Hruda KV, Hicks AL et al., 2003)

## Training in NH Residents

100 NH Residents: avg age 87 (72-98), 63F 37M, 10 wk 3x/week strengthening, 96% completion (Fiatarone et al., 1994)

| Parameter | Strengthening (80% of 1 RM) | Nutritional Supplement |
|---|---|---|
| Thigh muscle circ. | +3% | -2% |
| Spontaneous activity | increase | No change |
| Stairs | +38% | +3% |
| Walk speed | +12% | -1%` |
| Strength | +113% | +3% |

## Training in NH Residents

100 NH Residents: avg age 87 (72-98), 63F 37M, 10 wk 3x/week strengthening, 96% completion (Fiatarone et al., 1994)

| Parameter | Strengthening (80% of 1 RM) | Nutritional Supplement |
|---|---|---|
| Strength | +113% | +3% |

What does a 113% increase look like for your particular patient?

If they can lift 5lbs max, 40 lbs max, -5 lbs max?

## Young vs. Old

Older adults gain strength similarly to younger adults

2-3 x increase in strength in 3-4 months (using 5% increase/session)

Strength increases with 60-100% 1 RM resistance

Overwhelming evidence that when intensity is low, only modest increases in strength are achieved (20%)

Must use resistance that evokes near maximal muscle tension

## Evaluation Options for Strength/Power Assessment

**Systemic Strength/Power Deficits--Functional Strengthening Activities**

Sit to Stand, Bed Mobility, Steps

Also include other factors (coordination, balance, motor planning, etc)

Usually weight bearing thru UE, trunk, or LE

*** **Isolated Strength Deficits--Isolated Strengthening Exercises**

Targeted strength/power assessment of movement, muscle, or muscle group usually in non-weight bearing positions involving elements of strength (and ROM).

## Nancy

75 year old female with left low back pain, bilateral foot pain

scoliosis, low back pain, lumbar spinal stenosis, L5 S1 herniated disc, facet injection 1 week ago, irregular heart rate, htn, hypothyroid, 1 fall 2009, recent foot surgeries left foot and considering bunionectomy left in future

Has tried PT several times in past, Dtr states her mom is unable to keep up with her Dad, Mom is slowing down,

Described “lurching gait” and had heel strike and toe off, severely pronated

Previous PT HEP--mostly clam shell (“I can do 50 or more” and Full PPT)

## Nancy Clam HEP Video

## Where to Start

Start with Functional Objective Testing--Does this necessitate a more detailed strength (ROM) assessment?

## Evaluation/Functional Objective Testing (FOT)

**NUMERIC PAIN RATING SCALE**

1/10-- legs feeling uncomfortable
Worst: walking 8/10 left low back
Best: 0/10

**PATIENT SPECIFIC FUNCTIONAL SCALE**

Sit to stand 8.5/10, Walk around house 5/10, Balance 2.5/10

16/30=53.3% function

**The Short Physical Performance Battery** (SPPB)

Score 9/12

**GAIT SPEED**

(Norms: 70-79 years: normal gait speed 1.38 m/s fast 1.83 m/s)

Normal Gait Speed .74 m/s no device

Fast Gait Speed .95 m/s no device

## Score Interpretation

Why did I decide to do detailed strength evaluation on the second visit instead of exercise program based on functional activities?

She had relatively high functional scores for our typical population.

Low functional scores (SPPB 0-6) I usually focus on basic global strengthening and function.

Intermediate and higher scores (6+) I usually focus on detailed strength, movement impairments, and community mobility/balance

## Where to Start--Detailed Strength Evaluation

**Explain Procedures--**

Q: What are you doing?

A: Check out strength of your ….

Q: Why?

A: see if you are able to move your body against gravity.

Q: Why would I want to do that?

A: Make sure you can lift your arms and legs (mostly bed mobility--lifting legs, progress to proper weight bearing)

## Where to Start

Start with strength assessment against gravity

If unable to hold or get into proper position, go to gravity eliminated positioning

**Start with proper positioning!**

**Give several attempts!**

**Facilitate--vibrate, rub, massage, etc.!**

**Isolate--Tell them where they should feel it!**

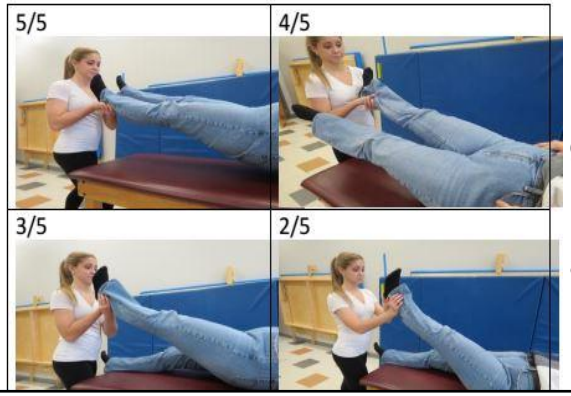
**Constantly look for compensations!**

## Movement Analysis

Supine--SLR, B Shoulder Flex, FABER, FADIR,

Side Lying-- Hip Abd, ADD, Clam, Rev. Clam, Int Rot, Ext Rot

Prone-- Knee flex, SLR, BKR, int rot, ext rot,




Unable to get prone?

Here's the answer...

## Supine Hip Extension Strength Assessment

**Supine Hip Extension**

Equipment:
- Firm surface for patient to lie on

Purpose:
- Assess the hip extensor muscles without placing the patient in the prone position. Assess the ability of the gluteal muscles to stabilize the pelvis

Procedure:
1. Patient is to lie supine on firm surface
2. Passively raise the testing leg to achieve a minimum of 45 degrees of hip flexion (approximately 36" from surface)
3. Examiner places both hands under the leg to be tested
4. Instruct the patient to keep the hip locked and push their foot into the examiner's hand, "Don't let me lift this leg"
5. No instructions are given for the opposite leg
6. Examiner observes the pelvis on both sides to grade the test leg hip extensors.

Scoring;
- 5/5: Pelvis is stable across both sides resulting in both hips coming off the surface with locked hips
- 4/5: Test hip is not locked initially but catches up and pelvis rises, pelvis could be tipped to either side or delayed in elevation
- 3/5: Test hip is not locked; good resistance is felt, pelvis not stable across both sides so pelvis does not rise or only rises minimally
- 2/5: minimal resistance felt, hip flexes, pelvis does not rise
- 0/5: no contraction felt.

## Strength Assessment of Hips, etc.

## Strength Training

Targeting muscle groups and reducing compensations

Supine with therapist providing manual resistance--least amount of compensations due to therapist directing force

Against gravity (supine, sidelying, prone)--more advanced due to requirement of coordinating stable core with moving extremity

Functional Activities--least amount of specificity due to increased potental for compensatory strategies

## Strength Training Session Video

## Intervention

Strength Training Only Intervention

Seen 1 x first week, 2 x per week for 3 weeks, 1 week no therapy, then re-eval and treatment

All visits included 97110 (ther ex--strengthening) with 5-10 minutes of balance or gait training with bilateral canes.

Home program was walking with bilateral SPC and “don’t limp” (hold in abdominals, tighten gluts, etc.)

## HEP

Weeks 1-3

Resumed Clam with Isolation

Hip ABD and EXT with resistance from husband as able

Week 4

Progressed to hip ABD over pillows

## Results--Functional Objective Testing (FOT)

**NUMERIC PAIN RATING SCALE initial** 1/10-- legs feeling uncomfortable Worst: walking 8/10 left low back Best: 0/10 REEVAL--Worst back pain 5/10

**PATIENT SPECIFIC FUNCTIONAL SCALE initial:** Sit to stand 8.5/10, Walk around house 5/10, Balance 2.5 /10. 16/30=53.3% function

Re Eval: 73% (=20%)

**The Short Physical Performance Battery** (SPPB) initial Score 9/12

Score 10/12

**GAIT SPEED--**(Norms: 70-79 years: normal gait speed 1.38 m/s fast 1.83 m/s) initial-- Normal Gait Speed .74 m/s no device (.83 m/s), Fast Gait Speed .95 m/s no device (1.1 m/s, + .15 m/s)

Negatives about gait speed--no gait quality, and short distance, not applicable for community ambulation.

## Strength (Power Training is different)

Majority of older and geriatric adults are able to exercise at 70-80% of 1 RM

How to determine resistance? Select amount of resistance you think will have exerciser experience muscle fatigue at 10 reps.

After 1-2 reps ask about RPE: Should be “somewhat hard” to “hard”, if not increase resistance, if too much, decrease.

Should experience fatigue at 8-12 reps

Fatigue--unable to perform mvmt, decreased ROM, change in mvmt quality, hesitation or tremor, increase speed

Will have look of concentration, mild increase in respiration

## Lesser Intensities

30-60% of 1 RM

Recommended for

RA, Acute Musculoskeletal conditions, recent MI, Extremely frail, post surgical tissue healing,

RPE rating would be “fairly light” to “somewhat hard” and could do 12-25 reps until fatigue

## Instructions

Slow mvmt, controlled movement--should be able to “stop on a dime”

# of Reps--until fatigue

## Progression

30-60% of 1 RM--prior session able to do 25+ reps increase resistance by 10%, 12-25 reps use same resistance.

70-80% of 1 RM--prior session 12+ reps, increase resis by 5%, 8-12 reps use same resistance.

## Duration

Depends on patient tolerance

Number of muscle groups requiring strengthening

## Frequency

Neurologic Adaption explains a majority of the strength gains for first 8 weeks (recruitment of motor units, synchronization of firing)

This is the period of rapid strength gain

After 2 months, fiber hypertrophy explains strength gain--this phase requires 48 hours of rest between training same muscle group

## Mode

Bands, weights, weights + bands, machines, weighted vests, etc.

## # of Sets

Research suggests only 2.9% increase in strength between those who did 3 sets vs. those who did only 1 set.

## Delayed onset muscle soreness

Any type of activity that places unaccustomed loads on muscle may lead to delayed onset muscle soreness (DOMS). This type of soreness is different from acute soreness, which is pain that develops during the actual activity. Delayed soreness typically begins to develop 12-24 hours after the exercise has been performed and may produce the greatest pain between 24-72 hours after the exercise has been performed.

DOMS--can be due to microscopic trauma, joint capsule stretching, lactic acid

Warn about soreness side effects (not pain)

## Power vs Strength

Lower intensity, higher reps

Strengthening is dose related (higher loads, achieved most strength gain)

Power Training increased irrespective of load (40, 50 or 80% of 1 RM)

Most studies have power loads at 40-70% of 1 RM with increased speed

## Which do I choose, power or strength?

Whatever client is having difficulty with...

If they are slow in movement production, choose power.

If they are fast in movement production, choose strength

## Integration--Nancy Standing Hip Hike Video

Integrate new strength gains into functional tasks as tolerated.

## Guided Lab

Strength Assessment (Against Gravity)

Strength Training Supine

Strength Training Hips plus Ankles

Foot/Ankle Assessment

- Supine
- Sitting
- Stand