

# Geriatric Rehabilitation Interventions

AC Joyner SPT

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The fun stuff!

- Important to consider that the presence of disease (like the ones discussed in previous lectures) may cause contraindications for specific interventions and positions may need to be modified
- After discussing the normal changes that occur with aging and identified the diseases that occur in each system...
- Do you think we underdose the geriatric patients in treatment???

Meta-analysis by Li et al in 2016 showed that :  
High intensity (6-8 reps at 80% 1RM) more effective than  
low intensity 12-15reps at 60% 1RM) for reducing pain and increasing physical function.

Meta analysis and systematic review from Schultz et al:  
82% of clinicians don't measure HR or VO2 max to even determine aerobic ex intensity

Not safe for monitoring adverse responses either!

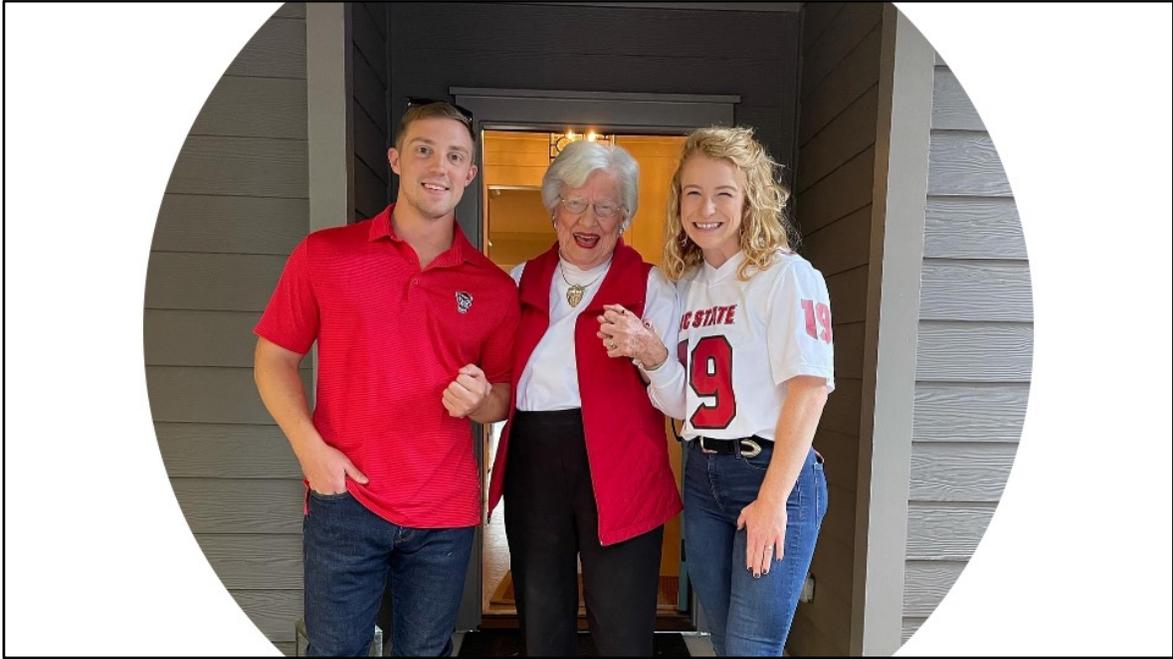
Only 16% actually use FITT principles

# About me!



Cassidy Plasticity Lab





- 96 years young and does water aerobics 4x a week, ambulates community distances with a rollator
- Hospital 2x in past 10 years
- Once after falling out of her chair in chair yoga and fracturing her back
- Recently with heart complications
- While she was in the hospital this past time, my mom was rubbing her back to comfort her and said, “wow, Mom your back is super muscular, you are really strong” and she replied, “Yeah I know. I work on it. ”
- This lecture is dedicated to her. May we all train our patients to be older adult BAs because we push and encourage them to “work on it”
- So ok, what does “working on it” mean?!?!?!

## Objectives

- Review the impact of tests and measures on evaluation and establish a plan of care
- Discuss the physical stress theory and exercise principles as they relate to older adults
- Determine various types of rehab interventions to use with older adults with consideration to modifications that might be required
- Identify contraindications and precautions for interventions
- Discuss how to respond to potential risk to patient safety during rehabilitation
- Discuss motivational barriers to exercise

## Schedule

Hour 1	Hour 2	Hour 3	Hour 4
<ul style="list-style-type: none"><li>• Physical Stress Theory</li><li>• Foundations of Exercise Prescription</li><li>• Exercise Guidelines for Geriatrics</li><li>• Integumentary System</li><li>• Genitourinary System</li><li>• Immune</li></ul>	<ul style="list-style-type: none"><li>• MSK</li></ul>	<ul style="list-style-type: none"><li>• Cardiopulmonary</li><li>• Neurological</li></ul>	<ul style="list-style-type: none"><li>• Multisystem</li><li>• Motivational barriers to exercise</li><li>• Psychology of exercise</li></ul>

4 hours is a long time, but we got this!

Fundamentals of exercise prescription, dosage and intervention  
Systems approach with case study incorporated

Slow down

## Physical Stress Theory

- Foundation of exercise prescription
- Response of tissue, organs and systems to mechanical and physiological stressors

Stress	Amount	Response
Too Much	>100 maximum	Injury/Death to tissue
Appropriate Overload	60–100% maximum	Strengthening
Usual Stress	40–60% maximum	No change
Too Little	<40% maximum	Atrophy
None	0% maximum	Loss of adaptation/death

\*These numbers ARE important\*

If it doesn't challenge you it won't change you!!!

Tissue must get at least 60% of its maximal capacity to effect change

i.e. 60% of max aerobic capacity to improve CV endurance

60% of max mm force to improve strength

\*\*Might need gradual accommodation with frail or deconditioned pts\*\*

Explains the effect of overload or insufficient load as well as lack of change with "usual" stress

Too much stress = injury or tissue death

Right amount = hypertrophy

Too little stress = atrophy

## Physical Stress Theory Exercise Principles

- **Overload**
- **Specificity**
- **Progression**
- **Recuperation/Recovery**
- **Use/Disuse**

Overload – must challenge the system to make changes (intensity, duration, frequency, speed), Tissue must get at least 60% of its max capacity to change

Specificity – training only improves those body parts being trained – must perform skill to be better

Break down functional outcomes tests in order to get specific deficit needed to target

Progression – prescribe optimal levels of exercise ASAP – no later than 3<sup>rd</sup> or 4<sup>th</sup> session

Must steadily progress intensity (essentially watch progression too quickly or slowly)

Recuperation / Recover – don't rush training, overload not done daily

Use / Disuse – balance between stress and rest, listen to the patient and let them tell you what they need

Educate your patient on DOMS!

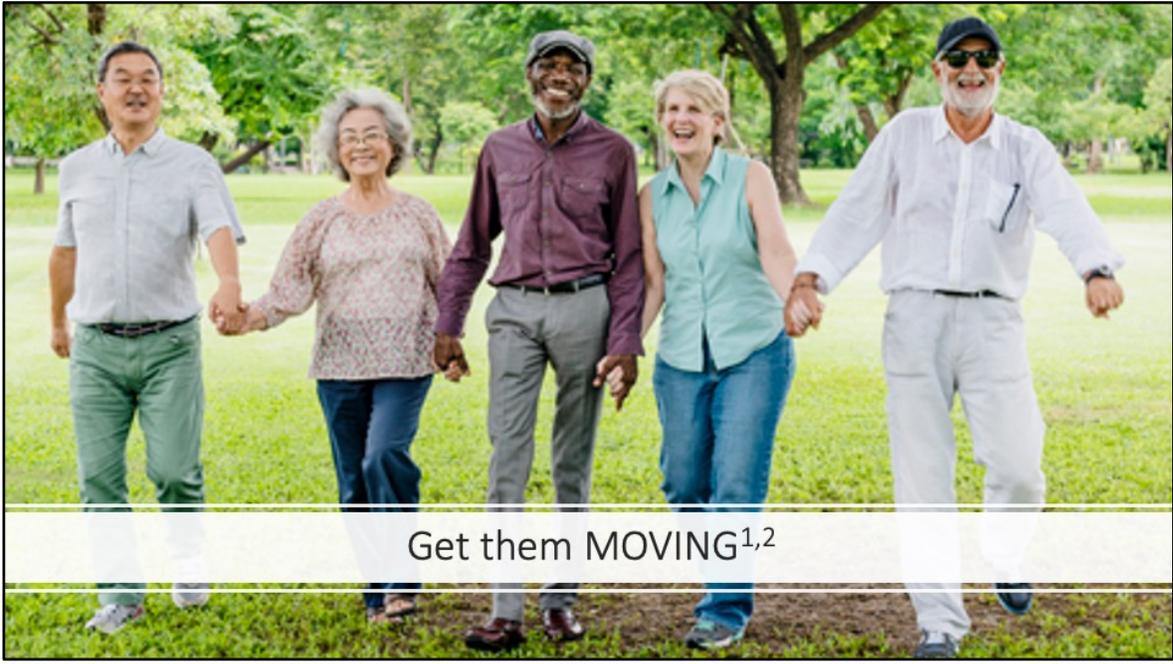


Photo: <https://www.cdc.gov/injury/features/older-adults-mobility/index.html>

**\*THE BEST EXERCISE IS THE ONE YOUR CLIENT DOES\***

World Health Organization 2020 Guideline on physical activity and sedentary behavior

- Recs for 65+
- High certainty evidence inverse dose response between volume of aerobic physical activity and risk of physical function limitations (the more you move the better you are, imagine that!)
- Dose-response: the more they get the better they do!!!!
- In adults, higher amounts of sedentary behavior are associated with...
  - Increased mortality rate
  - Cardiovascular disease mortality and incidence of cardiovascular disease
  - Cancer
  - Type 2 diabetes

Sardinha et al.

- The more you break up sedentary time, the higher physical function in older adults
- Anything is better than nothing
- Part of exercise program at home: limit time in sitting, get up and do \_\_\_\_\_ every hour
  - Get creative!!! While you are in sitting perform your upper body strengthening routine during commercials
  - Eliminate barriers!

## Properly dosed exercise can...<sup>3</sup>

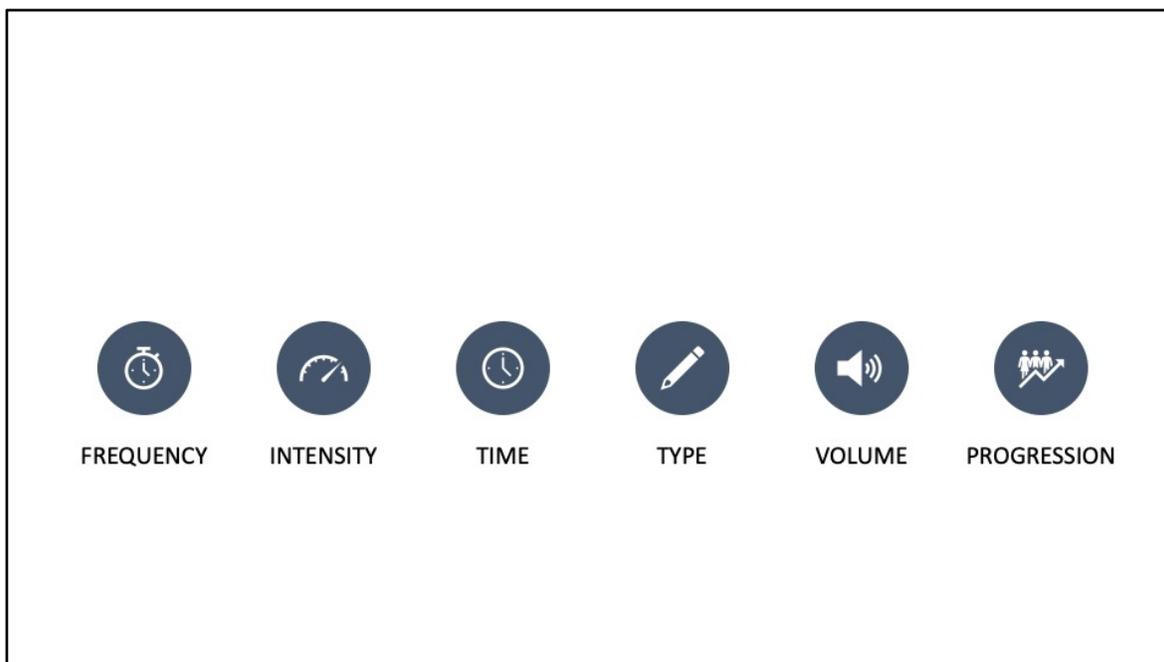
- Slow physiological changes of aging that impair exercise capacity
- Optimize age-related changes in body composition
- Promote psychological and cognitive well-being
- Manage chronic diseases
- Reduce the risk of physical disability
- Increase longevity

According to ACSM guidelines in 2018, only 11% of individuals aged  $\geq 65$  yr report engaging in aerobic and muscle strengthening activities that meet guidelines, and less than 5% of 85 yr and older meet these same guidelines

## ACSM Guidelines<sup>3</sup>

- General exercise guidelines healthy older adults
- 150 minutes of moderate intensity exercise per week
  - (3.0 – 5.9 MET or 5-6/10 RPE or 13—14 on 6-20 scale)
  - Noticeable increase in HR and breathing
- 75 minutes of vigorous intensity exercise per week
  - (6+ MET or 7-8/10 RPE or 16-17 on 6-20 scale)
  - Large increase in HR and breathing

- ACSM Guidelines:
- This is a starting place for designing exercise programs -> every patient is different
- Physiologic aging does not occur uniformly across the population
- Hard to distinguish the normal effects of aging from the effects of deconditioning or disease
- Disease parameters are going to differ across diseases



These are what you manipulate!

Frequency – how often – 2x per week/3x per week??

Intensity- RPE – scale of 10 scale of 20 – MET - % of HR max

Time – how long are they working? How long are they resting? Not only thinking about how long they are moving, but how long they are NOT moving

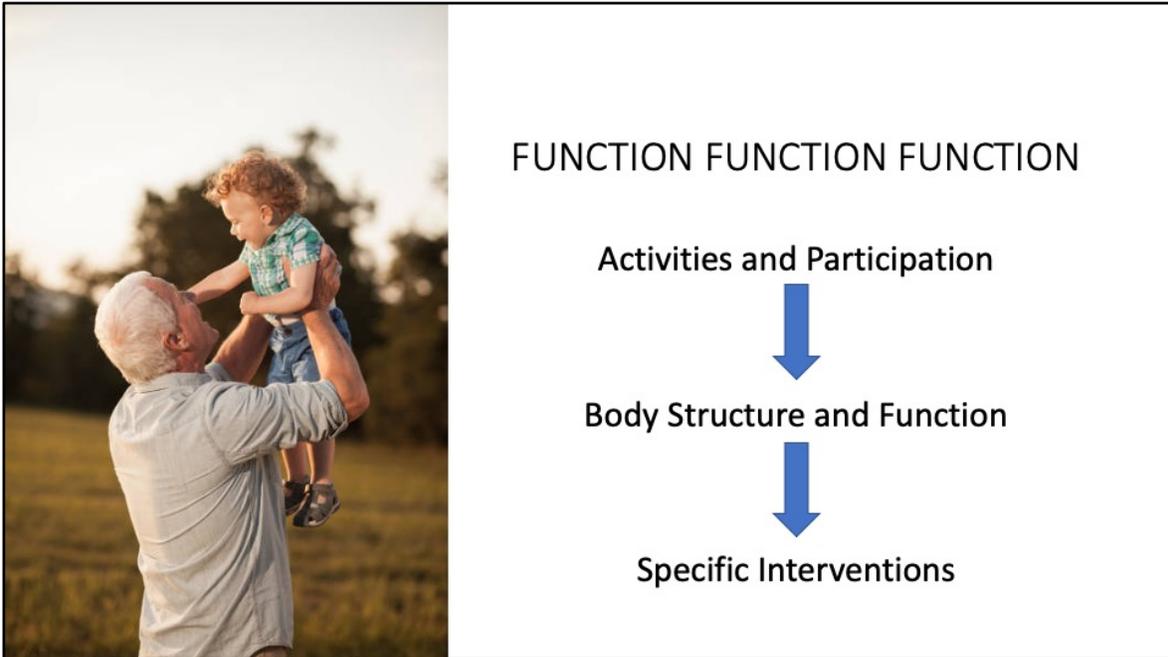
Type – what are their goals? Endurance or strength?

Volume – Quantity (2 sets for 8-10 reps)

Progression – should include physical stress theory principles!

-> Meet your patient where they are at....

- Start slow -> fast
- Level surfaces -> uneven
- Simple -> complex



Take it back to the ICF model...

What activities/participation is the patient having trouble with

What body structure, function, and impairments are impacting the patient's ability to do these activities

Breakdown the activity to create exercise programs -> MAKE IT FUNCTIONAL FOR THE PATIENT

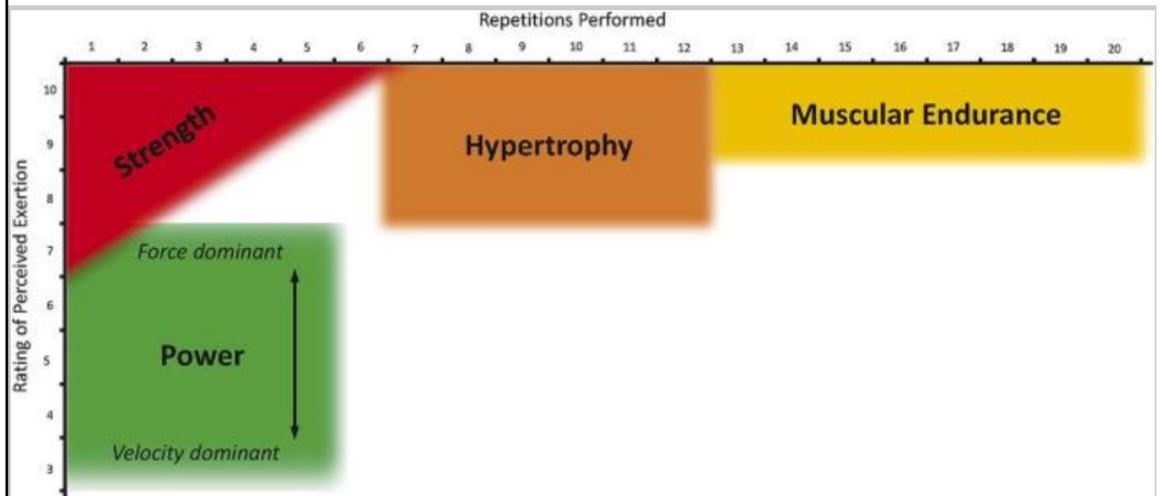
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Bridges/planks for core strength for bed mobility

squats/lunges for LE strength for transfers

scap strength/cuff for OH ADLs

## RPE and Training Goals<sup>4</sup>



Helms

Found this graphic helpful -> the FITTVP principles determine what you are getting out of the exercise and are going to do different things for the patient!!

What are the patient's goals? Are they working on strength? endurance? Choose appropriate interventions and dosage to match goals -> RPE MATTERS

#### Integumentary Interventions<sup>5</sup>

- Transfer Training
- Pressure Relief
- Compression
- Proper Positioning
- Patient/Family education
- Wound care
- Physical agents
- Exercise
- Referral

#### Transfer Training

- Age related changes: skin tears from thinning of basement membrane
- Reduce shear forces

#### Pressure relief (sacral wounds)

- Static: seat cushions, bed mattresses, overlay
- Dynamic: alternating air overlay (deflating and inflating)
- At least 1inch of material between surface and pressure point

#### Compression (Mutlak)

- Not as effective as exercise, but can enhance healing as secondary treatment
- 30-40mmHg for venous ulcer
- Contraindicated for arterial

#### Patient/Family education

- Skin check to bottom of feet (DM)
- Transfer training
- Wound care
- Total contact casting
- Compression
- Pressure relief changes

#### Wound Care

- Debridement
- Dressings
- Infection
- Wound Vacs

#### Physical Agents

- Pulsed US at low frequency
- Infrared laser
- Estim

#### Exercise

- Increase circulation, improve glucose tolerance, and decrease claudication pain
- VLU 12 weeks of light exercise (ankle pumps) significantly improved healing rates (Mutlak)

#### Referral

- Dietician
- Screen for infection (systemic signs and symptoms)
- 1.0 – 1.5g PRO per kg of body weight AND 35-40 kcal per kg of body weight; MyPlate

## Integumentary System – Exercise<sup>6</sup>

- Frequency
  - Most days
- Intensity
  - Mod/Vig
  - 60-80% HRM
- Time
  - 20-60 minutes of continuous
- Type
  - Aerobic: continuous, interval and circuit
  - Large muscle groups
- Volume
  - 150/75 minutes
- Progression
  - 3 stages

### Time

- Can be discontinuous if deconditioned

### Type

- Exercise associated with increased VLU healing (progressive resistance and aerobic activity) Yim
- Multiple mm groups contracting rhythmically
- Walk, bike, row, dance, swim, etc.

### Progression

Stage 1 (initial)	Stage 2 (Improvement)	Stage3 (Maintenance)
Lasts 1-6 weeks	4-8months	indefinitely
W/up 10-15 min	W/up 5-10 min	w/up 5-10 min
40-60% intervals	60-85%	70-85%
Cool down 10-15 min	Cool down 5-10min	Cool down 5-10 min
15-30 min	25-40 min	20-60 min

#### Integumentary System Disease Considerations

- DM
- Shingles
- Wounds

#### Diabetes

- Moderate is best
- Study showed 50% 1RM (15-20 reps) 2x/wk x 3 months = better glycemic control, mm endurance, and mm hypertrophy
- Caution with “vigorous” ex (>80%HRR) may lead to hyperglycemia
- Caution if BG >300
- Resistance Ex as effective as Aerobic
- Do not exercise during peak insulin activity > hypoglycemic event
- Rotate injection sites; don't ex area injected

Buerger-Allen exercise (physiological response hypothetical but proponents secondary to clinical expertise. Increases circulation - increased lateral collateral circulation to stimulate circulatory flow through postural change and mm activation in various positions.

Stage 1 – supine ankle pumps and circles for 3'

Stage 2 – 45\* elevation until blanching or max of 3' (APs, circles, GS,

QS x 1')

Stage 3 - Return to supine x 3' (APs, circles x 1'); should return to

rose color

Stage 4 – Sitting with legs over bed x 3' (or until rubor) (APs and

circles)

Repeat 3x each (total of 36'); 1x per day

Contraindicated in cellulitis/CHF

#### Shingles

Caution not to overload in shingles; can further immunocompromise  
Modifications to positions due to pain

#### Wounds

Positions may need to be modified due to pain



## Case: Ida

<https://photodune.net/item/happy-older-woman-gardening/7031488>

Ida is a 62 year old deconditioned female with DM who has developed a R DFU at the base of her first metatarsal. Her doctor has cleared her for full WB and referred her to you for PT. She has never gotten into weight training because it's "boring". She has recently stopped doing many of the activities she loves because she's "off balance" and is afraid she's going to fall. She lives on a large farm and loves gardening, but has stopped because she's having trouble getting up off the ground without becoming out of breath and losing her balance. What are three appropriate interventions you would consider for Ida?

- Resistance training: Moderate is best -> 50% 1Rm (15-20 reps) 2x per week for 3 months
- Resistance training AND aerobic training equally effective

Interventions:

- Bear crawl -> get comfortable with the ground!!! -> moderate intensity full body exercise -> rhythmic contraction

## Ida

- Ida is a 67 year old deconditioned female with DM who has developed a R DFU at the base of her first metatarsal.
- Her doctor has cleared her for full WB and referred her to you for PT.
- She has never gotten into weight training because it's "boring".
- She has recently stopping doing many of the activities she loves because she's "off balance" and is afraid she's going to fall.
- She lives on a large farm and loves gardening, but has stopped because she's having trouble getting up off the ground without becoming out of breath and losing her balance.

What are three appropriate interventions you would consider for Ida?

## Ida's Integumentary Interventions



- Consider her DM
- Resistance training: Moderate is best -> 50% 1Rm (15-20 reps) 2x per week for 3 months
- Resistance training AND aerobic training equally effective
- 20-60 minutes of continuous interval/circuit training

### Interventions:

- Bear crawl -> get comfortable with the ground!!! -> moderate intensity full body exercise -> rhythmic contraction
- Surrender squat (in front of bench) -> progress to away from bench
- Walking/biking/rowing
- Full body conditioning -> obstacle course, incorporate balance
- Patient education -> skin checks -> footwear
  - Protective, roomy in toe box,

## Genitourinary System

- Exercise
- Manual therapy
- Biofeedback
- Physical Agents
- Bladder Training
- Toileting Schedule
- Lifestyle Changes
- Referral

### Exercise

- PFM reduces stress UI by improving urethral closure and pelvic organ support
- Pelvic floor mm very thin with limited force capacity. Need help (TrA, psoas, hip rotators, etc)
- Will discuss strength parameters in MSK section

### Biofeedback

EMG internal/external

verbal feedback with palpation

US

Nothing definitive in lit re: ex only vs ex with biofeedback

### Physical agents

estim; DN; weights

Manual

Pelvic floor release; Instrument Assisted Soft tissue Mobs

### Bladder training for urge UI

Improve bladder capacity and restore normal function

Increasing time intervals b/w voiding

### Lifestyle

Smoking, drinking, weigh loss, caffeine reduction

Refer back to MD re: meds

Pelvic Health Therapist

## Genitourinary System Disease Considerations<sup>7</sup>

- UI
  - PFM strengthening + hip strengthening

### Multiple protocols

- 200 PFM contractions/day
- Quick flicks (3 sec) and sustained 10 sec contractions
- Perform during periods of UI triggers (sneeze, cough, laugh)

### CSM Study

- clams, 90/90 hip abd at wall, and monster walks x12 weeks improved PFM str

### Marques 2020

- Stress UI: Strengthening the pelvic floor muscles together with the hip synergic muscles showed a decrease in daily loss frequency
- Exercises for glut max, glut med, and hip adductors

## Immune System

- Exercise
- Decongestive therapy
- Manual therapy
- Physical Agents
- Education
- Referral

Ex boosts immune system

Ex enhances ability to battle side effects of chemo; incr mm strength, body mass, self-esteem in CA

Ex improves fatigue and pain in RA; reduces sarcopenia rate

MT for pain control

Edu on smoking cessation; nutrition; energy conservation

Referral to dietician; Oncological Clinical Specialist

## Disease Considerations<sup>3,8</sup>

- RA
- Cancer
  - Resistance
    - F: 2-3x per week (48 hours between sessions)
    - I: 60-80% of 1RM
    - T: at least 1 set, 8-15 reps, at least 60 secs rest between sets
    - T: Major muscle groups
  - Aerobic
    - F: 3-5x per week
    - I: 40-60% HRR (heart rate reserve)
    - T: Greater or equal to 30 minutes
  - Flexibility
    - F: 2-7x per week
  - Balance
    - F: 1-7x per week (increased risk for falls)

### RA

- The standards for exercise and intervention in patients with RA and physical therapy
- Dr. Louise Thoma at UNC is currently working on developing protocols for PT and RA patients -> if that is something you're interested in I would encourage you to contact her and consider it for your Capstone
- Adjust during a flare up!!!
- Caution with MT on RA (no upper cervical Gr III/IV mobilization)
- Interventions (<https://www.choosept.com/guide/physical-therapy-guide-rheumatoid-arthritis>)
  - Energy saving measures to improve daily function
  - Pain relief (Estim)
  - Personal exercise plan for ROM and muscle strength
  - Low load resistance training with blood-flow restriction (Rodrigues) -> low-load resistance training (30% of 1RM) with partial blood-flow restriction effective in improving muscle strength, mass, function, and health related quality of life
  - high intensity/WB if in remission

### Cancer (ACSM Guidelines for Exercise Testing)

- Avoid inactivity and be as physically active as possible
- Exercise is safe during and after treatment
- Moderate intensity!
- RPE is correlated with % of 1RM in cancer survivors (8/10 RPE = 80% of 1RM)
- Caution with manual therapy if mets in bones

### General Guidelines for Cancer

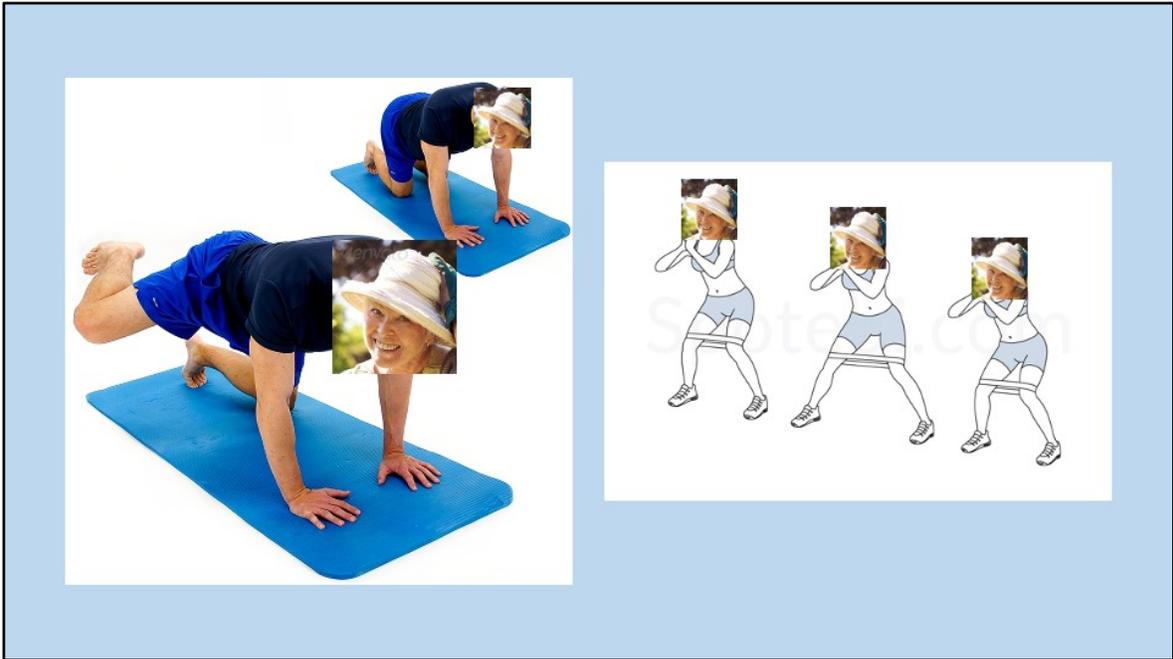
150 min of mod intensity OR

75 min of vig intensity

## Ida

- Ida comes back for her follow-up appointment and says that with all the moving around she has been doing she has been accidentally peeing herself more than she would care to admit.
- She's noticed that she's been leaking some while walking after her morning coffee and when she laughs with her friends.

Would you do anything to adjust her exercise program?



- Discuss bladder irritants (coffee)
- Glut max, glut med activation
- Incorporate some banded sidestepping into her obstacle course
- Abduction and extension in quadruped combined with her bear crawls
- Screen for it! Make the uncomfortable comfortable. You are a professional.

[https://www.hep2go.com/exercise\\_editor.php?exId=10683&userRef=gciaake](https://www.hep2go.com/exercise_editor.php?exId=10683&userRef=gciaake)

- <https://www.spotebi.com/exercise-guide/squat-band-hip-abduction/>

## Ida

- Oh no! Ida had a fall and is now in the hospital. After her fall she was complaining of back pain and had a workup of scans. Xray came back negative for fracture but her DXA scan came back indicating she was osteopenic throughout her spine. She has been in the bed for 2 days before PT is ordered and is now feeling rather weak, tired, and deconditioned.
- You take on a second job PRN at the hospital and Ida is your patient! Small world!
- What are three exercises you would consider for Ida as part of your acute program?

## Musculoskeletal System

- Education
  - Prevention strategies
  - Precautions/Contraindications
  - VitD supplementation
  - Protein supplementation
  - FRAX risk
- Exercise
- Physical Agents
- Posture Re-education
- Gait Training
- Balance Training
- Manual Therapy
- Transfer Training
- Referral

High intensity and WB in general yields better outcomes (will discuss disease states)

Overload principle

Mm must be exposed to at least 60% of max force production in order to improve force

60% of 1RM = 15RM

80% of 1RM = 8RM

Physical agents – modalities, FDN, IASTM/Graston

Posture re-ed – chin tucks, scap retraction, lumbar extension, thoracic extension; hip flexor stretch; hamstring/gastroc stretch (common postures adopted by geriatrics – alignment first)

Gait speed, surfaces, dual task, head turns, obstacles (make it functional)

Manual + ex better than manual alone

Questionable biomechanical change with MT

Don't forget neuro principles (stability and/or motor control impairments disguised as mobility; unload > retest. SFMA?)

## Musculoskeletal System

- Strengthening
  - Frequency
    - 3x per week
    - 48 hours rest between sets
  - Intensity
    - 60-80% 1RM
    - Through functional full ROM
  - Time
    - 8-15 reps
    - 2 minutes – optimal set to fatigue
  - Type
    - Weights, bands, machines, med balls, KB, FUNCTIONAL ACTIVITIES!
  - Volume
    - All major muscle groups
  - Progression
    - If hitting 15+ reps, increases resistance by 5%

Healthy adults – different parameters for disease

key mm groups

hip ext/abd

knee ext/flexion

ankle DF

1RM not recommended -> subjected to higher stress loads and greater risk for injury  
at 60-80% of 1RM should have momentary fatigue between w 8-15 reps (8-12 closer to 70-80%)

RPE “somewhat hard” to “hard” within first few reps.

Stop on a dime or correct technique with verbal cues

If not, increase resistance, <8 reduce the weight

If working to **fatigue/failure**, 1 set is sufficient \*\*another key differentiator with this population\*\*

If at lower intensity (30-60% 1RM)

25+ reps = increase resistance 10%

If between 12-25, keep the same

Key predictors of functional decline; largest predictor of institutionalization is decr LE strength

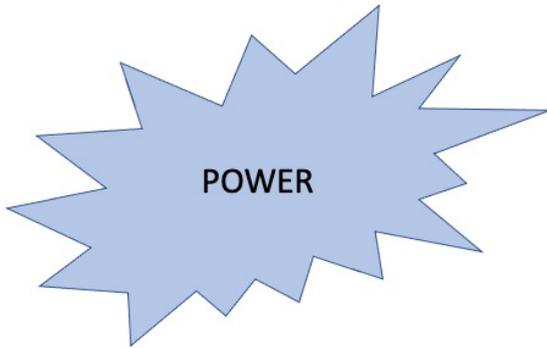
Eccentrics =high force production with less energetic cost = very beneficial in geriatrics

RM changes more rapidly in untrained older adults and will need reassessment regularly.  
Initially not used to exerting max force and need to learn how to generate force/recruit

Remember you are also building reserve to combat slippery slope

Watch for increased speed, form deterioration, lack of ROM and unable to correct with cues

## Musculoskeletal System<sup>3,9,10</sup>



- Power: the production of force against an external load QUICKLY
- Frequency
  - 2x per week
- Intensity
  - 40% of 1RM
- Time
  - 1-3 sets
  - 3-6 reps
- Type
  - Exercise completed as quickly as possible

ICE Ex Rx Deep Dive, ACSM, Sayers

Strength -> production of force against an external load

Power -> production of force against an external load QUICKLY -> manipulating the FITTVP principle of time within the motion

Analogy: You must push your grandchildren a stroller across 4 lanes of traffic before the light changes, you not only need the strength to do so but power/speed

\*Easy to take a strength exercise and cue patient to do "as fast as possible"\*

- Seated at box to standing
- Box jumps
- Bar hangs

Tired and don't want to do resisted movement? Use this to your advantage!

Why?

- Preferential loss of type 2 muscle fibers as we get older
- Loss of power and weakness are both linked with decreased physical function and falls
- Reactive strength -> helps you reactive swiftly if you lose your balance
- Some studies show its more effective than strength in improving mobility
- Con: Greater injury risk at higher speed
- Can be low volume!
- Drop in intensity from traditional strength training because older adults are able to become more powerful at lower external resistance and increasing the velocity component of power will improve speed-related performance to increase reaction time and keep older adults safe in their environment (Sayers)

## Musculoskeletal System

- Flexibility
  - Frequency: 2-7x per week
  - Intensity: slight sensation of resistance; mild discomfort
  - Time: 60 seconds
  - Type: sustained
    - Yoga, Pilates, TaiChi
  - Volume: all major muscle groups
  - Progression

Make it functional and enjoyable

\*60 seconds for older adults vs 30 secs for younger adults is key intervention differentiator

Key MM groups -> FLEXORS -> forward posture leads to tight flexors (pecs, psoas, gastros, HS) -> weak extensors (spinal extension decreases most with age)

Watch for...

Joint instability (contraindication)

Ensure you are getting the target mm (tight everywhere -> hip flexor with tight gastric)

Neural tension -> nerves can get tight too!

Short term decrease in mm strength -> consider timing

Don't stretch before you strengthen!! Stretch AFTER strengthening

## OA/DJD

- Isometrics best in knee OA if acutely inflamed/unstable (angle-specific mid range; protocol in book if pain/swelling is too great to do traditional ex)
- Study on concentric vs. eccentric with knee OA -> strength gains equivalents and WOMAC scores comparable (Vincent)
- Small amount of muscle and joint discomfort is common -> educate the patient on difference between DOMS and pain (ACSM)
- Are they in knee valgus? -> learn in MSK II all about how joints above and below can impact knee
- Consider unloaded -> lower compressive load across the joint -> higher reps and lower load better for synovial fluid in joint space
- Aquatic therapy –another reason to screen for UI (ACMS)

## LBP

- Whole body intensive
- Strengthening extensors! fatty infiltrate commonly inhibits of multifidus); highest co-contraction for stabilization is seated isometric trunk rotation
- Flexion/extension – debatable; radiographic vs clinical stenosis (studies on core stab with ext bias still improved with stenosis)
- Multifidus degeneration and atrophy predictor of back sx success – strong case for prehab. Stronger back extensors = better surgery -> YAY PREHAB
- Progressive aerobic training and progressive resistance training are equally effective at decreasing pain intensity (ACMS)

## Osteoporosis

- Caution with MT (Gr IV PA mob ok with caution – no manip) and agents (FDN)
- Focus on back ext strength; trunk position sense and trunk motor control; WB! 60-80% 1RM
- Plyo can be great, but avoid jarring (jumping off stuff)
- LIFTMOR Trials (High-intensity/resistance/WB – deadlift, backsquat, chin up with jump landing)

See Protocol (Liftmor-M Protocol Harding et al 2019)

- No ex is better than flexion ex in osteoporosis (increase incidence of compression fx 67% vs 89%)
- NO! – trunk flexion, end range loaded rotation or SB, forced end range hip rotation (some yoga poses), strenuous OH lift (axial load a lot)
- Hip hinge vs trunk flexion with STS in osteoporosis
- X taping kinesotape for posture
- Weighted vest or weighted backpack

## RCT

- No difference at 2 and 5 years with PT vs surgery for RCT

## Joint Replacement

- Prehab leads to better post-op outcomes
- High intensity programs yield better functional performance
- NO Knee valgus on STS (add + IR);
- Hip dislocation risk 1%; 50% of dislocations were a result of fall – not breaking pxns – be judicious & edu properly

## Hip fracture

- Common to have limited confidence; need to build
- May see these patients for more prolonged time

## Foot pain

- Foot wear – thumb distance from longest toe to end of shoe (in standing); space between met heads and lateral sides of toe box
- Consider positioning modifications

Don't forget neuro principles of motor control here

Considerable CV compromise after anesthesia for sx

\*Tie into function whenever you can!!\*\* -> break down what they want to do to and practice that -> utilize muscle muscles and joints

## Ida

- Oh no! Ida had a fall and is now in the hospital. After her fall she was complaining of back pain and had a workup of scans. Xray came back negative for fracture but her DXA scan came back indicating she was osteopenic throughout her spine. She has been in the bed for 2 days before PT is ordered and is now feeling rather weak, tired, and deconditioned.
- You take on a second job PRN at the hospital and Ida is your patient! Small world!
- NOW what are three exercises you would consider for Ida as part of your acute program?



What NOT to do?

NO trunk flexion, end range loaded rotation or SB, forced end range hip rotation (some yoga poses), strenuous OH lift (axial load a lot)

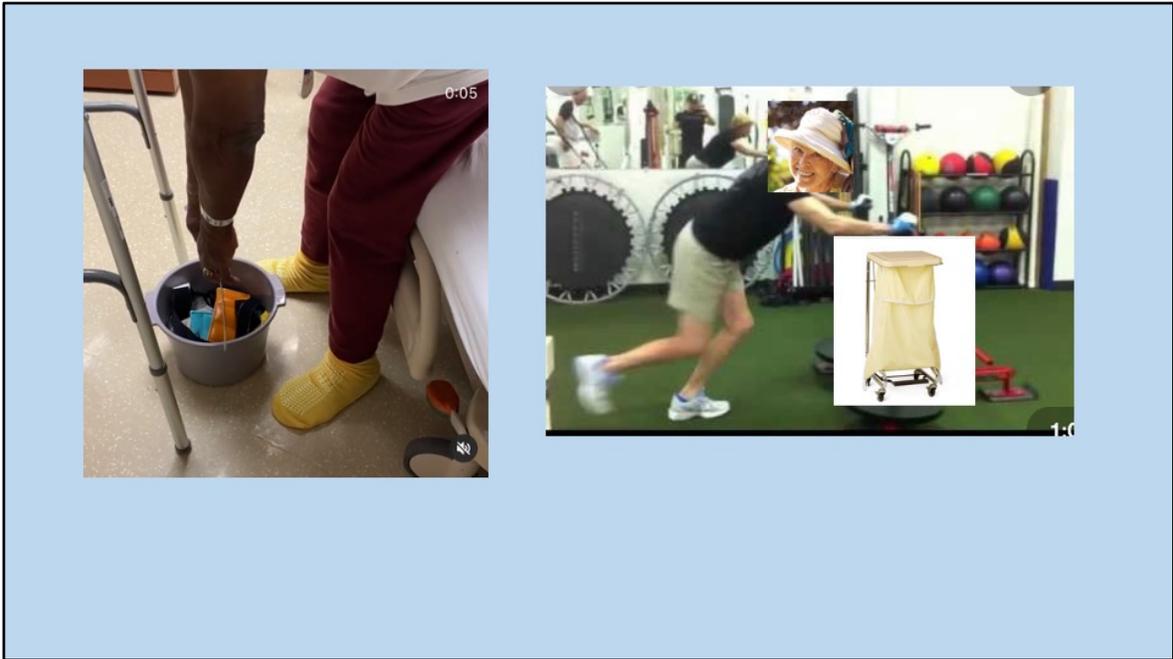
What you want...

High-intensity/resistance/WB – deadlift, backsquat, chin up with jump landing)  
Focus on back ext strength; trunk position sense and trunk motor control; WB! 60-80% 1RM

Sally Tube + bed tilt + overhead rail = pullups

Sally tube + bed tilt = leg press

Bucket thruster sit to stand



Level up your gait training with a loaded linen cart or loaded walker for a sled push!  
Use a (clean) bedside commode bucket for KB swings, deadlift, squat, press etc  
Can fill with clean wet towels to increase weight

Tray pushes in sitting -> use power! How quickly can you push the tray and bring it back to you?  
Hip hinges with TB under feet

Snatches from sitting

You may not see a huge difference in their speed between "normal" and "go quickly"  
-> what does that tell us about their reaction time?

## Cardiopulmonary System

- Postural re-educ
- Breathing education
- Airway clearance/respiratory therapy
- Manual therapy
  - Tspine and ribs
- Aerobic Exercise
- Strengthening
- Transfer Training

Chest expansion is key to optimal lung function – Interventions should focus on chest expansion!!!!

Posture > decreased chest expansion if hyperkyphotic; therefore decreased lung capacity

Significant excursion of tspine in multiple directions just with deep breathing

Diaphragmatic breathing allows more air to enter lower lobes; pistoning action can also help with lung recoil in COPD; often flattened and weak due to barrel chest -> Nasal/chest breathing causes accessory mm breathing

Thoracic mob/manip and rib mobilization increases chest expansion which will increase lung function  
-> No Gr IV or manip if osteoporotic

Pulmonary toileting now respiratory therapy

Exercise increases cardiac output, VO2 max, arterial blood flow, aerobic threshold; decreases BP

ACSM rec 150 min/week moderate intensity of 75 min of high intensity

Moderate: 3 – 5.9 MET activity or RPE of 5-6/10

Brisk walk 3.0mph; cycling <10mph (4); dancing (5) ; mowing lawn (5.8)

Vigorous: 6 or more MET activity of RPE of 7-8/10 (high)

Hiking; rowing; kayaking; cycling >10mph

Overload principle

Vital monitoring -> consider medications

Calculate MHR [206.9 – (0.67xage)]

220-age overestimates MHR in geri

HRR =MHR – Hrrest

Target HR= [% intensity x HRR] + HRrest

Don't forget strengthening in this population as well -> increased mm mass correlated with increased aerobic capacity

Transfer training if sternal pxns

Assistive device for energy conservation

Modifications? Consider other systems

Risk for injury

Conservation techniques instead

AD prescription ie. rollator

Management on portable O2

## Cardiopulmonary – Exercise

- Frequency
  - Most days
- Intensity
  - Moderate/Vigorous
  - 60-80% MHR
- Time
  - 20-60 min of continuous
- Type
  - Aerobic, continuous, interval, circuit
  - Multiple, large mm groups
- Volume
  - 150/75 minutes
- Progression
  - 3 staged for healthy

Exercise increases circulation

Intensity = 60-80% MHR; RPE (12-16 on BORG) , talk test (unable to talk comfortably=upper resp limit)

Moderate: 3 – 5.9 METs or RPE of 5-6/10 (mod)

Brisk walk 3.0mph; cycling <10mph (4); dancing (5) ; mowing lawn (5.8)

Vigorous: 6 or more METS or RPE of 7-8/10 (high)

Hiking; rowing; kayaking; cycling >10mph

Time

Discontinuous ok in deconditioned

Type

Best outcomes in aerobic endurance is with LARGE mm groups contracting rhythmically over prolonged time (walk, bike, row, dance, swim, etc)

<https://media.hypersites.com/clients/1235/filemanager/MHC/METs.pdf>

Progression

Stage 1 (initial)	Stage 2 (Improvement)	Stage3 (Maintenance)
Lasts 1-6 weeks	4-8months	indefinitely
W/up 10-15 min	W/up 5-10 min	w/up 5-10 min
40-60% intervals	60-85%	70-85%
Cool down 10-15 min	Cool down 5-10min	Cool down 5-10 min
15-30 min	25-40 min	20-60 min

Imperative they “warm up” (>3 minutes) -> slower AV O2 exchange, stiffer vessels, reduced SNS output, and lower aerobic capacity

What are the goals? Rehabilitative/restorative or compensatory?

Ex parameters vary depending on setting/acuity

Inpatient cardiac

RPE 13 or below on 6-20 scale

HR <120bpm

2:1 exercise:rest; 3-5 minutes aerobic

Outpatient cardiac (formal rehab 4 weeks s/p MI or sx)

RPE 11-16

40-80% HRR

20-60 min

COPD

High intensity yields greater physiologic benefits

Mild COPD -> use intensity guidelines for healthy older adults

Severe COPD -> use intensity  $\leq$  60% peak work rate

\*\*\*Interval training is your best friend here\*\*\*

High intensity exercise with periods of rest -> no clinically important difference between interval and continuous programs in this population

Use rest as a variable to manipulate! Remember primary goal is to increase their exercise tolerance!!!

6MWT

Borg RPE

Aerobic

F: 3-5 (more is better)

I: Mod-vig (4-6 on Borg 10 RPE)

T: >20 min of exercise interspersed with rest periods, 20-60 min mod-high intensity is ideal

T: walking, cycling, arm ergo.

Resistance

F: 2x per week

I: 60-80% 1RM (strength), <50% (muscular endurance)

T: 2-4 sets, 8-12 reps (strength), <2 sets, 15-20 reps (muscular endurance)

MI

Avoid isometrics leading to Valsalva maneuver

Cooldown important to avoid sudden decrease in venous return

Perfusion is lessened so monitor confusion, fatigue, syncope

Discontinue exercise if...

Failure to return to baseline (within 5 minutes)

DBP drops 10-20 mm Hg below baseline

SSP > 210-240

DBP > 110

HR drops > 10 bpm below baseline

HR rises > 50 bpm with low level activity

CHF

Gradually increase volume of exercise with duration and frequency increased BEFORE intensity -> mod intensity aerobic and resistive are both good

Resistance training can be added after individual has adjusted to tolerating aerobic training -> typically takes at least 4 weeks

(1-2 sets of 10-15 reps focusing on major muscle groups) -> 1-2 non-consecutive days per week

Circuits of aerobic/resistive showed best outcomes in CHF

## Covid-19 Interventions<sup>12-14</sup>

- Implications for general population
- Proning
- Return to physical activity after Covid-19
- Long Covid or PASC



Photo: <https://www.bu.edu/sph/news/articles/2020/for-covid-19-patients-breathing-easier-could-be-as-simple-as-flipping-over/>

### General Population (Denay)

Most severe cases linked to obesity, obesity related conditions like hypertension and type II diabetes, older age, racial and ethnic minority status and physical inactivity  
Mod-Vig PA decreased during the early phases of the pandemic -> people are going to be more deconditioned than usual -> gradual return is key! -> restoration of exercise tolerance takes time

Add screening to your exam

### Proning (D'Souza)

Implemented to improve oxygenation in intubated and non-intubated patients -> use gravity to reach alveoli -> ventilation-perfusion matching by more homogenous ventilation, draining secretions, decreasing atelectasis, and changing the position of the heart

Can be in this position up to 12-18 hours

### Return to PA after Covid (APTA)

Return after 7 days free of Covid symptoms

Begin exercise with 2 weeks of minimal exertion

Recent study showed that 54% of those hospitalized for Covid had residual physical impairments 4 months post-discharge (standing balance, LE strength, gait speed, and endurance)

### Long Covid/PASC (APTA)

Post-acute sequelae

Effects individuals differently -> exercise may not be appropriate for everyone living with long covid

Symptoms: extreme fatigue, SOB, racing heart, dizziness, muscle aches and pains, brain fog, problems with everyday activities, poor exercise tolerance, GI symptoms, post-exertional malaise

Energy conservation strategies!

## Neurological System

- Exercise
- Motor re-ed
- Balance Training
- Gait Training
- Postural re-ed
- Manual therapy
- Physical Agents
- Referral

What does exercise do? (incr reaction time, postural control, premotor time, etc)

High intensity for neuroplasticity

Multi-modal: varied speeds

Alignment (esp vestib)

X-taping

Don't forget ortho principles here...

Best dynamic balance performance in those with strong knees/ankles

19% of dynamic balance related to knee strength

58% of BERG score is related to DF/eversion strength

48% of TUG related to PF/inversion strength

Referral to OT/SLP

Modifications?

Kyphosis can alter sway

Multi-systems

Vestibular system!

# Neurological System

- Balance
  - Frequency
    - 1-7x per week
  - Intensity
    - Challenge limits of stability -> both static and dynamic
  - Time
    - 10-15 minutes
    - Incorporated into daily activities
  - Type
    - Static and dynamic -> functional obstacles courses, enjoyable activities
  - Volume
    - Daily
  - Progression
    - Wide BOS -> narrow
    - Non-compliant -> compliant
    - EO > EC

Anticipatory vs. Reactionary -> Which tests for reactionary? We have BOTH in our daily life, need to be prepared for both

Tandem while brushing teeth, hallway walk on toes or in carioca

Vision as the most critical sensory modality to community mobility – tasks to train visual system (hitting targets, avoiding obstacles, caring object that obscures view of legs, challenging light conditions, scanning environment

Head turns, reaching, rotation with reach, march in place large steps, walk on toes, heels, side step, tandem walk, grapevine, EO/EC compliance, arm position, dual motor-cog task

<p>Neurological System</p> <ul style="list-style-type: none"> <li>• Disease Considerations <ul style="list-style-type: none"> <li>• CVA</li> <li>• PD</li> <li>• Vestibular Hypofunction</li> <li>• Dementia</li> </ul> </li> <li>• Motor Learning</li> </ul>
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## CVA (ACSM)

High intensity/high reps for neuroplasticity

Avoid Valsalva maneuver during resistance training to avoid excessive elevations in BP

Every stroke is different -> important to use ICF model and address impairments that are impacting participation

Early onset local muscle and general fatigue are common and should be considered when setting work rates and rates of progression

Types: Constraint induced movement therapy (CIMT), Neuro-developmental treatment (NDT),

Proprioceptive neuromuscular facilitation (PNF), Bodyweight supported treadmill training (BWSTT)

FUNCTION!

## Aerobic

F: 3-5x per week

I: RPE 11-14 on 6-20 scale

T: Progressive increase from 20-60 minutes -> can be multiple 10 minute sessions

## Resistance

F: 2x per week

I: 50-70% 1RM

T: 1-3 sets of 8-15 reps

## PD

Exercise is best defense ; high intensity/vigorous

high intensity/aerobic = dopamine stim; med delivery; neuroprotection

Stretch flexors, Strengthen extensors, Posture, Aerobic

LSVT BIG: high intensity; amplitude training to move with bigger effort to overcome brady/hypok

Rock Steady; PWR Moves; BWSTT; music therapy; dance therapy (beats to music = metronome)

## Vestibular

Habilitation exercises

Correction with epley maneuver

## Dementia

Consider time of day that may be most beneficial

Utilize caregiver for help with motivation, support, and safety (depending on stage)

Aerobic exercise is neuroprotective -> balance, gait, falls prevention

## Motor Learning

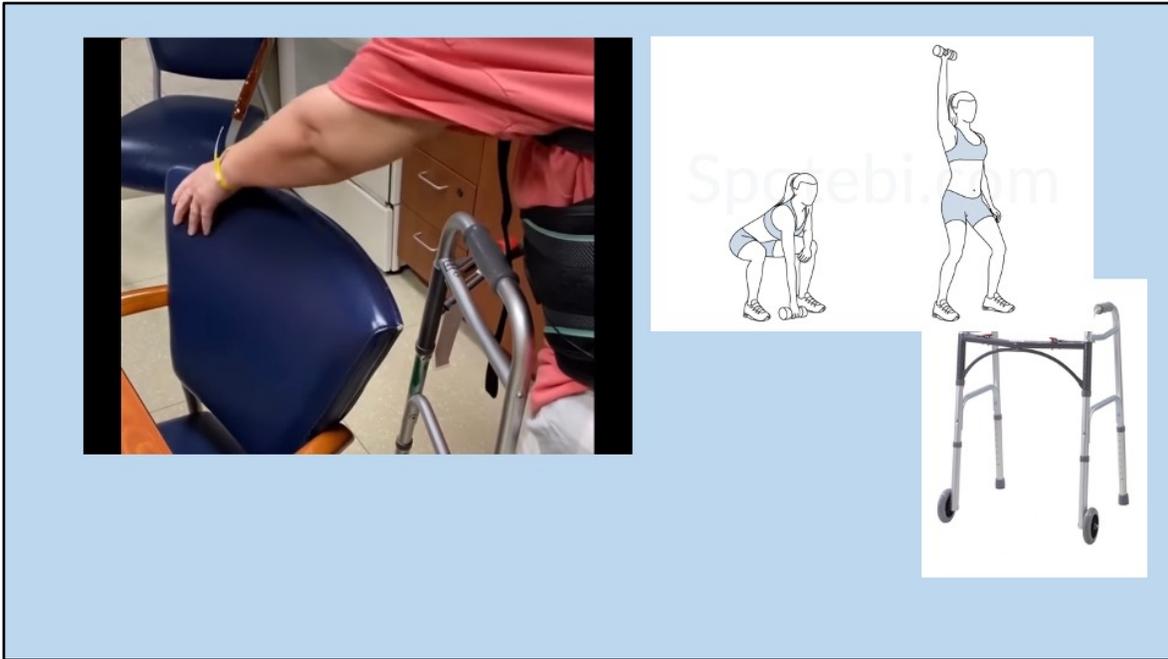
Must use principles of motor learning – repetition and sufficient stimulus to aid with changes while working within the confines of the disease process, will require thousand of repetitions

Task specific

High intensity/high reps = motor learning

## Ida

- During her hospital stay it was determined that Ida's fall was due to a CVA. As a result she has had increased difficulty with balance and her ADLs and is currently ambulating CGA with a RW.
- Name an appropriate intervention for Ida during IPR and any potential considerations for interventions after CVA



Meaningful obstacle course around patient goals:  
Goal is to move around house independently....

Combine aerobic and strength training! Weighted sit to stand to press follow-up by an obstacle lap

Goal is to move around house independently....

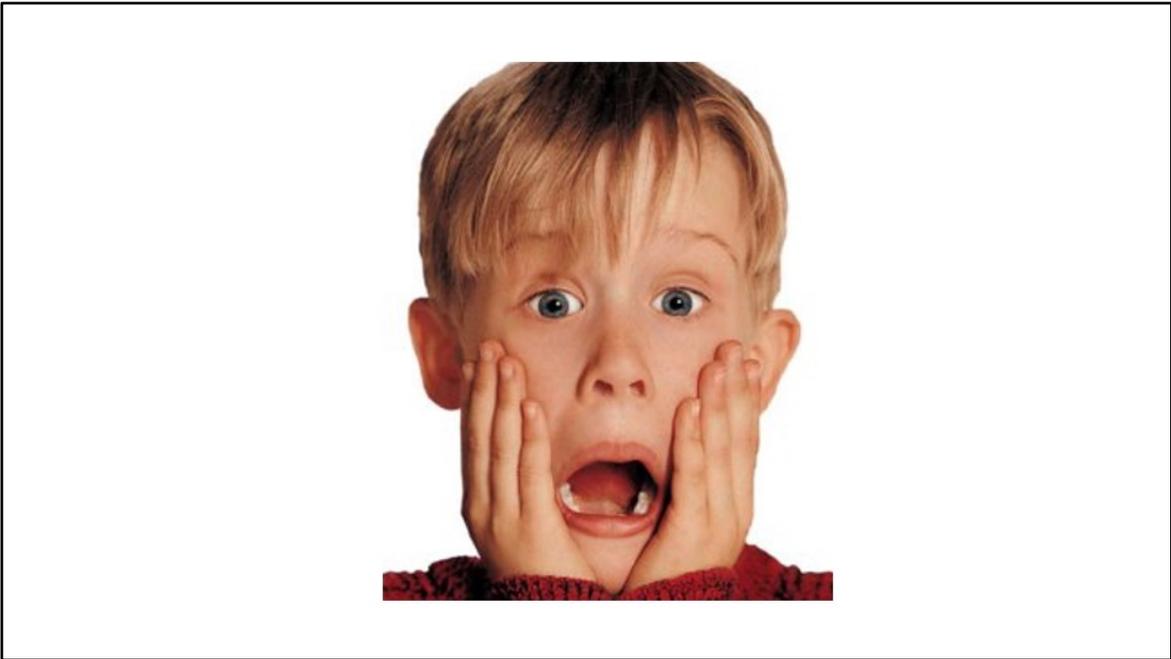
Use furniture obstacles instead of cones (realistically mimic goals move heavy things) and challenges balance and core strength to maintain stability during pushing and pulling

Hip hinges to pick things up off ground when you drop them -> problem solve

Snatches at RW -> force transfer at hip -> momentum -> power -> internal perturbation with arm overhead

Any upper body exercise can be in tall kneeling to add an element of trunk control and stabilization

Developmental progressions!



This is probably how you are feeling and that's understandable!! Ida has SO much going on, like so many of your patients will, so how do we prioritize what type of training to do? Aerobic, resistance, or concurrent??

## Single Component vs. Multicomponent Programs<sup>3,15,16</sup>

- ACSM
  - Multicomponent > single component
- Aerobic vs. Resistance vs. Combined
  - Aerobic and combined improved cardiovascular fitness
  - Resistance and combined improved strength and power
  - Cognitive function improved across all groups
  - Combined group was the most effective for increasing gait speed and lower limb strength

### ACSM Guidelines for Older Adults

- Multicomponent exercise (aerobic, resistance, balance, flexibility) programs have a greater impact on improving overall function than single-component programs

### Practical Programming PDF – ICE MMOA

#### Timmons

- 12 week study (3x per week, 72 minutes of exercise per week)
- Time matched: aerobic, resistance, and concurrent groups
  
- Combine it! What this data screams at me is combined aerobic and resistance training can be awesome for specific patients if it's indicated!
  
- DOSE RESPONSE -> overload to get stronger, more is better

## Ways to Program

- **EMOM**
  - Every minute on the minute
- **Manipulate FITTVP principles**
  - Frequency
  - Intensity
  - Volume
- **AMRAP**

\*Consider how you can manipulate and progress these styles for progressive overload of the tissue\*

### EMOM

- Every minute on the minute
- Alternates between movements for a certain number of rounds
- Pick 3 or so movements
- Incorporate a rest round -> build in a cognitive task, do a balance task, maximize your time!
- Can manipulate by changing frequency, intensity, or volume for progressive overload
  - Frequency -> how many reps per minute
  - Intensity -> increase weight or resistance
  - Volume -> number of rounds

### AMRAP

- As many reps as possible
- Use this to set goals and intensity
- If they are able to do 10 curls in 1 minute, use that as a baseline number to manipulate for part of your EMOM



## IDA'S EMOM

Create 2 different EMOM workouts with 3 exercises that would be appropriate for Ida while she is in acute care and after discharge to outpatient.

What would an EMOM look like for Ida in the hospital vs. outpatient?

**EMOM #1 (3 rounds)**

**Min 1: One lap around obstacle course**

**Min 2: 1 minute standing balance  
(semi tandem, tandem stance, SLS)**

**Min 3: 5x sit <>stand**



**EMOM #2 (4 rounds)**

**Min 1: Banded sidesteps**

**Min 2: Earthquake bar loaded carry**

**Min 3: Bear crawl walkouts**

EMOM 1: Acute

EMOM 2: Outpatient

Incorporate a “rest” round -> build in a cognitive task, do a balance task, maximize your time

A little bit of a trick question, because depending on function these could be the exact same!!

# Multisystem

- Exercise
- Pain Neuroscience Education
- Physical agents
- Balance re-ed
- Gait training
- Referral to dietician
- Education
  - Vit D supplementation for fallers
  - SNS downtraining for chronic pain
  - Environmental hazards to reduce falls

[https://www.instagram.com/tv/CXOsUjF0cB/?utm\\_medium=copy link](https://www.instagram.com/tv/CXOsUjF0cB/?utm_medium=copy_link)

Moderate intensity in chronic pain  
Limit passive modalities in chronic pain  
Frailty responds to resistive ex; cachexia does not

Ex for falls reduction should be multi-modal!!  
Balance, agility, proprioception, aerobic, flexibility, strengthening

## POWER TRAINING!

Older adults may particularly benefit from power training because this element of muscle fitness declines most rapidly with aging, and insufficient power has been associated with a greater risk of accidental falls. Increasing muscle power in healthy older adults should include both single- and multiple-joint exercises using light-to-moderate loading (30%–60% of 1-RM) for 6–10 repetitions with high velocity.

Gait training  
consider environmental demands  
starts/slows/acceleration/stops  
direction changes  
obstacles/curbs/stairs  
dual UE or picking up objects/ pushing/pulling doors  
lighting

AD vs no AD – sometimes more cog demand/ energy demand  
Sometimes w/c is best option

Vit D supplement = 22% reduction in falls

## Multi-System

- Disease considerations
  - Chronic pain
  - Frailty
  - Falls

Consider yoga, aquatic for chronic pain

Limit passive modalities in chronic pain

Moderate intensity 60-70% MHR in chronic pain (avoid eccentrics)

Challenges of pain management

underreporting/undertreatment in older adult population!!

med adherence and side effects

comorbidities – physical and cognitive

Frailty = prevention; build reserve; slide back up “slippery slope”

Falls= primary intervention is prevention

Strength/flexibility

Balance – anticipatory and reactionary

Have to challenge LOS; holding as little as 5g is ineffective

Fear/anxiety may be barriers

Fall recovery; how to fall; floor transfers

The unknown is scary! If you don't know how to fall, don't know if you can get up off the ground, the idea of falling is scary! Take the fear away and reduce anxiety by training for it to happen.

#### Motivation and Education<sup>17</sup>

- Potential Barriers
- Potential motivators?
- What considerations will we need to make when working with and educating patients?

Barriers: Lack of time, too old, lack of energy, fear of injury, pain vs. sore, motivation, lack of knowledge, finances, transportation

Agism -> stereotyping threat -> self-fulfilling prophecy -> if you tell someone they have a memory problem they will perform worse on memory tests

Behavior change is not linear -> transtheoretical model of change -> educate them that it's ok if they "relapse" in a behavior change -> that is normal, they are not a failure

#### Motivators

Music

Meaningful activities!

Education

Positive reinforcement

Reduce fear -> graded exposure -> start easiest and allow success

They respond better to positive benefits -> for example, this exercise will help you do your laundry

Any amount of time up encourages positive health outcomes

ASK THEM! Let them guide the session -> what are their perceived barriers? What energizes them?

#### Positive effects of aging

Increased internal self regulation -> better than younger adults at maintaining behavior change -> they love routine -> how do you work this into their current routine

#### Other considerations

Hearing (background noise; low pitch; speed)

Vision (where to stand; HEP print; contrast sensitivity)

Distractions (MCI may need to be in isolated area if unable to pay attn)

More practice trials are req'd for older adults to learn novel tasks; add'l time required

Subsequent task performance improves sig when verbal feedback given (but need to adjust to the learning style (kinesthetic, visual, verbal)

Interventions should be salient to their goals; self-care tasks seem to feel most relevant

Promote independence; "the more you do, the more you'll be able to do"

Performance is improved when specific goals are set (walk 10 more feet; instead of "do more")

## Takeaway

- Successful aging is possible with the proper dosage
- Function >>>
- Multimodal and multicomponent exercises are safe and functional for older adults
- Overload for positive change!
- Don't underestimate



Intensity matters

## Works Cited

1. Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med.* 2020;54(24):1451-1462. doi:10.1136/bjsports-2020-102955
2. Sardinha LB, Santos DA, Silva AM, Baptista F, Owen N. Breaking-up Sedentary Time Is Associated With Physical Function in Older Adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences.* 2015;70(1):119-124. doi:10.1093/gerona/glu193
3. Liguori G, American College of Sports Medicine (ACSM). *ACSM's Guidelines for Exercise Testing and Prescription (American College of Sports Medicine).* Eleventh, Paperback. LWW; 2021:548.
4. Helms ER, Cronin J, Storey A, Zourdos MC. Application of the Repetitions in Reserve-Based Rating of Perceived Exertion Scale for Resistance Training. *Strength Cond J.* 2016;38(4):42-49. doi:10.1519/SSC.0000000000000218