Brain Health and Quality of Life for the Aging Population

PRESENTED BY

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- Educational Trainer for ACE and FAI
- Owner Fitness Specialist – Post Rehab, Fall Prevention, Corrective Exercise, Brain Health etc.
World Centenarians

The world’s centenarian population projected to grow rapidly

Number of persons ages 100 and older

PEW RESEARCH CENTER
Different Generations

- Greatest (1901 – 1927) (121-95) 1.33 million
- Silent (1928 – 1945) (94-77) 21.78 million
- Boomers (1946 – 1964) (76-58) 70.68 million
- Gen X (1965 – 1980) (57-42) 64.95 million
U.S. Population Predictions for Seniors and Children

Population values in millions

Chart: U.S. News & World Report • Source: U.S. Census Bureau • Get the data
Share of Population Aged 65 or Older in 2018

July 2018 population estimates
Map: U.S. News & World Report • Source: U.S. Census Bureau • Get the data
Activity

Turn to Person on Right – make partner
Tell them:
➢ Your name
➢ Your age and generation (example baby boomer)
➢ Your state and what % of 65+ year-olds live there (COGNITION TEST from Map)

• Greatest (1901 – 1927) 1.33 million
• Silent (1928 – 1945) 21.78 million
• Baby Boomers (1946 – 1964) 70.68 million
• Gen X (1965 – 1980) 64.95 million
• Gen Y (Millennials) (1981 – 1996) 72.26 million
• Gen Z (1997 – 2012) 67.06 million

Statista (2019)
Categories of Old-Age

- Young – Old: 65 - 74
- Middle – Old: 75 - 84
- Old – Old: 85 +

Lee et al. (2018)
The Blue Zones

Okinawa Japan, Icaria Greece, Sardinia Italy, Nicoya Costa Rica, Loma Linda California USA (Seventh-Day Adventist)

Juneau, M., M.D. (2017)
In the US, the average life expectancy is 78.79 years

Blue Zone Inhabitants

• Chance of living to 100 years old is ten times higher than the US average

• Remain active into their 80s and 90s and do not suffer from the chronic diseases common in most parts of the industrialized world.

Robson, D. (2020)
Blue Zone Traits

1. Move Naturally
2. Purpose
3. Down Shift
4. 80% Rule
5. Plant Slant
6. Wine @ 5
7. Belong
8. Loved Ones First
9. Right Tribe

Eisenbraun, K. (2021)
Activity

- Turn to same partner
- Tell them:
  - Which of the 9 traits you practice
  - One of the 9 traits you want to work on

1. Move Naturally
2. Purpose
3. Down Shift
4. 80% Rule
5. Plant Slant
6. Wine @ 5
7. Belong
8. Loved Ones First
9. Right Tribe
6 Components of Function

• **Musculoskeletal** – strength, joint integrity, power, speed & endurance
• **Cardiorespiratory** - aerobic, anaerobic, CP
• **Balance** – multisensory, postural stability, fitness, center of gravity control
• **Mobility** – obstacle negotiation, walking gait, agility, floor-sit-stand
• **Neuromuscular** – motor control, coordination, proprioception, reaction time
• **Cognitive/Emotional** – processing speed, self-efficacy, executive function, attention, memory

Functional Aging Institute (FAI) (2021)
Hierarchy of Physical Function

**Elite** – High Risk and Power Sports, Competition

**Fit** – Regular Exercise – all domains

**Independent** – some AADLs (recreation, service, occupation, mostly sedentary) and all IADLs (shopping, finances, cooking etc.)

**Frail** – Some IADLs, all BADLs (feeding, dressing, bathing etc.)

**Dependent** – Can’t do BADL – must have care

American Council on Exercise (2021)
Priorities for Fit

• Typically, very good strength, endurance, balance
• Low Fall Risk
• Less likely to have multi-morbidity (OA, HTN)
• **Higher risk of musculoskeletal injury with training**
• High energy levels
• Cognitively sharp
• Individual deficits vary

Functional Aging Institute (FAI) (2021)
Priorities for Independent

- **Dynapenia** not typically sarcopenia
- Low to **Moderate** Fall Risk
- Cognitively adequate or sharp
- Low to moderate endurance
- Good basic mobility, **poor complex mobility**
- Good gait ability (specific deficits)
- Possible morbidity (**huge variation**)
- Low risk of serious injury with training

*Functional Aging Institute (FAI) (2021)*
Priorities for Frail

- Dynapenia
- Sarcopenia
- High Fall Risk
- Poor basic mobility and gait
- Multi-morbidity (CHF, Osteoporosis, OA)
- Higher potential for cognitive decline
- Low energy levels and endurance
- Higher risk of serious injury with training

Functional Aging Institute (FAI) (2021)
Common Impairments Among Older Adults

- Low Muscle Strength
- Low Muscle Power
- Poor Muscle Endurance
- Slow Muscle Contraction Speed
- Poor Posture
- Limited Joint Range of Motion
- Poor Balance
- Poor Cardiovascular Endurance

- Slower Processing Speed
- Low Self-Efficacy
- Increased Fear
- Decreased Fine Motor Skills
- Poor Coordination
- Reduced Proprioception
- Sensory Loss

Functional Aging Institute (FAI) (2021)
Even Climbing Stairs Depends on Numerous Factors

- Quadricep and Glute Strength
  - * Power
- Hip Flexor Mobility
- Lateral Stability Through Core
  - * Abdominals
  - * Hips/Pelvis
  - * Back
- Somatosensation
- Endurance
  - * Local Muscle
  - * Cardiorespiratory
- Balance
- Plantar Flexor Power / Dorsiflexion
- Ankle Stability
- Proprioception

This “simple” task requires a lot more than just strength!
Takeaways

- Almost **ALL** major systems decline with age – some more than others
- Age is a poor predictor of function – huge variability
- Lifestyle is the key factor – genetics 20-25 %
- Many systems can improve at any age with a (correct) exercise intervention
- We are not immortal, the biological process of aging eventually wins
Activity

• Turn to same partner
• Tell them:
  ➢ Which of these clients do you work with the most (elite, fit, independent, frail, dependent)
  ➢ What is one of your takeaways from this section (6 components of function, hierarchy groups of function, priorities for each hierarchy)
Assessments

- Body Composition
- Heart Rate
- Blood Pressure
- Posture
- Fitness
- Balance
- Gait
- Cardiorespiratory
- Core – Stuart McGill
- Movement
- Cognition
Health coaching is a collaborative approach to support health behavior change and improve health through 3 pillars:

- Nutrition
- Physical Activity
- Behavior Modification
# New Coaching Paradigm

## Traditional Care Model
- Health professional as expert
- Client told what to do
- One size fits all solutions
- Extrinsic motivators
- Client required to facilitate change
- Ignore barriers to change
- High resistance to change

## Health Coaching Model
- Client as expert in own life
- With permission, client offered information, but chooses own solutions
- Individually-tailored solutions
- Intrinsic motivators
- Collaboration and assistance to facilitate change
- Address barriers to change
- Low resistance to change
Transtheoretical Model

- Preparation
- Action
- Maintenance
- Contemplation
- Precontemplation

Progress → Relapse
Relapse → Progress
Factors that prevent Relapse in behavior change:

- Awareness of present thinking, habits, and triggers
- Learning new coping skills
- Rebuilding confidence and resilience
- Having a support network
Self-Efficacy

• Self-efficacy refers to a person’s belief that they can perform a given task or change a behavior

• Self-efficacy predicts degree of consistency and accountability in change, especially when it becomes difficult

• Set realistic goals, empower, create autonomy and consistency (maintenance)
# 1 Musculoskeletal

strength, joint integrity, power, speed, & endurance
• Load with proper posture and mobility

• Movement patterns without postural and joint compromise

• 5 primary movements / 3 planes

• Postural stability and mobility, endurance, flexibility, core, and balance
6 Functional Movements

1. Bend and Lift
2. Single Leg
3. Push/Press
4. Pull
5. Rotation / Anti-Rotation
6. Locomotion
Almost ANY Type of RT is Beneficial for Older Adults

Machines
Free Weights
Elastic Resistance
Hydraulics – (opposing muscles)
Body Weight
Pneumatic - Keiser (speed)
Aquatic
Manual - partners – 4 sec. eccentric

Concentric
Eccentric
Isometric
Isolated
Compound
Strength Training

After about 1 year of lifting lower intensities (40-50% 1RM), strength improves nearly as much as higher intensities (80% 1RM) as long as volume is equal.

Higher intensities do not appear to improve functional tasks better than lower intensities – they are both effective (strength threshold).

(Raymond 2013; Silva 2014; Borde 2015; Csapo 2016)
Strong Enough is Strong Enough
Activity – Musculoskeletal

30 Sec Chair Stand (Senior Fitness Test)

- Assesses lower-extremity strength under practical (functional) conditions
- Validated against 1RM leg press
- Comparable to the 5X Sit to Stand (SPPB)
- Number of times a person can rise from a chair in 30 seconds (arms folded across the chest)
- Uses a standard-height chair (43-45cm, 17-18 in) with a non-compliant surface
## Chair Stand Norms

<table>
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<th>% Rank</th>
<th>60-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
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</table>

Muscle strength declines 30% (on average) from age 50-70, more dramatic losses after age 80
Large degree of variability between individuals

Type I (slow-twitch) muscle fibers show little change.
Type II (fast-twitch) muscle fibers decline 25-50%.
Relationship of Strength, Power and Function

Bean (2002), *The relationship between leg power and physical performance in community dwelling mobility limited older people*
# 2 Cardiorespiratory

aerobic, anaerobic, CP
Discover levels of function
Prioritize needs
Provide exercise guidelines for safety and effectiveness

- Moderate and vigorous intensity
  - Integrate near max and max intervals

- Increase duration and frequency
  - Integrate vigorous intensity intervals

- Moderate intensity for enjoyment
  - Increase duration and frequency

Cardiorespiratory Training
Cardiorespiratory Training

Recommendations are similar for adults of all ages

• Accumulate 150+ min of moderate or 75+ min of vigorous exercise each week or a combination
• Modality depends on chronic conditions, goals and personal preferences
• Intensity can be measured several ways:
  ➢ Heart Rate
  ➢ Calculate Max Predicted Heart Rate: 208-(0.7 x age) ....... Tanaka
  ➢ Karvonen Formula: \((220\text{-age}) - (RHR)\) X (%) – RHR
  ➢ Rating of Perceived Exertion
  ➢ Talk Test
Aerobic Exercise

• Aerobic exercise appears to increase BDNF (Brain Derived Neurotrophic Factor)
• BDNF promotes survival of nerve cells (growth, maturation and maintenance)
• Significantly in the hippocampus in the lateral brain - thought to be the center of emotion, memory, and the autonomic nervous system
• Improving: memory, retention, comprehension

Griffin, E.W. et al. (2011).
The brain does not receive as much blood as other organs in the body. The blood it does receive brings oxygen, glucose and other nutrients. Lack of blood flow increases cognitive decline.

What is good for the heart is good for the brain

# 3 Balance

multisensory, postural stability, fitness, center of gravity control
Balance

As we age, our limit of stability and the degree to which we lean significantly decrease which causes our balance problems.

This change can be due to:

- Reduced ankle ROM and weak ankle muscles
- Neurological issues (stroke, Parkinson, MS etc.)
- Overall muscle weakness in lower extremity
- Reduced ROM in hip muscles
- Fear of falling
- Lack of sensory in feet
Most important of all systems. Vision provides critical information about our movement position in space.

It is important in navigation for both avoidance and adaptation.

Most individuals are vision dependent for balance.

This is why people fall at night or in areas where the lighting is compromised.

(Rose, D. 2010)
This system gives information on location and movement.

This is done by proprioceptors in the muscles and joints.

These neurological receptors are less sensitive as we age and must be stimulated by specific practice. (Naboso mat)

Certain pathology can shut down the information in our periphery.

(Rose, D. 2010)
This is a delicate system in the inner ear which is activated when we move our heads.

It works with our vision to determine if our body is moving or if the world is moving.

It becomes very important when our vision and somatosensory systems are compromised.

(Rose, D. 2010)
Activity - Balance

- Stand (1 foot, tandem or semi-tandem) move head right and then left
- Stand (tandem or semi-tandem) eyes closed
- Stand in wide stance / shift weight to 1 leg / balance
- Leans – ankle movement (postural stability)
obstacle negotiation, walking gait, agility, floor-sit-stand
Effectiveness Of Normal Gait Depends on:

- Free joint mobility
- Muscle action
- Bone health
- Sensory nervous system
- Central motor control
- Cardiopulmonary system
Gait and balance disorders are major causes of falls and predict future falls more consistently than other identified risk factors.

Evaluation of gait and balance is an essential step in identifying persons at increased risk of falling.

Al-Aama T. (2011)
Activity - Mobility

**Activity Set Up** - 2 individuals per line

**Activity Play**
- # 1 - turn 360 degrees to left
- # 2 - sit and stand
- # 3 - 2 high knees alternating with arms going up
# 5 Neuromuscular

motor control, coordination, proprioception, reaction time
Neuromuscular training focuses on performing exercises that train the nerves and muscles to react and communicate, both physically as well as well as mentally.

Weak-Links

- Old injury or ailment
- Musculoskeletal imbalance (*strength, flexibility, or both*)
- Incomplete rehab syndrome (IRS)
- Genetics
- Aging EFX (musculoskeletal tissue)
- Pathology
Weights

Training with Weights is the Most Common Form of Training One’s Dysfunction

If a person cannot maintain proper form and function throughout the movement being performed, weights should not be added until the appropriate mechanics can be achieved.
Activity - Neuromuscular

Activity Set Up – 2 individuals – one person behind other person

Activity Play

- Partner from behind taps shoulder or hip – person in front uses opposite hand to quickly tap body part
- Partner from behind taps shoulder or hip – person in front uses opposite hand to quickly tap body part, say side of body they are tapping, and the joint name
- Turn around and switch partners
processing speed, executive function, attention, memory
People who experience the least declines in cognition and memory all share certain characteristics:

- Partaking in regular physical activity
- Pursuing intellectually stimulating activities
- Staying socially active
- Managing stress
- Eating healthy
- Sleeping well

Nichols H. (2017)
<table>
<thead>
<tr>
<th>Description</th>
<th>Age Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selective Attention</strong></td>
<td>Ability to focus despite distractions Slight decrease</td>
</tr>
<tr>
<td><strong>Divided Attention</strong></td>
<td>Multi-tasking       Moderate decrease</td>
</tr>
<tr>
<td><strong>Attention Switching</strong></td>
<td>Ability to switch from one task to another Significant decrease</td>
</tr>
<tr>
<td><strong>Sustained Attention</strong></td>
<td>Sustained Attention No decrease</td>
</tr>
</tbody>
</table>

Open Skill

- Object manipulation
- Non-fixed space parameters
- Non-fixed time parameters
- Group performance
- High inter-trial variability
- Simultaneous oppositional performance
- Dual / Multi-task

Closed Skill

- Fixed apparatus/no object manipulation
- Defined Space
- Defined Time
- Individual performance
- High inter-trial consistency
- Sequential oppositional performance
- Single task

Gu, Q. et al (2019)
Cognitive Tasks

Memory Tasks
• Routines, procedures, steps, complex instructions, rules, choreography
• Visual recall of locations, the verbal recall of lists or numbers

Attention Tasks
• Attending to sensory stimuli
• Audible cues, visual cues, and external focus

Executive Function Tasks
• Organizing, planning, directing, reasoning, problem-solving, working memory
• Open skill, novel, enjoyable, social, challenging

Processing Speed Tasks
• Higher temporal or speed demands
• How fast movements are executed based on visual, auditory or sensory cues
Guidelines

- Research indicates that we can shape the brain, much like we do the rest of the body through combined physical and cognitive training.
- Specificity – activities that challenge the brain and body simultaneously.
- It must be challenging but not overly frustrating, interesting, and taught to be incorporated into daily life.
- The more time spent – the better the results (40 min vs 20 min).

Activity - Cognitive

Arrows
- Red card follow
- Blue card opposite

Cards
- Small # (1-5) right
- Large # (6-10) left
- Black – backward
- Red – forward
ACE Senior Fitness Specialist
You will learn a variety of programming, assessments and communication techniques to help you understand the role that health and fitness plays in restoring or maintaining independence and health in older adults.

Brain Health Trainer Certification
You will learn about the different aspects of brain health with the primary focus being on the outcomes associated with cognition and exercise.

https://www.acefitness.org/fitness-certifications/specialty-certifications/senior-fitness.aspx
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https://www.kkr.com/globalperspectives/publications/what_does_population_aging_mean_for_growth_and_investments


