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SCHOOL OF MEDICINE

PHYSICAL THERAPY
AND REHABILITATION SCIENCE

The effects of neuromuscular activity and muscle structure on stepping performance in older adults

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Outline

- Who am I and what I do?
- Pepper Pilot
 - Award
- Introduction
 - Background
 - Research question
- Study design / Data
- What I want to see from this data



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Who am I and what I do?



- Assistant Professor
 - University of Maryland Baltimore
- Aging research / Teaching
 - Understand the physiological and biomechanical mechanisms related to physical function



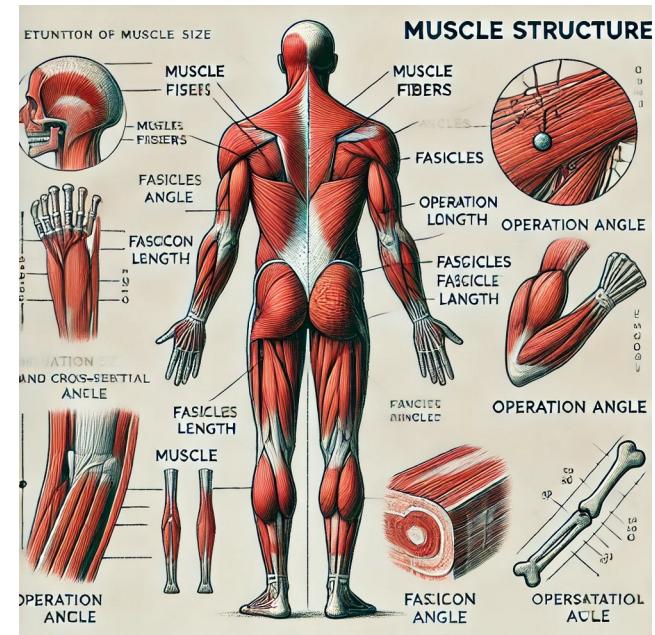
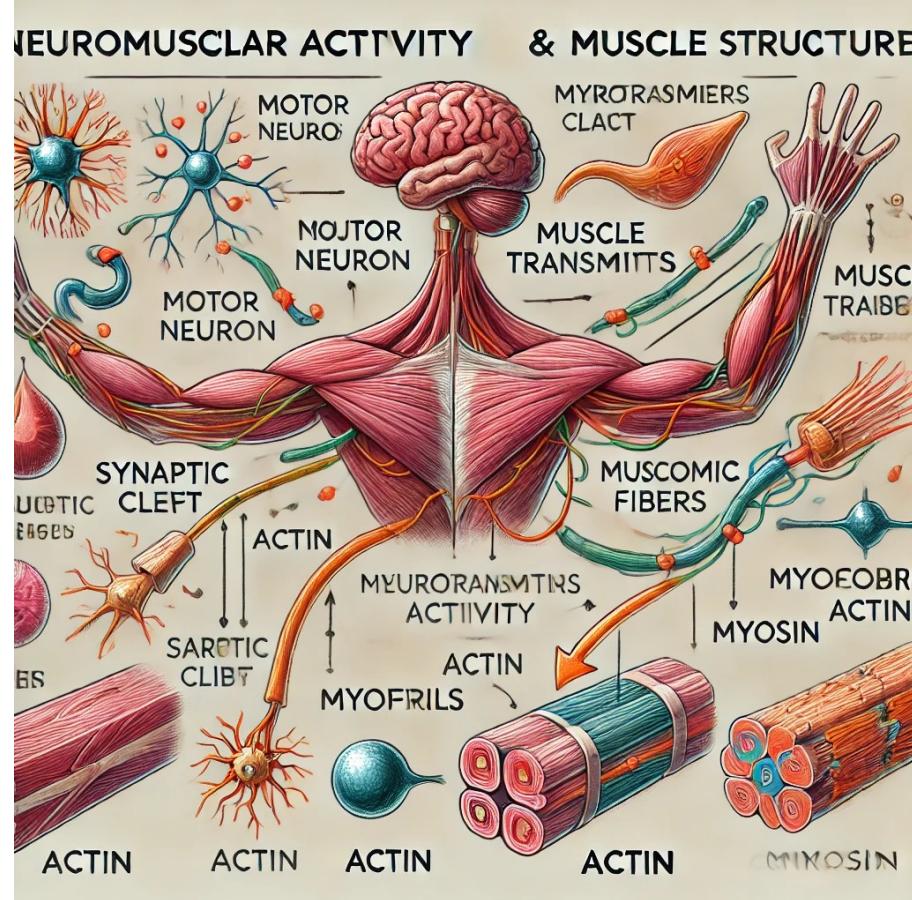


Pepper Pilot

Claude D. Pepper Older Americans Independence Centers (OAICs)

The Claude D. Pepper Older Americans Independence Centers (OAIC) program was established in honor of the late Representative to establish centers of excellence in geriatrics research and research career development to increase scientific knowledge, leading to better ways to maintain or restore independence in older persons. A listing of the currently active OAICs, their achievements, and other pertinent information can be found on the [National Pepper Center Website](#).





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Introduction



Balance recover

Why balance recover?

Falls

- **1/3 of older adults (≥ 65 yrs) fall...**
- **Half of the falls lead to injury...**
- **10% are serious injuries (e.g., hip fracture)...**
- **Some individuals die...**
- **Hospital cost - \$50 billion (USA)**





What is one of the most common reactions
when you lose your balance?





Journal of Electromyography and Kinesiology

journal homepage: www.elsevier.com/locate/jelekint



Kinetic, muscle structure, and neuromuscular determinants of weight transfer phase prior to a lateral choice reaction step in older adults

Marcel B. Lanza ^{a,*}, Odessa Addison ^{a,c}, Alice S. Ryan ^{b,c}, Tawanna L. Danner ^c, Vicki L. Gray ^a



Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2022;103: 1651–62



REVIEW ARTICLE

Systematic Review of the Importance of Hip Muscle Strength, Activation, and Structure in Balance and Mobility Tasks

Check for updates

Marcel B. Lanza, PhD, ^a Breanna Arbuco, MS, ^a Alice S. Ryan, PhD, ^{b,c}
Andrea G. Shipper, PhD, ^d Vicki L. Gray, PhD, ^a Odessa Addison, PhD ^{a,c}



What about the other muscles of the inferior part of the body?



The effects of neuromuscular activity and muscle structure on stepping performance in older adults

- Aim 1: To determine the age-associated changes of stepping performance during lateral, forward, and backward steps by comparing older and younger adults.
- Aim 2: To examine the association between the muscle structure of six hip and leg muscles and the stepping performance of lateral, forward, and backward steps in older and younger adults.



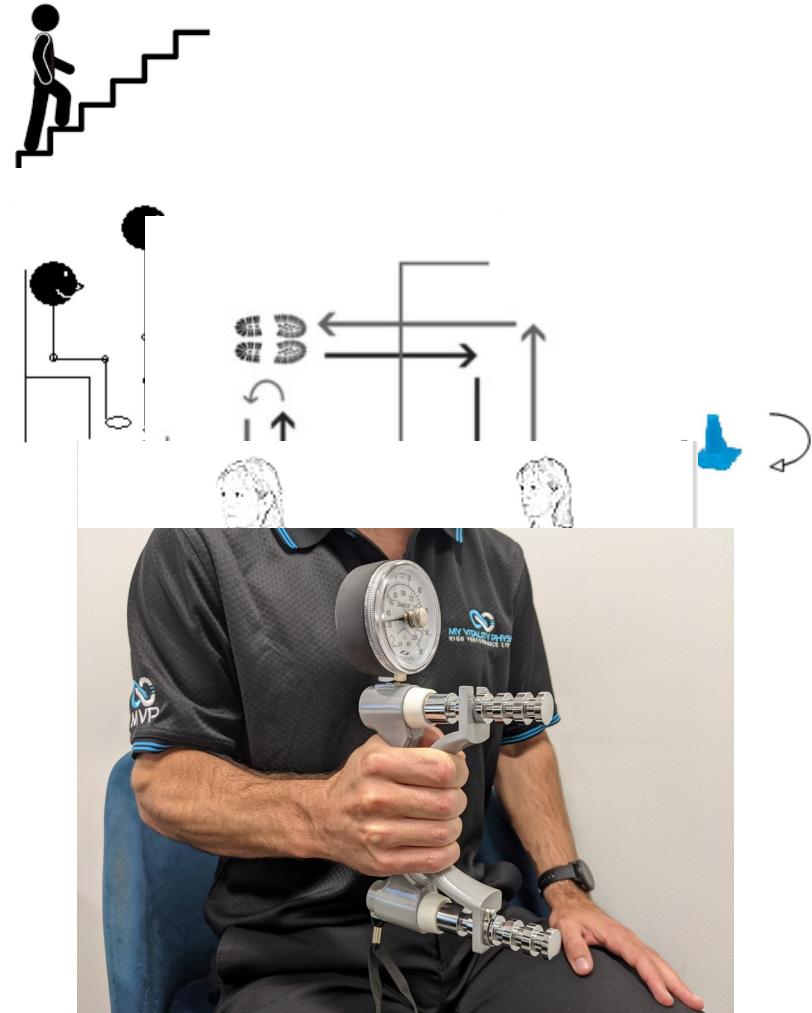
What tasks do the participants perform during the testing sessions?

- Clinical assessments
- Ultrasound
- Maximal contractions (with EMG sensors)
- Stepping test (with EMG sensors and motion capture system)



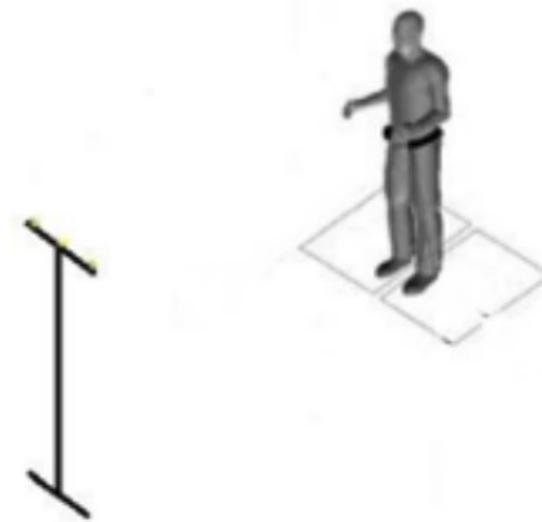
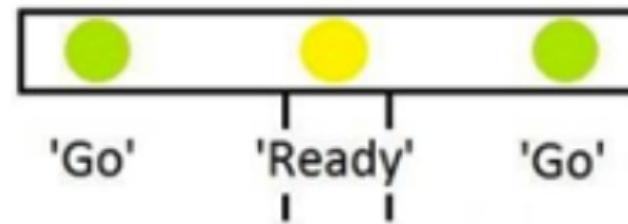
Clinical Assessments

- Staircase Power Test
- Time Up and Go
- Four Square Step Test
- Sit-to-Stand Test
- Handgrip Strength Test





Stepping Test





Stepping performance

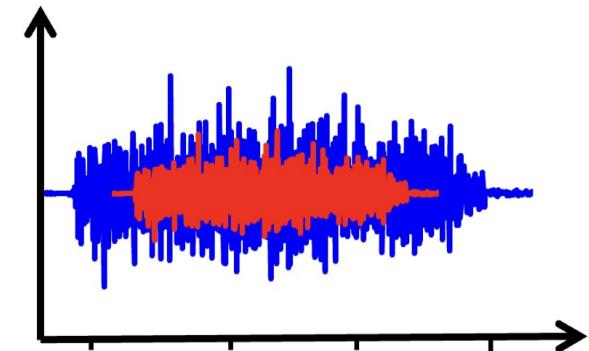
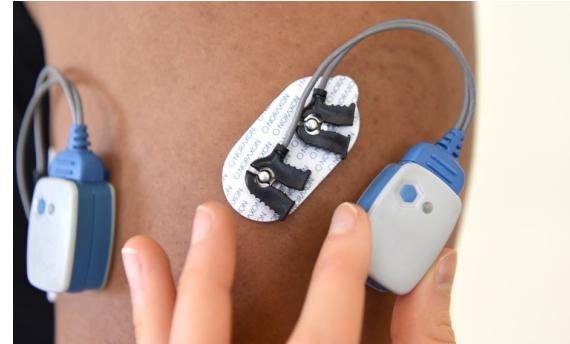
- Weight transfer time
- Stepping time





Neuromuscular activity and Muscle Morphology

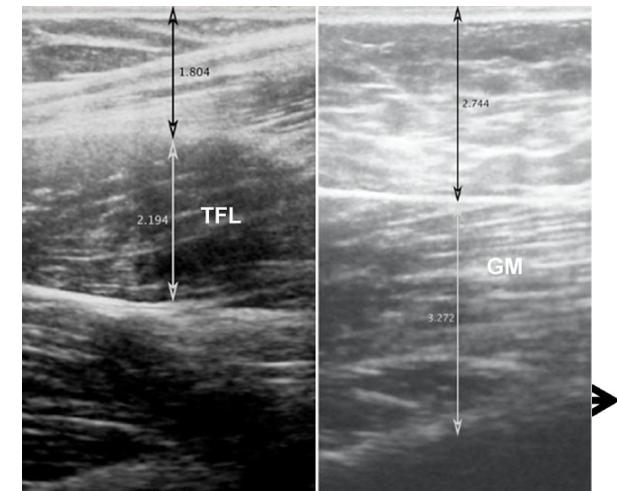
- Neuromuscular Activity
 - Amplitude of the signal from six different muscles





Neuromuscular activity and Muscle Morphology

- Muscle Morphology
 - Muscle Size
 - Muscle Quality
 - Muscle Stiffness
 - Subcutaneous Fat





What I want to see from this data?

- Aim 1: To determine the age-associated changes of stepping performance during lateral, forward, and backward steps by comparing older and younger adults.
 - Are the older adults transferring weight slower than the young adults during the lateral, forward, and backwards steps?
 - Are the older adults stepping slower than the young adults during the lateral, forward, and backwards steps?
- Aim 2: To examine the association between the muscle structure of six hip and leg muscles and the stepping performance of lateral, forward, and backward steps in older and younger adults.
 - Is there an association between muscle size, muscle stiffness, and intramuscular fat with the transfer of weight in young and older adults?
 - Is there an association between muscle size, muscle stiffness, and intramuscular fat, and the stepping time in young and older adults?
 - Are these associations different between young and old adults?



Sample Size

- Sample size: 21 (13 younger adults / 8 older adults)
- Sample size goal: 30 (+ 2 younger adults and 7 older adults).



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Thank You!

Questions?

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