

# Age-Related Differences in Habituation of Arm and Center of Mass Displacement to Repeated Exposure to Laterally Induced Imbalances

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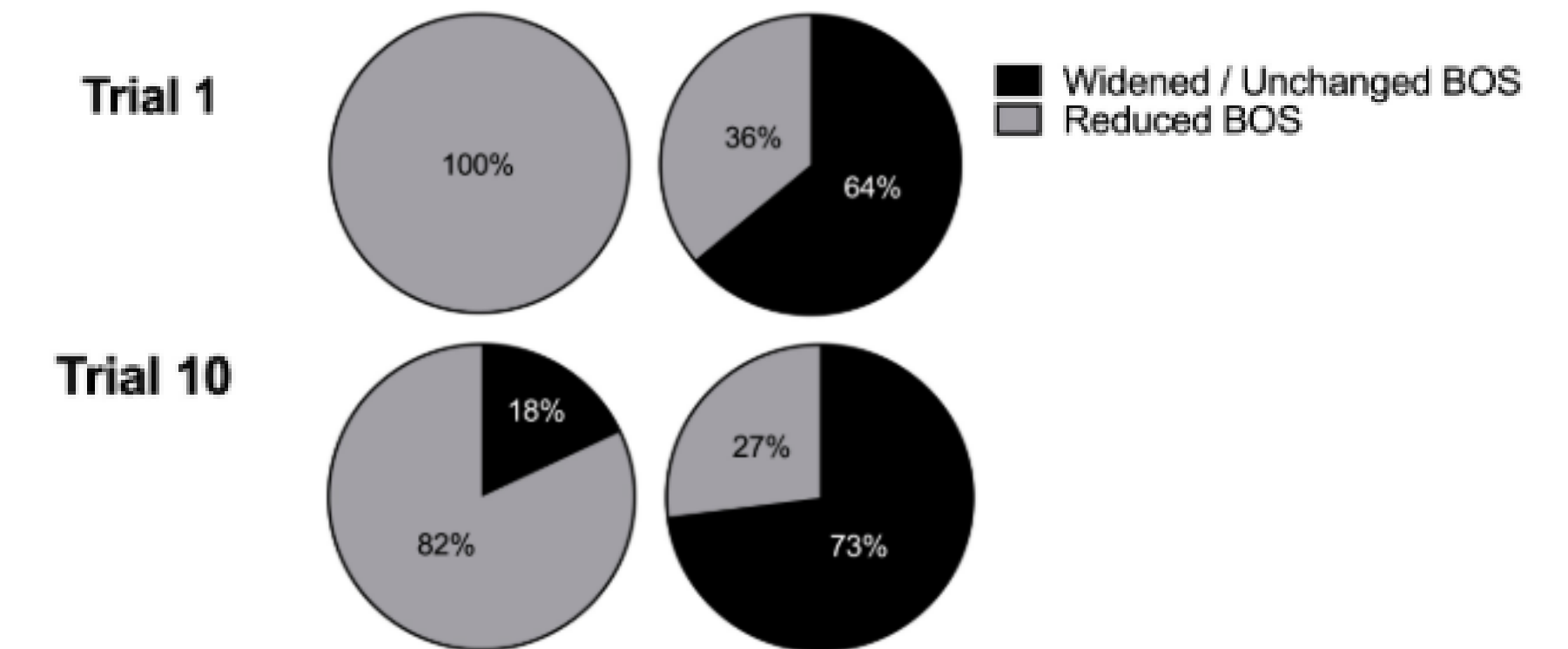
## Background and Objective

- Falls are a significant public health concerns that can result from excessive center of mass displacement(CoM) without appropriate postural responses
- Older adults (OA) have the tendency to use ineffective arm response strategies that can further increase CoM displacement and predisposes them to falls<sup>1,2</sup>.
- Postural habituation to repeated perturbations can provide insight to a person's capacity to learn postural strategies to avoid a fall
- This study explores age related differences in habituation of arm responses and CoM displacement to repeated lateral perturbations

## Equipment & Postural Responses



## Results: Secondary Outcomes

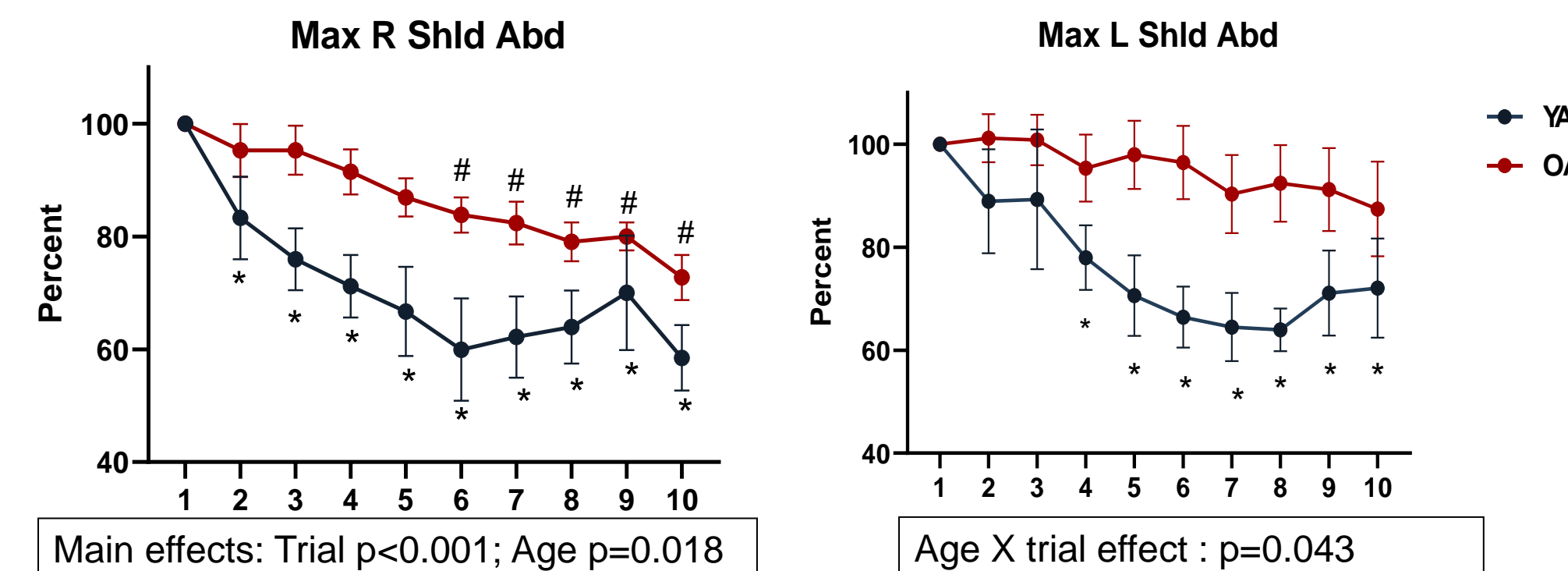


## Methods

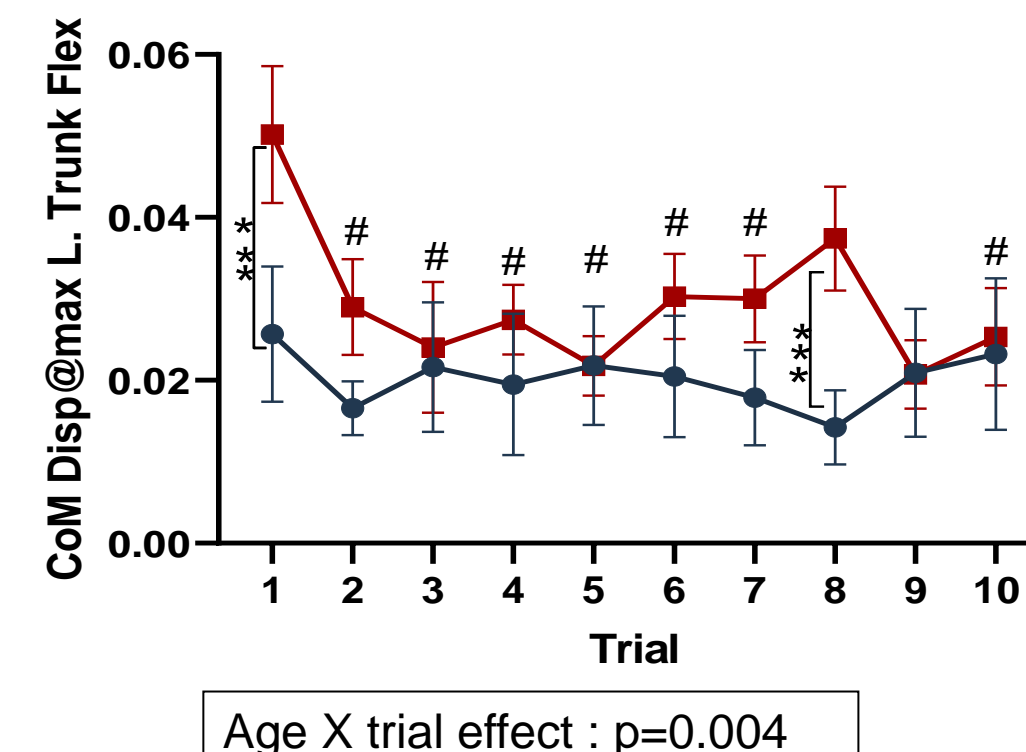
Demographic	Mean +sd	
	OA (n=11)	YA (n=11)
Age (years)	70.3 ±5.4 yrs	25.8±3.5 yrs
Sex (F/M)	8/3	7/4
BMI	27.3±4.6 kg/m <sup>2</sup>	22.8±4.0 Kg/m <sup>2</sup>

- Participant stood laterally on the ActiveStep treadmill which triggered 10 rightward surface translations of the same intensity.
  - Intensity : 7.67 m/s<sup>2</sup> acceleration over 90ms then deceleration of 4.93 m/s<sup>2</sup> over 140ms
  - Total displacement = 0.14 m
- Participants were unaware of the time and direction of perturbation.
- A safety harness integrated with loadcell was worn to prevent a fall and measure harness reliance
- Body position data was captured through the Vicon system and video recording
- Primary outcome: Maximum shoulder joint angles and CoM displacement at maximum trunk lateral flexion within 1 minute of perturbation
- Secondary outcome: Change in base of support (BoS) based on step type and group harness reliance over 10 trials.
  - Harness reliance was defined as load cell recording > 5% body weight per trial

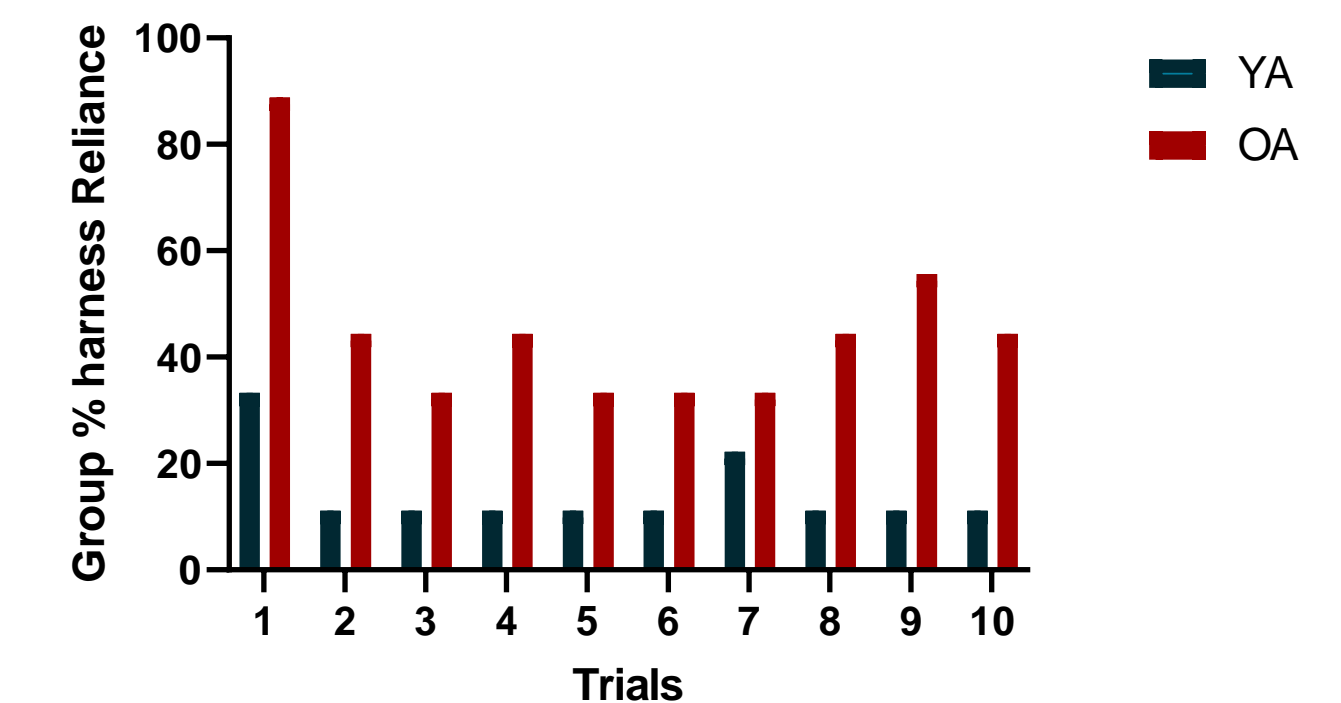
## Results: Primary Outcomes



### CoM Displacement at Max L. Trunk Flex



### Harness Reliance Per Group Across Trials



## Conclusion and Implication

- Evidence for postural habituation to repeated lateral suggest that older adults may be able to learn effective strategies to avoid a fall.
- Higher harness reliance during perturbations in OA implies the need for effective balance rehabilitation efforts to prevent falls in OA.

## Reference

- Holliday, P.; Fernie, G.; Gryfe, C.; Griggs, G. Video Recording of Spontaneous Falls of the Elderly. In Slips, Stumbles, and Falls: Pedestrian Footwear and Surfaces; ASTM International: West Conshohocken, PA, USA, 2009; Volume 7. [CrossRef]
- Yang, Y.; Mackey, D.C.; Liu-Ambrose, T.; Leung, P.-M.; Feldman, F.; Robinovitch, S.N. Clinical Risk Factors for Head Impact During Falls in Older Adults. J. Head Trauma Rehabil. 2017, 32, 168–177. [CrossRef]