Relationship between trunk stiffness and risks of fall in older adults [abstract only]

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The relationship between trunk stiffness and the risk of falls in older adults is a critical area of study, highlighting the interplay between ageing, mobility, and postural control. As individuals age, they experience changes in various body systems, including cognitive impairments, decreased walking performance, and loss of postural stability, all contributing to an increased risk of falls. Studies estimated that approximately 29% of people over 65 in the United States and 30% in the United Kingdom experience falls, emphasising the importance of understanding and mitigating these risks.

Mobility assessments aim to monitor independence and frailty, measure the adaptive capacity of the neuromusculoskeletal system in diverse environments, evaluate improvements after interventions, and predict fall risks through clinically significant metrics. Indicators of ageing, such as trunk mobility and gait performance, are closely linked to functional declines and increased frailty. However, falls are multifactorial, influenced by a combination of neuromechanical, cognitive, and physical factors.

Trunk control plays a pivotal role in maintaining postural stability. Muscle stiffness and spine rigidity can adversely affect postural control, leading to higher fall risks. Research shows that younger adults exhibit low trunk rigidity and flexible gait patterns, adjusting stride length through coordinated movements of the lower limbs, pelvis, and trunk. In contrast, older adults display high trunk rigidity, modifying stride length primarily through lower limb movements without corresponding changes in pelvic and trunk motion, reflecting a more rigid gait pattern.

Posture stiffness significantly impacts fall risks. Older adults, particularly those with a fear of falling (FoF), exhibit less smooth trunk motions and greater trunk acceleration amplitude in dual-task conditions compared to those without FoF. This underscores the clinical importance of examining the association between FoF and trunk mobility control. Individuals with FoF demonstrate less smooth trunk motions at both usual and fast walking speeds.

Assessing fall risk factors in representative designs that mimic real-life contexts and functional tasks under various conditions is crucial. Falls prevention programs should focus on movement adaptation in dynamic and challenging environments to help individuals recalibrate their postural responses to contextual demands. One model is Environmental Constrained Physical Activity (ECPA) which integrates health-related fitness components (muscular strength, endurance, aerobic capacity), motor fitness components (agility, speed,

reaction, coordination, balance), and cognitive functions (decision-making, dual-tasking, problem-solving, perception of visual and haptic information) to simulate activities of daily living (ADLs). This model emphasises stimulating and challenging exercise environments that accommodate the diverse balance needs of older adults. These activities can be conducted indoors or outdoors, involving problem-solving and guided discovery. The approach is based on perturbations in the postural system to enhance fall prevention and dynamic balance. It encourages participants to explore multiple movement solutions without explicit instructions, fostering an environment rich in information. In this method, practitioners act as designers, while participants are problem-solvers, facing multidimensional and multidirectional task challenges that engage various movement axes. In conclusion, understanding the relationship between trunk stiffness and fall risks in older adults is essential for developing effective prevention strategies.