MODEL HEALTH

Sit-to-stand analysis report

Subject	Session	Trial	# Repetitions
tom-admin	demo-stationnary	5xSTS	5

Sit-to-stand metrics

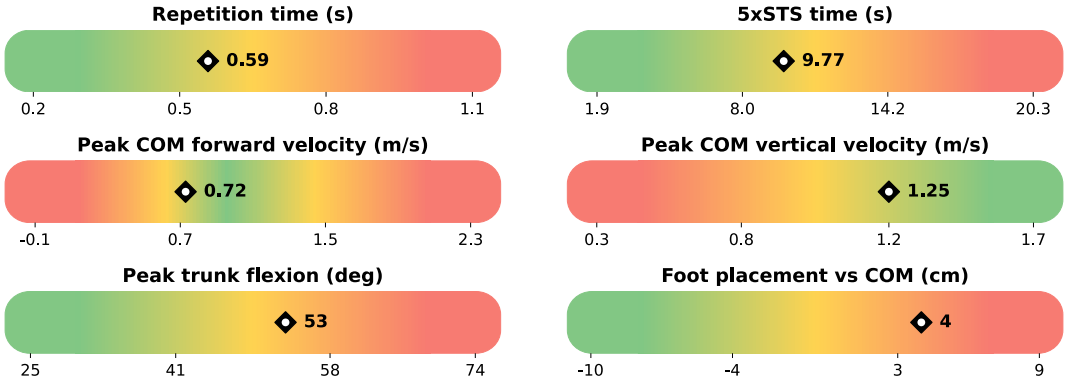

Figure 1: Values are averaged over 5 repetitions (except for 5xSTS time). Colors indicate how results compare to normative data from an average population. For directional metrics, the distribution is split into the top 25% (green), middle 50% (yellow), and bottom 25% (red). For centered metrics, green represents the middle 40% (P30-P70), red marks the outer 10% extremes, and yellow is the transition zone between green and red.

Per-repetition metrics

Metric	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Repetition time (s)	0.53	0.60	0.59	0.61	0.61
Peak COM forward velocity (m/s)	0.75	0.70	0.67	0.75	0.73
Peak COM vertical velocity (m/s)	1.32	1.21	1.19	1.30	1.25
Peak trunk flexion (deg)	51.9	51.4	51.5	54.6	56.3
Foot placement vs COM (cm)	4	5	6	4	3

Description of the metrics

- **Repetition time** is the duration from seat-off to full upright standing for a single repetition. Lower values generally reflect greater lower-limb strength, movement efficiency, and postural control; prolonged duration may indicate weakness, pain avoidance, fear of falling, or impaired neuromuscular coordination.
- **5xSTS time** is the duration from seat-off of the first repetition to full upright standing at the end of the fifth repetition. It is a widely used clinical measure of functional lower-limb strength and dynamic balance; higher values are associated with increased fall risk, reduced physical function, and lower-limb weakness.
- **Peak COM forward velocity** is the maximum forward velocity of the center of mass (COM) during the sit-to-stand transition. A sufficient forward momentum is required to shift load from the seat to the feet; reduced values may reflect a momentum-transfer deficit due to weakness or pain avoidance, while excessive values may indicate compensatory reliance on trunk flexion to initiate the rise.
- **Peak COM vertical velocity** is the maximum upward velocity of the center of mass (COM) during the rising phase. Higher values reflect a more dynamic and powerful transition from sitting to standing, indicative of greater lower-limb extensor strength; reduced values may suggest quadriceps or hip extensor weakness, fatigue, or pain-related guarding.
- **Peak trunk flexion** is the maximum trunk angle in the sagittal plane during the sit-to-stand. Higher values indicate a hip-trunk momentum strategy; lower values reflect a more knee-dominant strategy with greater quadriceps demand. Altered trunk flexion patterns may reflect compensatory strategies secondary to lower-limb weakness, limited ankle dorsiflexion, or pain.
- **Foot placement vs COM** is the horizontal distance at seat-off between the line connecting the feet and the projection of the center of mass onto the ground. Positive values indicate feet positioned in front of the COM. More posterior foot placement facilitates momentum transfer and reduces lower-limb extensor demand; more anterior placement increases the mechanical challenge of rising.

Rising strategy

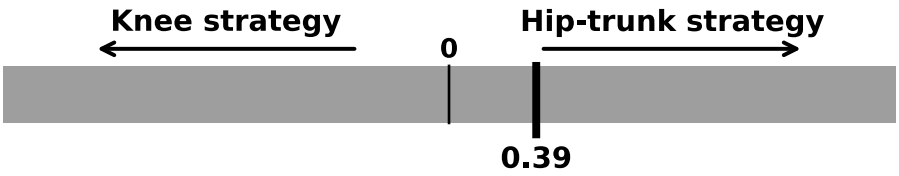

Figure 2: The rising strategy is determined by the z-score of the peak trunk flexion angle, which is calculated based on normative data. The z-score indicates how many standard deviations a given value is from the mean of the reference population. Assuming a continuum of rising strategies, positive values correspond to a hip-trunk rising strategy, whereas negative values correspond to a knee strategy. A hip-trunk strategy involves lower knee extension moments but higher hip and trunk extension moments compared to a knee strategy, resulting in decreased demand on the knee extensors and increased demand on the hip and trunk extensors. It is a rising strategy often used by older adults and is associated with low functional muscle strength. A knee strategy may offer better efficiency, while a hip-trunk strategy could improve stability by positioning the center of mass closer to the base of support.

Joint kinematics

Lower-body and lumbar joint angles

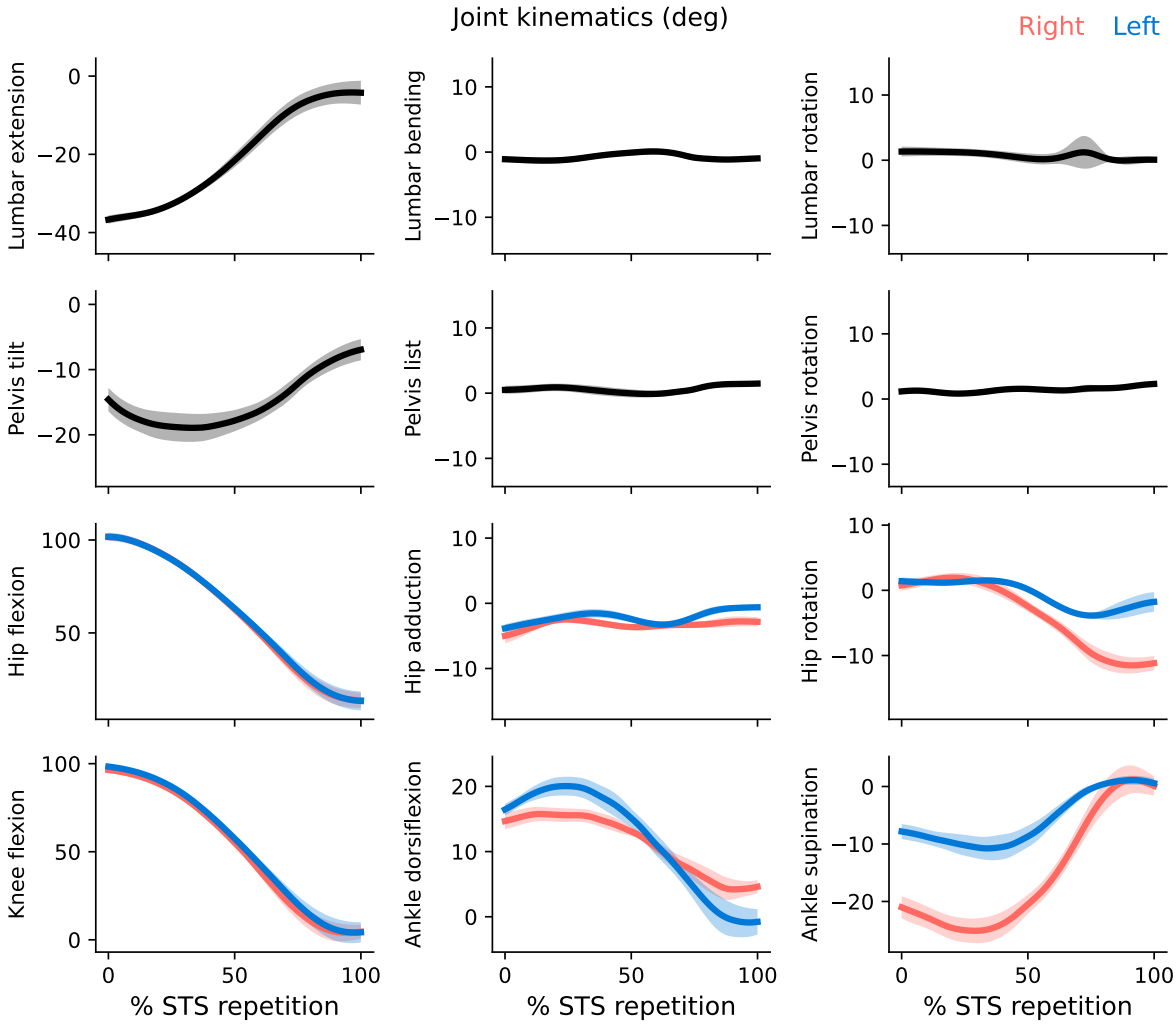

Figure 3: Joint angles (mean ± standard deviation across 5 repetitions) normalized over the sit-to-stand (STS) repetition.

- Lumbar extension (sagittal plane) is positive when the trunk extends posteriorly.
- Lumbar bending (frontal plane) is positive when the trunk bends toward the right side.
- Lumbar rotation (transverse plane) is positive when the trunk rotates toward the left side.
- Pelvis tilt is positive when the pelvis tilts posteriorly.
- Pelvis list is positive when the left side of the pelvis moves upward.
- Pelvis rotation (transverse plane) is positive when the right side of the pelvis rotates anteriorly.
- Hip rotation is positive when the femur rotates medially (internal rotation).

Pelvis translations

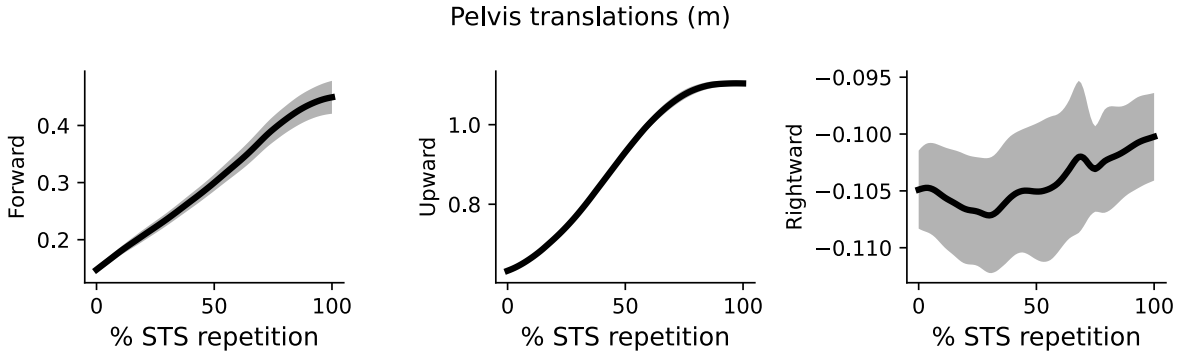

Figure 4: Pelvis translations (mean ± standard deviation across 5 repetitions) normalized over the sit-to-stand (STS) repetition.