Introduction to Randomised Controlled Trials

Gait Speed Limitations in Residential Aged Care: Prevalence, Relationship to Sarcopenia and Determinants

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Complexity of Gait Cycle
- Involves total body and segment movements
  - Dynamic stability in 6-dimensions;
  - Concentric, eccentric and isometric contractions;
  - Magnitude, direction, point of application & time of activation all important.
- Influenced by three levels of constraint
  - Organism, task and environment;
  - Example of a perception-action couple;
  - Often is a dual task due to dividing of attentional resources.

Deterministic model of gait
- Loss of step / stride length may reflect:
  - Reduced total body and joint power
  - Reduced dynamic stability
  - Reduced joint range of motion

Step Length
- Loss of step / stride frequency may reflect:
  - Longer ground contact time, especially double support
    - Reduced dynamic stability
  - Reduced speed of joint movements

Stride Frequency
Introduction to Randomised Controlled Trials

Sarcopenia & Gait Speed

- Gait speed perhaps most important functional outcome
  - Easily measured and very clinically relevant
  - Multifactorial, but biomechanics allows us to examine direct determinants of gait speed
  - Gait stability measures may also be important dynamic stability measures and falls predictors

IANA committee conducted systematic review of literature and found that low gait speed is predictive of:
- ADL or mobility disability
- Dementia
- Mortality
- Falls
- Institutionalisation and Hospitalisation

Table 1: Gait Speed categories for the RAC residents (n = 102) and the predicted effects from the literature.

<table>
<thead>
<tr>
<th>Gait Speed (m/s)</th>
<th>Number (%)</th>
<th>Predicted effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1.0</td>
<td>1 (1%)</td>
<td>Healthy older population. Lower risk of health events</td>
</tr>
<tr>
<td>&lt; 0.8</td>
<td>99 (97%)</td>
<td>Mobility and ADL disability at 2 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobility and ADL disability at 3.8 yrs</td>
</tr>
<tr>
<td>&lt; 0.7</td>
<td>96 (94%)</td>
<td>Death, hospitalisation, institutionalisation and falls</td>
</tr>
<tr>
<td>&lt; 0.6</td>
<td>90 (86%)</td>
<td>Functional or cognitive decline, institutionalisation and mortality</td>
</tr>
<tr>
<td>&lt; 0.42</td>
<td>59 (59%)</td>
<td>Functional dependence and severe walking disability</td>
</tr>
<tr>
<td>&lt; 0.2</td>
<td>22 (22%)</td>
<td>Extremely frail</td>
</tr>
<tr>
<td>&lt; 0.15</td>
<td>17 (17%)</td>
<td>Institutionalisation, highly dependent older people</td>
</tr>
</tbody>
</table>

Prediction of Walking Speed - Linear Regression

Univariable analysis – statistically significant factors at 10% level

<table>
<thead>
<tr>
<th>Factor</th>
<th>Coefficient (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male gender</td>
<td>-0.08 (-1.18 – 0.01)</td>
<td>0.09</td>
</tr>
<tr>
<td>Total SPPB</td>
<td>0.09 (0.07 – 0.10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physically active &lt; 50 yrs age</td>
<td>0.32 (0.12 – 0.52)</td>
<td>0.002</td>
</tr>
<tr>
<td>Physically active post retirement</td>
<td>0.12 (0.01 – 0.24)</td>
<td>0.03</td>
</tr>
<tr>
<td>IPAQ sitting time (hrs)</td>
<td>-0.03 (-0.01 – -0.04)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Multivariable analysis – statistically significant factors at 5% level

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<th>Factor</th>
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<th>P-value</th>
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</thead>
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<tr>
<td>Total SPPB</td>
<td>0.075 (0.07 – 0.08)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physically active &lt; 50 yrs age</td>
<td>0.32 (0.12 – 0.52)</td>
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<td>-0.01 (-0.00 – -0.02)</td>
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Prediction of Walking Speed from Participant History Only - Linear Regression

Multivariable analysis – statistically significant factors at 5% level

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Figure 2: Components of gait speed in mobility and risk of adverse outcomes found in literature.

Table 1: Components of gait speed in mobility and risk of adverse outcomes found in literature.
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Gait Determinants

Stride Determinants & Falls

• Results of the systematic review of Hamacher et al. (2011) indicate that many simple gait measures can distinguish between:
  - Older vs younger adults
  - Older fallers vs non-fallers
  • Variability in stride time, stance time, step length and swing time most predictive of falls

• How can such measures be obtained?

Clinical Gait Analysis Techniques

• 3-D high-speed motion capture
  - Criterion standard

• Pressure mat e.g. Gaitrite or pressure sole e.g. Pedar systems

• 2-D, regular speed video analysis

• Visual observation and stopwatch

Conclusions

• Gait speed limitations more endemic in RAC than muscle strength or mass
  - Predictive of many adverse effects
  - Predicted by physical activity history, sitting time & overall physical function

• Limited research conducted examining ways to improve gait speed in RAC
  - Even less has examined gait stability measures
  - Plasticity to improve gait outcomes relatively unknown
Future Research

- Assess gait patterns in RAC residents using GaitRite system
  - Obtain biomechanical predictors of gait speed

- Assess exercise- & nutrition-related changes in gait speed and stability in RAC residents using GaitRite system
  - Determine if changes in gait speed associated with improvements in other health, functional & QOL outcomes