Relationship between lower limb strength and running performance in 3 populations of athletes

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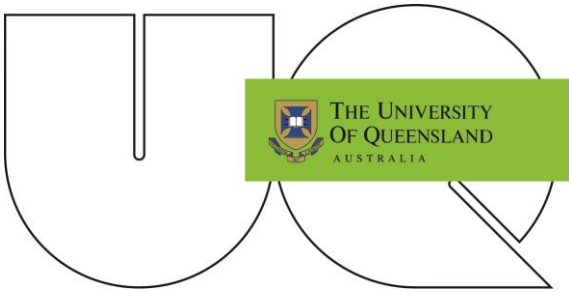
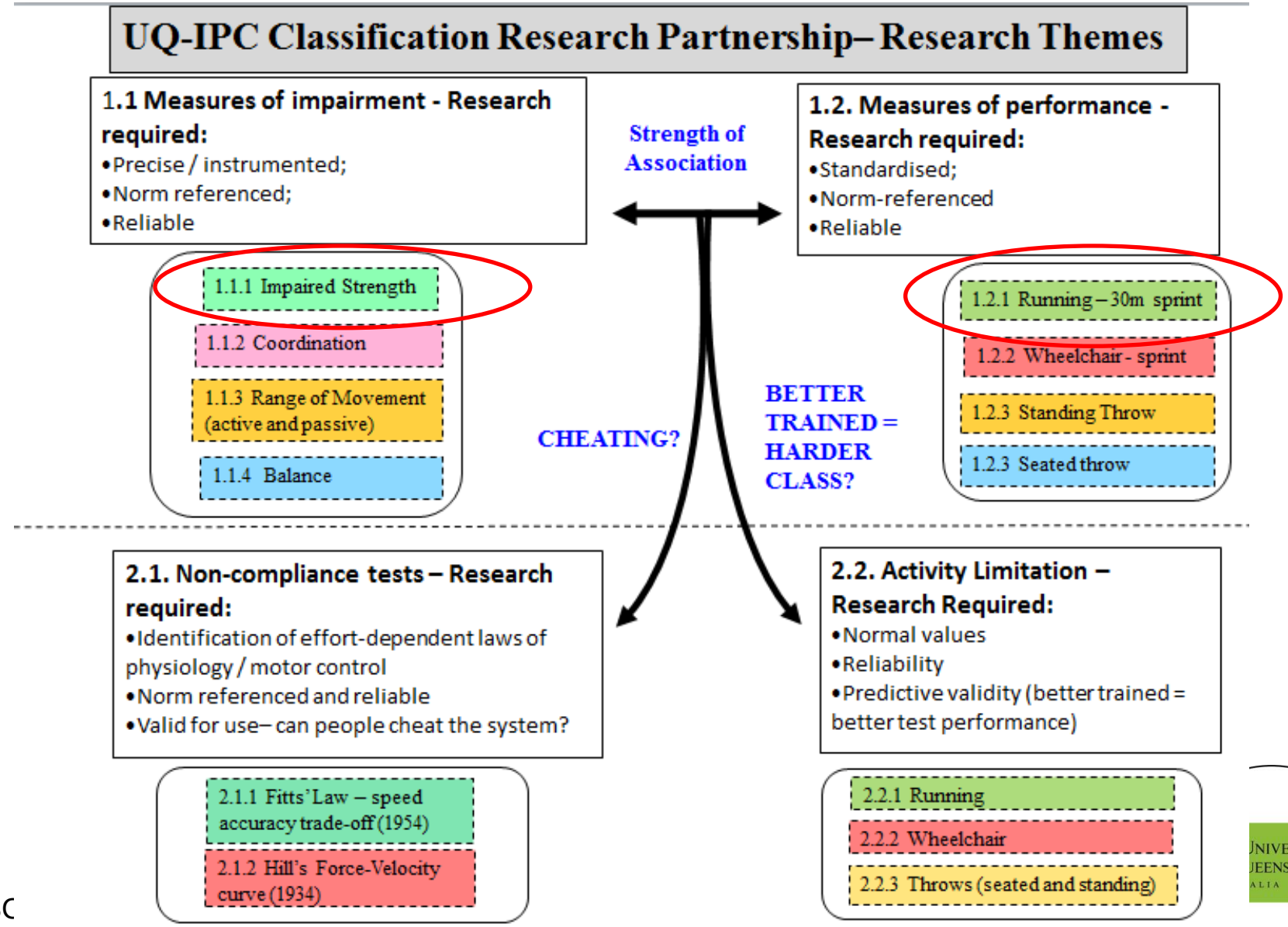


Background

- Classification in Paralympic Sport aims to minimise the impact of impairment on the outcome of competition.

- The relationship between strength and performance should be assessed in conditions where strength is likely to be impaired

- Previous research has recognised the importance of muscle strength in the performance of activities of daily living in people with impairments however, less is known about the relationship between strength and key components of running performance, including stride length and stride frequency



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Aims

- Quantify differences in running performance in people with Cerebral Palsy (CP)/Traumatic Brain Injury (TBI) and Poliomyelitis (Polio) when compared to non-disabled athletes
- Quantify impairments of muscle strength in these groups
- Determine the relationship between lower limb strength and sprint parameters (time to 60m, stride length, and stride frequency).
- Investigate differences in stride parameters across the 3 groups (stride length and stride frequency) with respect to muscle strength

Methods

- 66 Athletes
- Group 1: 29 athletes with cerebral palsy (CP) or Traumatic Brain Injury (TBI)
- Group 2: 9 athletes with polio
- Group 3: 28 non-disabled athletes (NDA)
- All athletes performed two isometric strength tests (lower limb extension test and isolated plantar flexion test), and a running performance test (maximal 60m sprint test).
- Stride parameters were taken from video recorded from 45m of the fastest trial

Statistical analysis

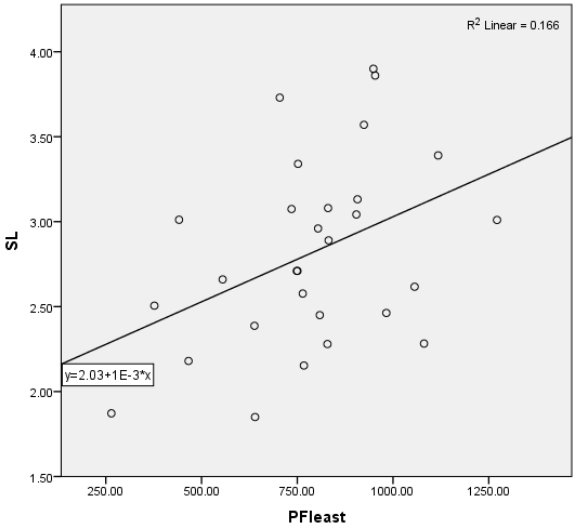
- One-way between-group ANOVA's with post-hoc Bonferroni correction -significant differences between groups in relation to 60m sprint time and strength measures as well as Stride length and stride frequency.
- Pearson correlations to determine if there were correlations between strength and running performance and other variables

Outcome	CP Mean(±SD)	Polio Mean(±SD)	Non-Disabled Mean(±SD)
60m Sprint time (s)	12.00 (2.17)*	14.59(3.47)*	6.53 (0.43)
Stride Length (SL) (m)	2.69 (0.55)*	2.16 (0.56)*	4.24 (0.41)
Stride Frequency (SF) (Hz)	2.17 (0.40)*	2.14 (0.40)	1.93 (0.18)
Least affected leg extension (N)	1062 ± 320.4*	1067 ± 380.7*	1743 ± 400.5
Most affected leg extension (N)	795.6 ± 243.0*	444.4 ± 239.7*[a]	1582 ± 374.6
Least affected plantar flexion (N)	731.8 ± 249.7*	974.2 ± 109.1*[a]	1555 ± 294.5
Most affected plantar flexion (N)	585.3 ± 239.1*	656.2 ± 219.7*	1411 ± 279.4
Symmetry of leg extension	0.75 ± 0.16*	0.4600 ± 0.23*[a]	0.91 ± 0.07
Symmetry of plantar flexion	0.782 ± 0.19*	0.68 ± 0.21*	0.91 ± 0.06

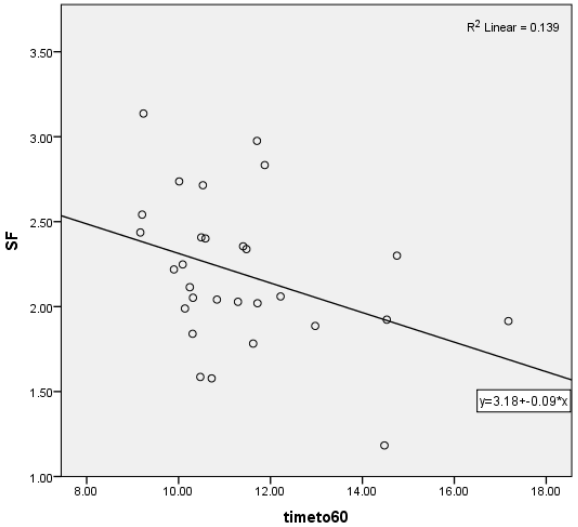
* denotes significantly different from the Non-Disabled group ($p<0.05$)
[a] denotes significantly different from the CP/TBI group ($p<0.05$)

Results and Discussion- Athletes with CP

- Strength profile
- Significant relationship between Plantar Flexion strength (least affected) and Stride length



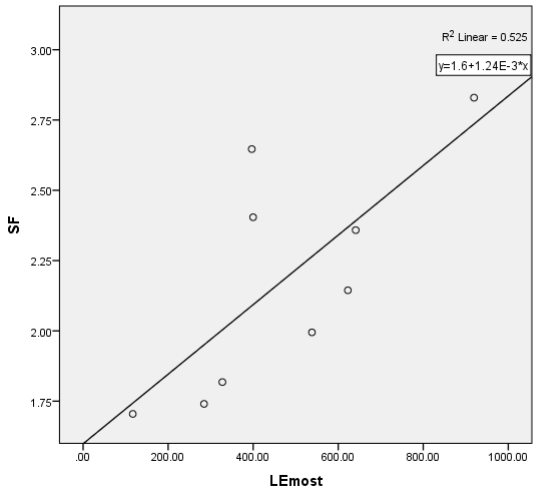
- Significant relationship between Stride Frequency and running performance



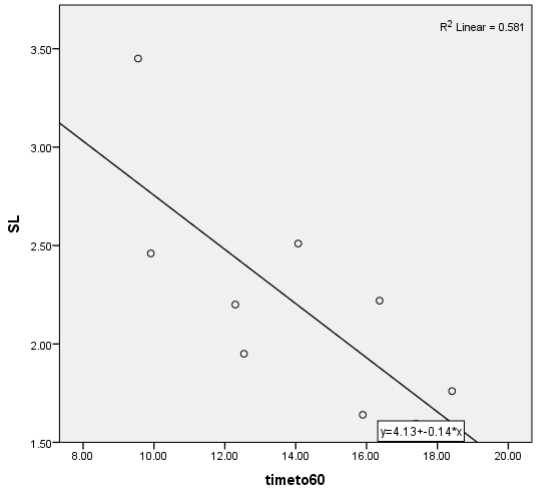
- **Need to optimise SF because of impairments limiting SL? Performance may then depend on coordination and ROM**

Results and Discussion – Athletes with Polio

- Strength Profile
- Significant relationship between Leg Extension Strength and Stride frequency



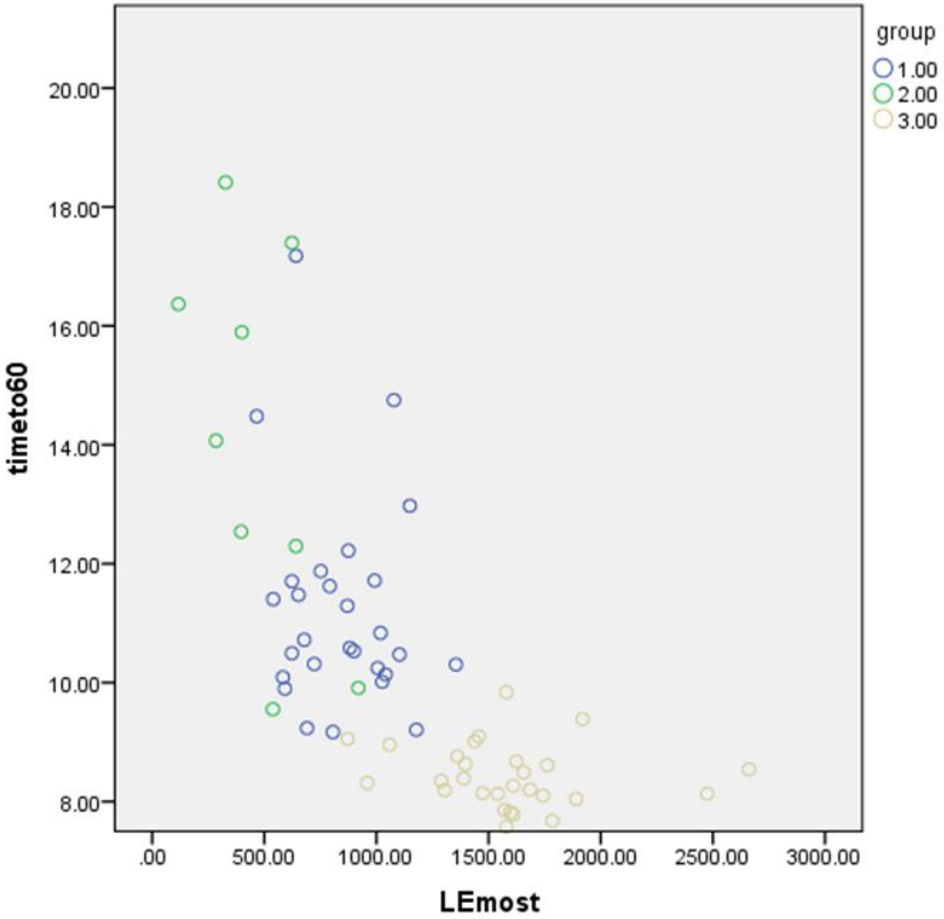
- Significant relationship between Stride length and running performance



- **Need to optimise SL because of impairments limiting SF? Symmetry?**

Discussion

- No relationships in between strength and performance in ND runners
- Whole group indications that there are strength imperatives for performance across proximal and distal muscles and as an index of symmetry



Conclusions

- Assessment of muscle strength is a key requirement of evidence-based classification in Paralympic Athletics.
- Results indicate that as impairments to muscle strength increase in severity, running performance is more affected.
- Future studies should investigate the use of muscle strength assessment to distinguish between impairment severity

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