Development of two evidence-based classification systems for Paracanoe

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Para-kayak

Para-va'a

Part 1
3D kinematics and kinetics
Performance determining joints
Ranges of movement and power production

Limb deficiency
Impaired muscle power
Impaired range of motion

Able-bodied kayak
N = 10

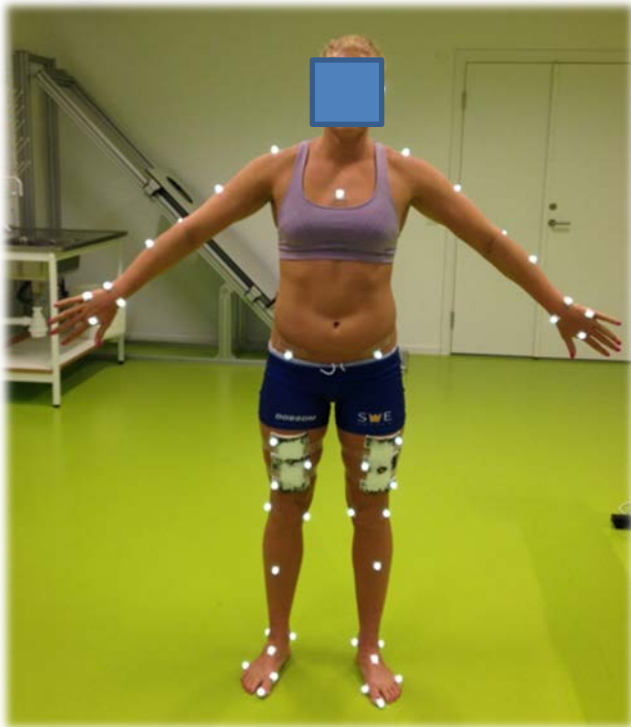Para-kayak
N = 41

Able-bodied va'a
N = 10

Para-va'a
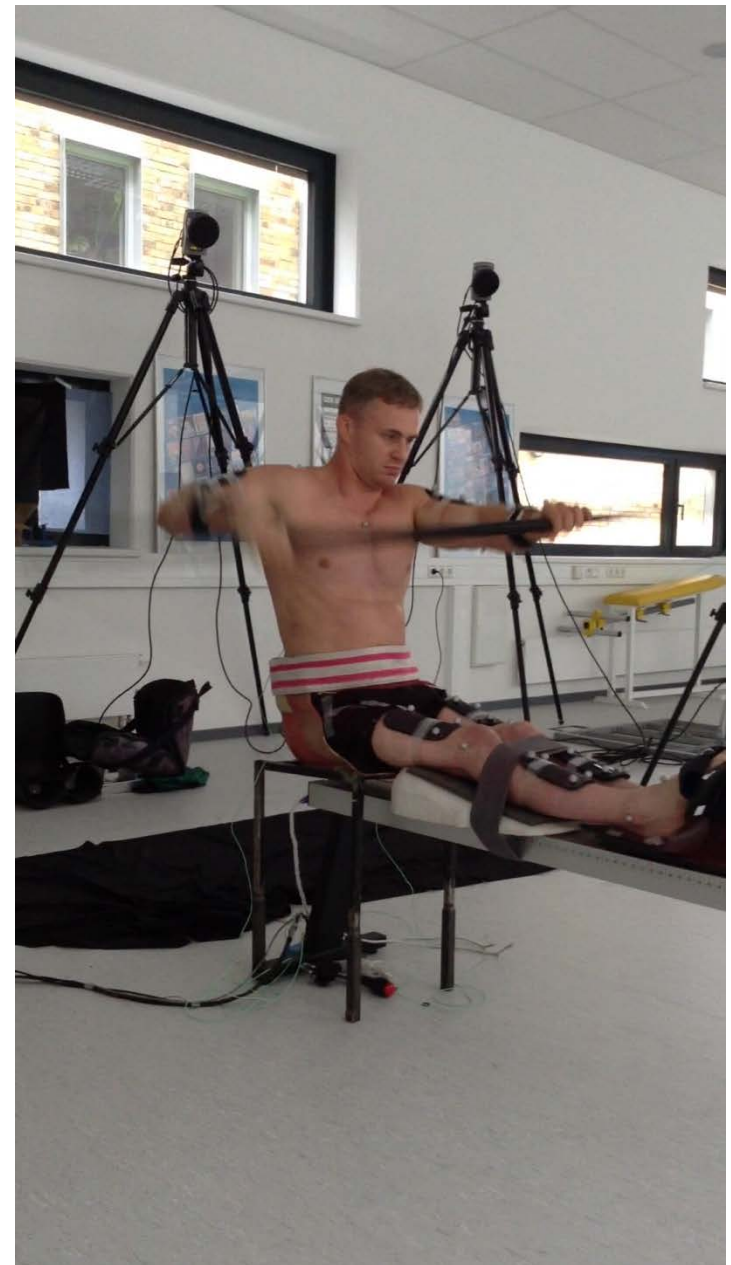N = 44

12-camera 3D optoelectronic system
39-64 reflective markers

Marker placements were adjusted for athletes with limb deficiency

Elite sprint athlete

Elite para-kayak athlete

Results Part 1
Defining of sport-specific reference values

Movement	Anatomical RoM	Reference values based on able-bodied athletes (±1 SD)
Trunk flexion	80°	9° [b]
Trunk extension	25°	5° [b]
Trunk lateral bending	20°	7°
Trunk rotation	45°	30°
Hip flexion	120°	110°
Hip extension	20°	75° [c]
Knee flexion	135°	55°
Knee extension	0°	0°
Ankle plantar flexion	45°	40°
Ankle dorsiflexion	20°	0°

Anatomical RoM values from Hislop and Montgomery (1995).

Results Part 1
Correlations between Power output and
Sport-specific range of movement and joint angle values

		Males		Females	
		Pearson r	*p-value*	*Pearson r*	*p-value*
Trunk	**Flexion Maximum**	0.83	<0.001	0.56	0.017
	Rotation RoM	0.66	<0.001	0.83	<0.001
Leg	**Hip Flexion RoM**	0.71	<0.001	0.82	<0.001
	Knee Flexion RoM	0.69	<0.001	0.88	<0.001
	Ankle Flexion RoM	0.38	0.039	0.79	<0.001

Part 2
Develop physical assessment tests for trunk and leg function

Trunk (42 trunk tasks)

Manual Muscle Test

Sitting balance Test

Leg (14 leg tasks)

Manual Muscle Test

Sport Specific leg test

Part 2
Develop sport-specific technical assessment test

Items scored
Left & Right leg movement
Balance
Trunk posture
Trunk rotation
Trunk side bending

Results Part 2
Validation of the classification tests

Compartments
- Trunk   (rotation RoM, flexion maximum)
- Leg   (hip, knee, ankle flexion RoM)
- Sport-specific   (trunk and leg compartment)

Results Part 2
Validation of the classification tests

A. Correlation Compartments and power output

	Males		Females	
	Pearson r	p-value	Pearson r	p-value
Trunk compartment	0.82	<0.001	0.82	<0.001
Leg compartment	0.71	<0.001	0.86	<0.001
Sport-specific compartment	0.80	<0.001	0.89	<0.001

Results Part 2
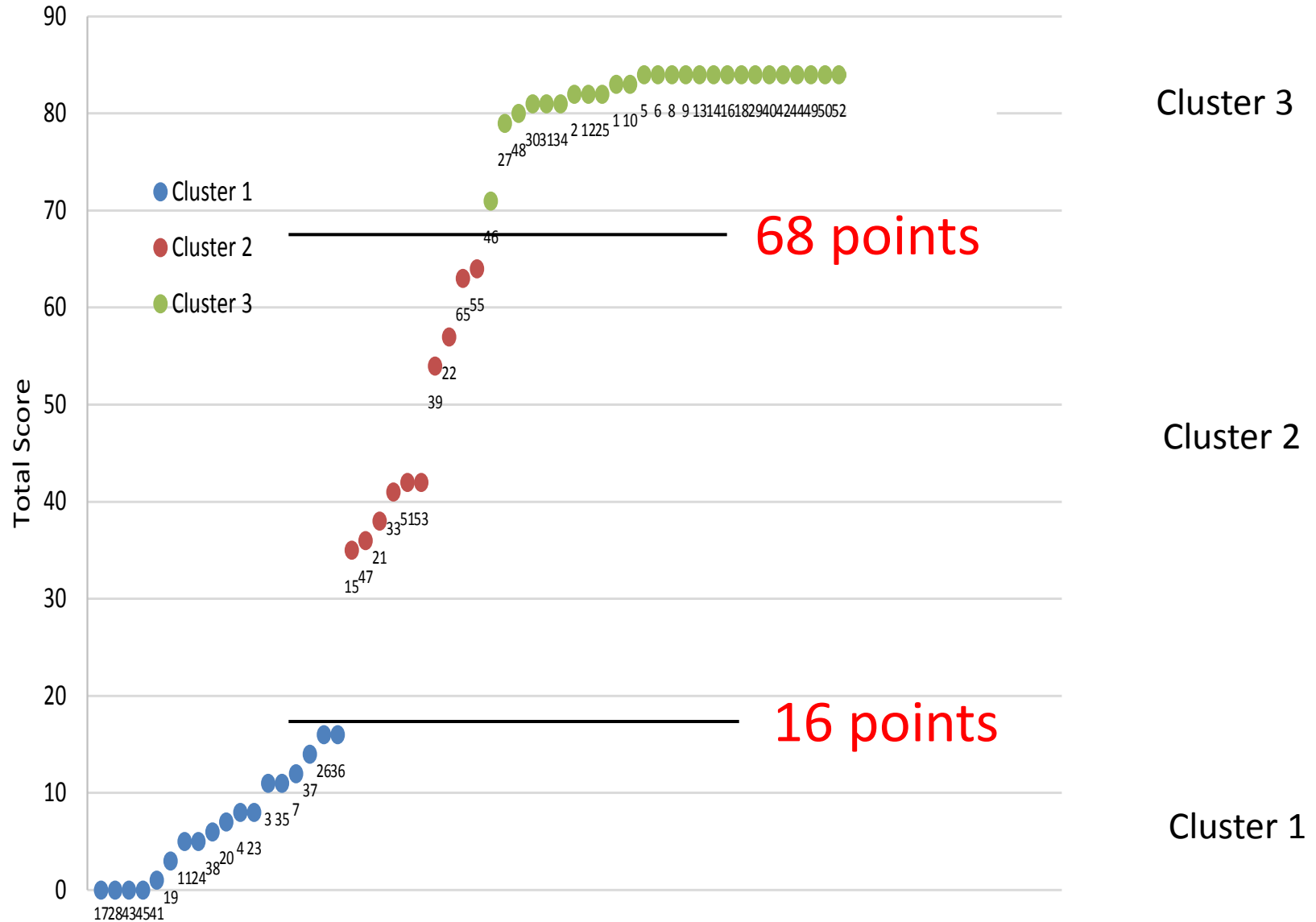
Validation of the classification tests

Test	Spearman's Rho	p- value
Trunk test vs. Trunk compartment	0.69	<0.001
Leg test vs. Leg compartment	0.72	<0.001
On-water test vs. Sport specific compartment	0.81	<0.001

Results Step 3
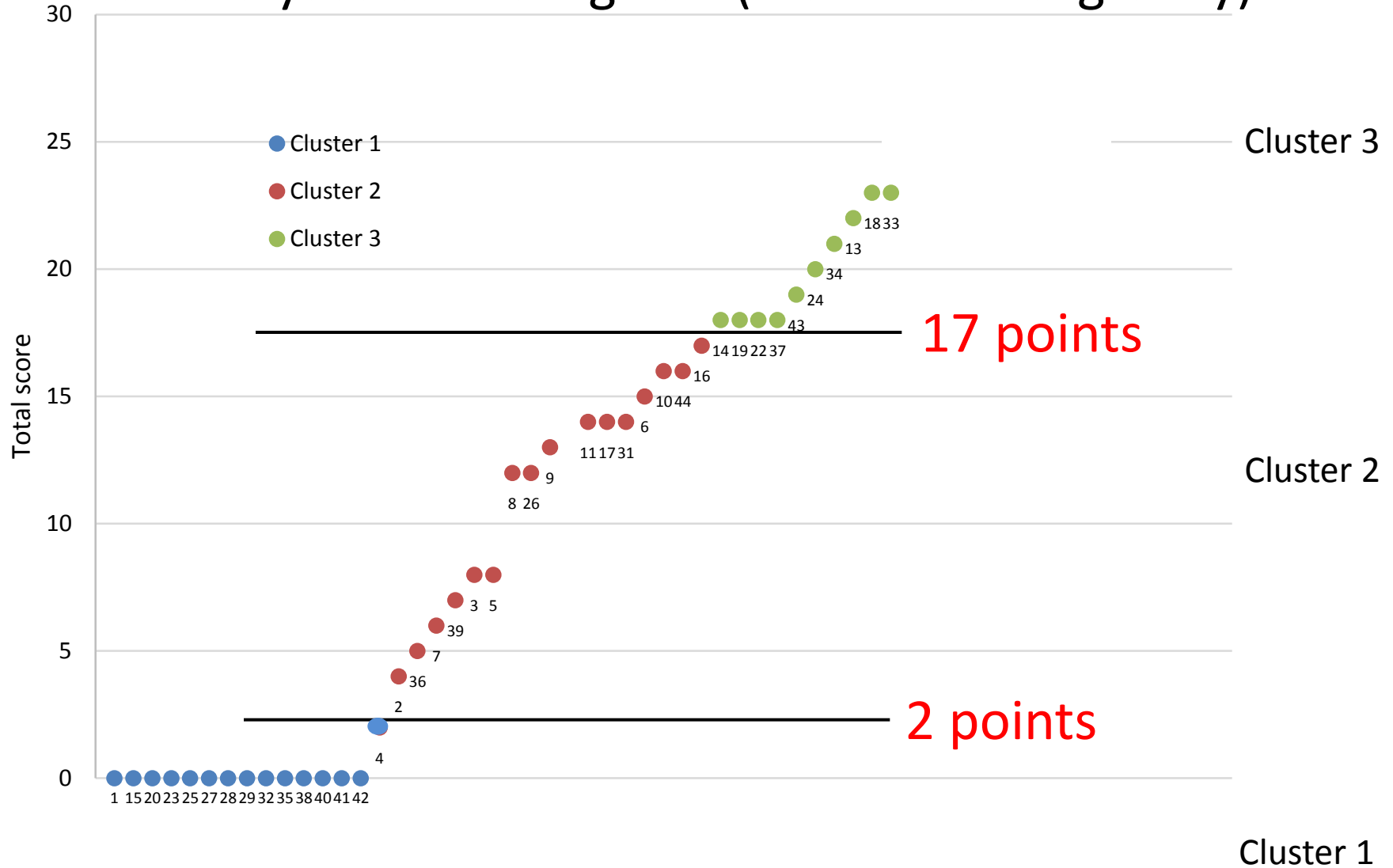
Cluster analyses of the tests

Results Part 3
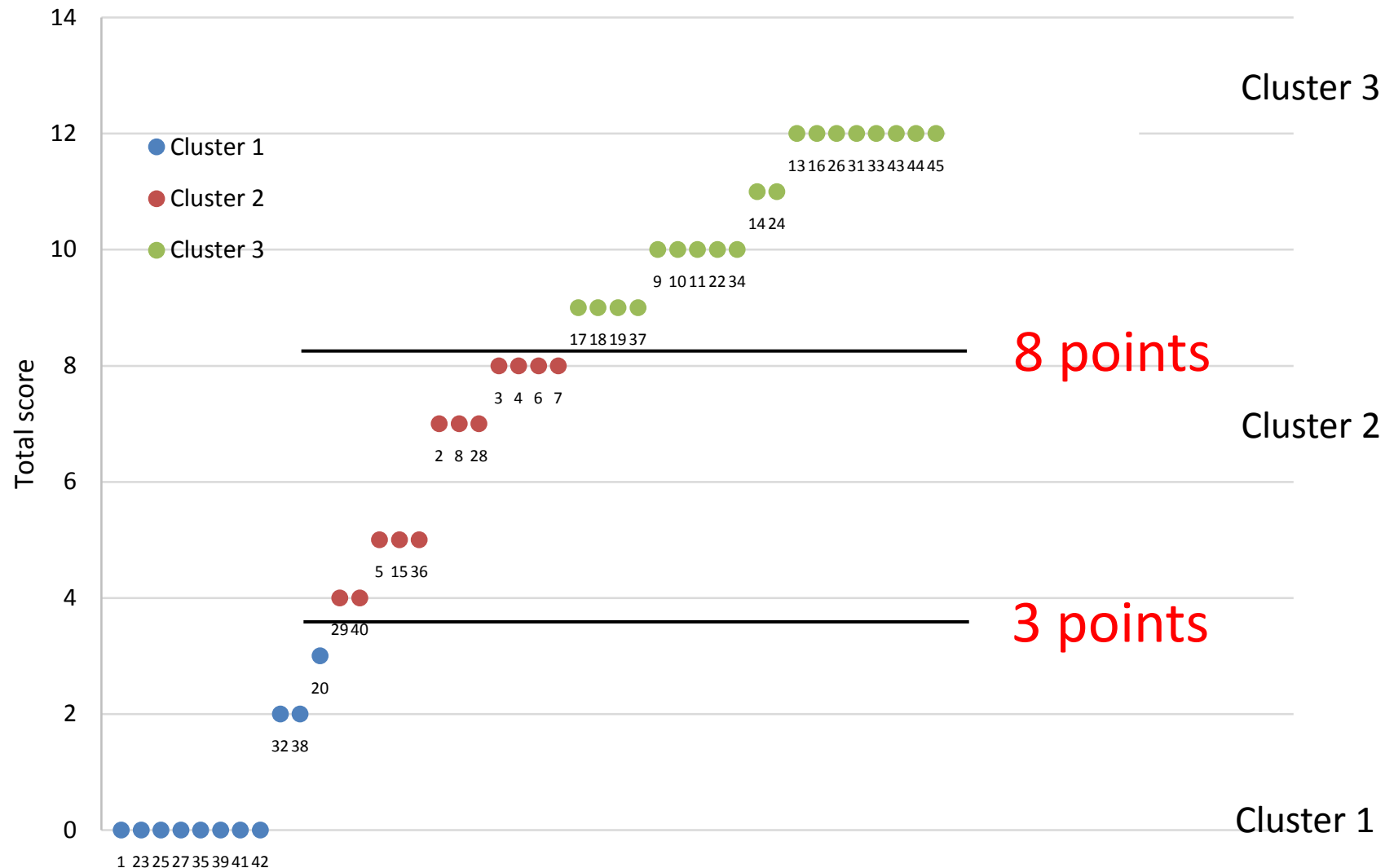## Cluster analyses of the trunk test (max 84 p)

Results Part 3

Cluster analyses of the leg test (max 24 for eligibility)

Results Part 3
Cluster analyses of the on-water test (max 12 p)

Results Part 4
Identification of number of classes

Minimal eligibility for parakayak athletes in Paralympics

Minimal loss of 4 points in one leg in the leg test

Rio results

Women	KL 1	KL 2	KL 3
1st place (s)	58.760	53.288	51.348
2nd place (s)	58.874	55.599	51.378
3rd place (s)	1:00.23	56.796	52.103

Women	AB
1st place (s)	39.864
2nd place (s)	40.279
3rd place (s)	40.401

Men	KL 1	KL 2	KL 3
1st place (s)	51.084	42.190	39.810
2nd place (s)	51.129	43.726	39.909
3rd place (s)	51.220	44.936	40.199

Men	AB
1st place (s)	35.197
2nd place (s)	35.362
3rd place (s)	35.662

Thank you for your attention!

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- International Paralympic Committee
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