Paralympic Sports Research from a UK Perspective

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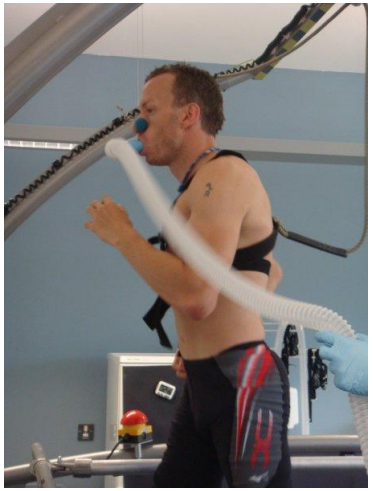

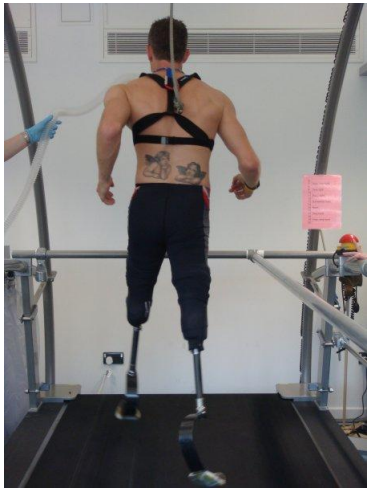

Sport Science Support – Applied Research

One of the primary aims of a sport science support programme is to provide high performance athletes with accurate and reliable information about their training status as well as to make recommendations for interventions that may enhance their performance.

Dovetail the needs of the coach with their use of 'Science'…….this should be seen as a partnership!

Key Principles: **Paralympic Research**

- Coach-led

- Athlete-centred

- Performance impact

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Feedback / Educational Material

Research in the UK: Disability Sport

NGB
Centres of Excellence

FES
Glasgow
Brunnel

Swimming/ technique
Payton

Testing ACE Protocols
Smith, Price

NHS Posture/Chair-set up
Stanmore - Rose

Thermoregulation
Price, Webborn, Castle
Tolfrey, Diaper

sportscotland institute of sport
high performance expertise

ParalympicsGB

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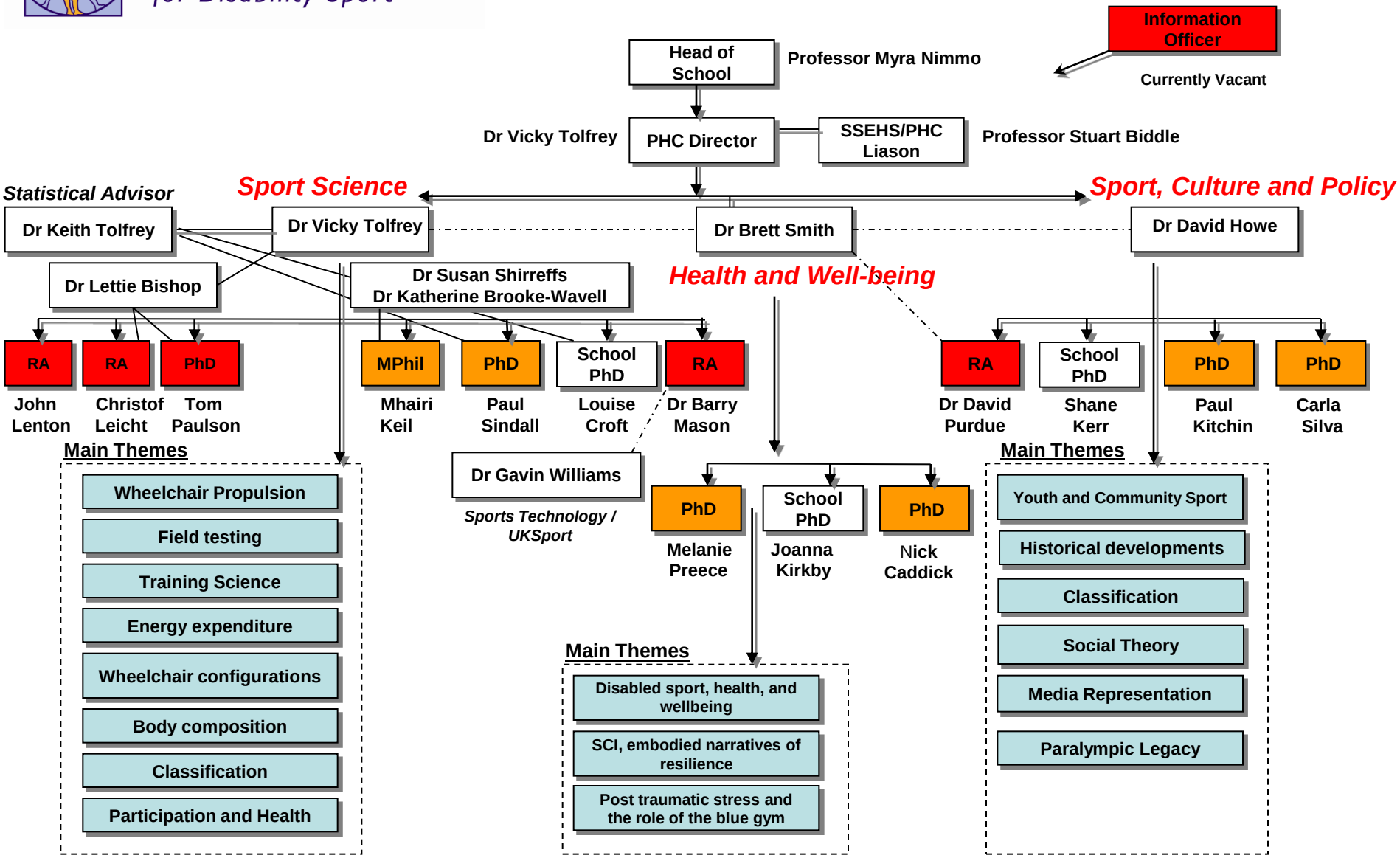
ENGLISH INSTITUTE OF SPORT

sports council wales
cyngor chwaraeon cymru

BASES
The British Association of Sport and Exercise Sciences
Honorary Fellow

Peter Harrison Centre
for Disability Sport

CURRENT STAFFING



Recent PhD Completions 2011
Barry Mason – funded by UKSport
David Purdue – SSEHS PhD

Staff Funding Key:
Red (PHC funds), White (Loughborough University), Orange (External funding).

- UK Sport's Research and Innovation programme – with NGB's: identifies ideas that may be relevant to specific sports and ensure that these ideas have the best possible opportunity of coming to fruition.

- The UK Sport Research and Innovation programme has secured over £12 million in external funding to support the work in addition to the lottery and exchequer funding. UK Sport recognises the importance of securing the financial support and expertise of some of the world's leading technological experts and has pioneered seeking and securing a third income stream for their work in this area.

Wheelchair Configurations for Court Sports

ParalympicsGB

Introduction

Maintaining an active lifestyle is especially important for the health and wellbeing of wheelchair users. Regular exercise can play a key role in preventing the likelihood of cardiovascular disease and other associated health risks. Consequently, wheelchair sport can be an important vehicle for achieving an active lifestyle. The wheelchair court sports (wheelchair basketball, wheelchair rugby and wheelchair tennis) are an increasingly popular activity in the UK and contribute significantly towards an active lifestyle given that they are characterised as endurance based activities interspersed with frequent bouts of high intensity pushing.

Many participants progress through to competing at an elite level in these sports, whereby the performance of the following manoeuvres becomes crucial to successful mobility performance:

Endurance
Acceleration
Manoeuvrability
Sprinting
Braking
Stability

Although the physical conditioning of the athlete is imperative to each of these aspects of mobility performance, the configuration of the wheelchair also plays a vital role. Until recently however, very little scientific research has been conducted to establish the exact influence of different wheelchair configurations on mobility performance specific to the wheelchair court sports.

The aim of this booklet is to document the effects that certain areas of wheelchair configuration can have on each aspect of mobility performance to assist users from a novice/rehabilitation setting to elite athletes about the consequences of certain wheelchair selections specific to both the task and individual. In addition to mobility, considerations are also offered wherever possible relating to the effects of configuration on ball handling skills and stroke production performance. A less than optimal wheelchair configuration not only impairs performance, it can also place the user at an increased risk of injury.

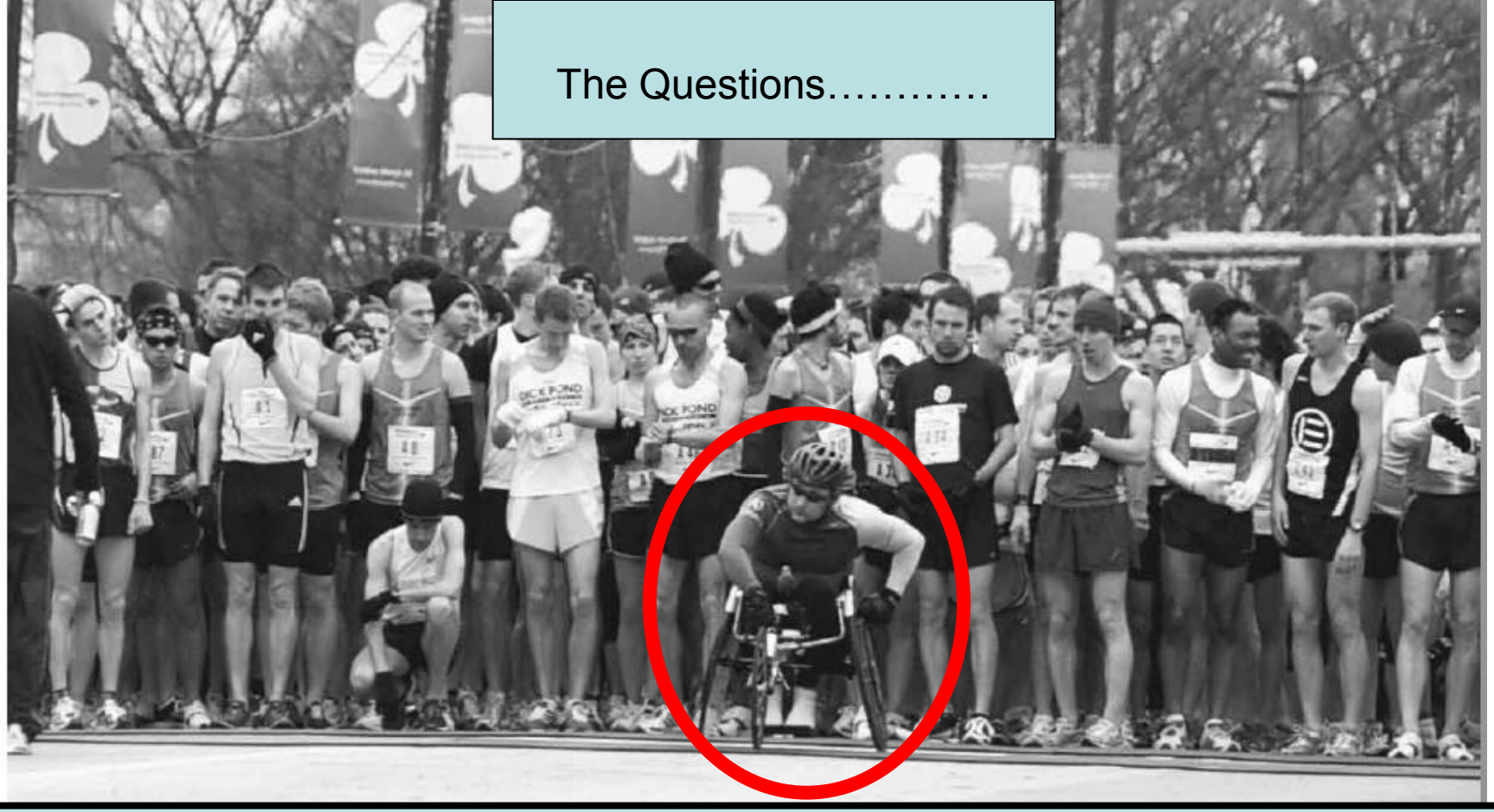
There are numerous areas to a court sports wheelchair that can be configured in a variety of different ways. This booklet addresses the following areas and documents considerations for users with regards to each:

Contents

Basketball Wheelchair

Rugby Wheelchair

Tennis Wheelchair



The Questions……

‘How do the training requirements differ in disabled athletes when compared to those of an able-bodied (AB) athlete?’

‘Can we use the training/coaching recommendations used by AB athletes?’

Recent Questions……

Quantification of Training Load in Wheelchair Athletes

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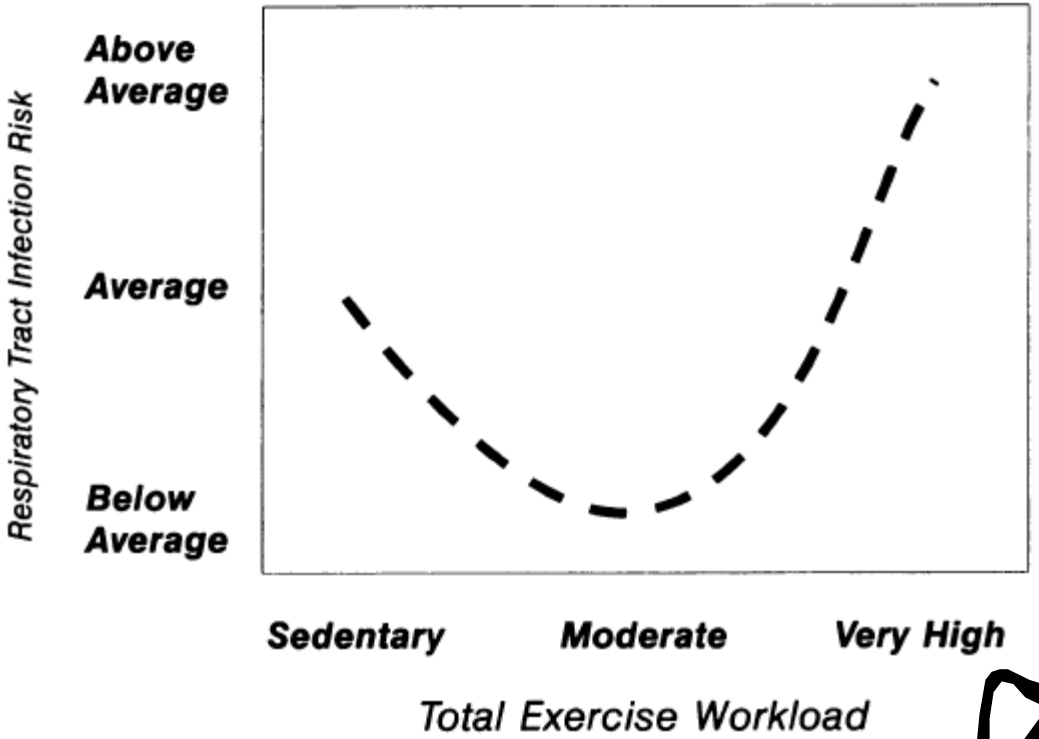
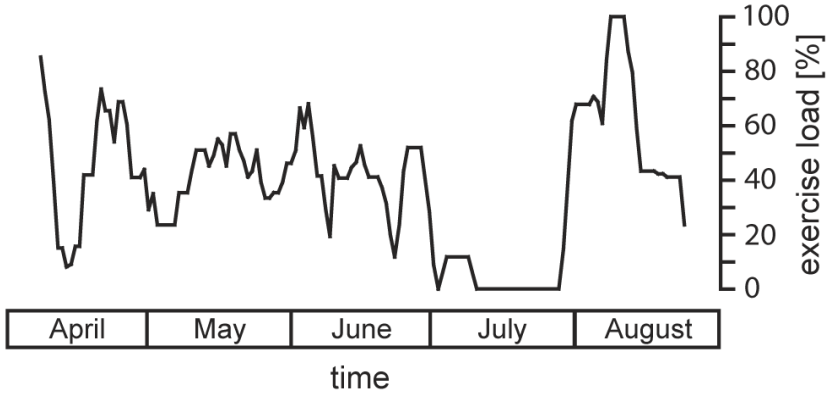
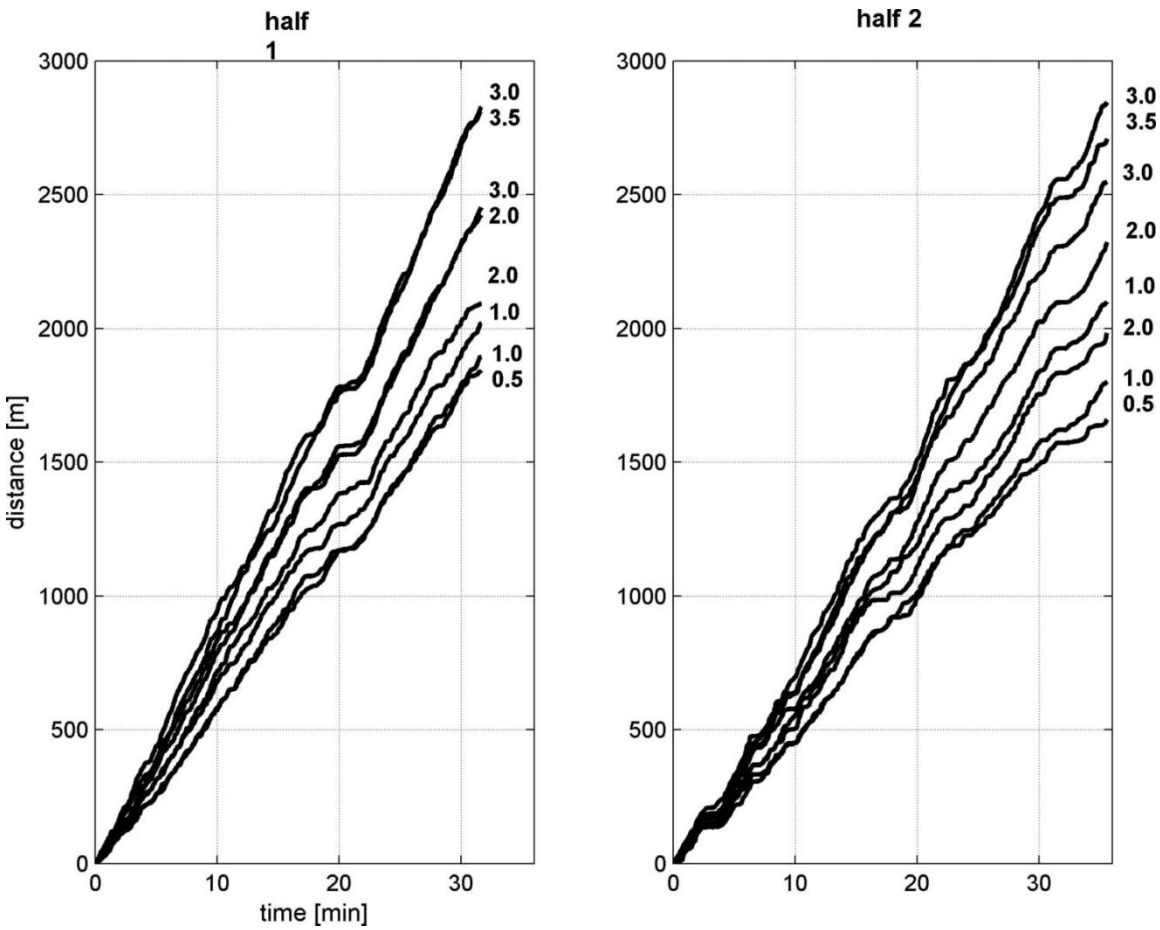


Being an athlete can be risky…

Supporting the Coaches / Trainers

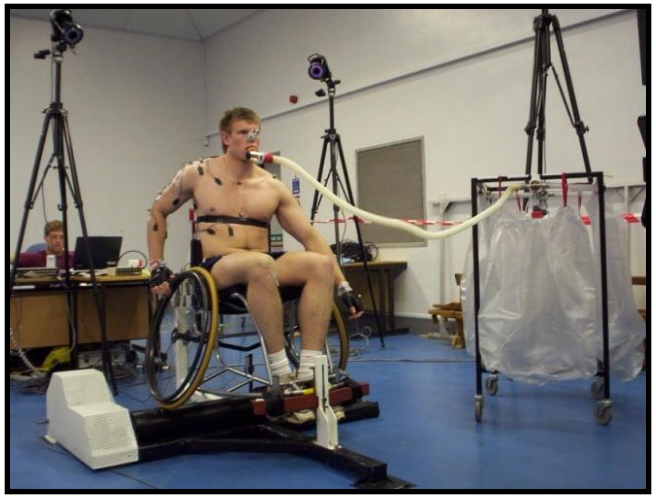
- Volume of training
- Recovery
- …….disability.





The distances covered by a group of highly trained wheelchair rugby players by classification level, as derived through video analysis and manual digitisation (Sarro et al., 2010).

What does research look like?



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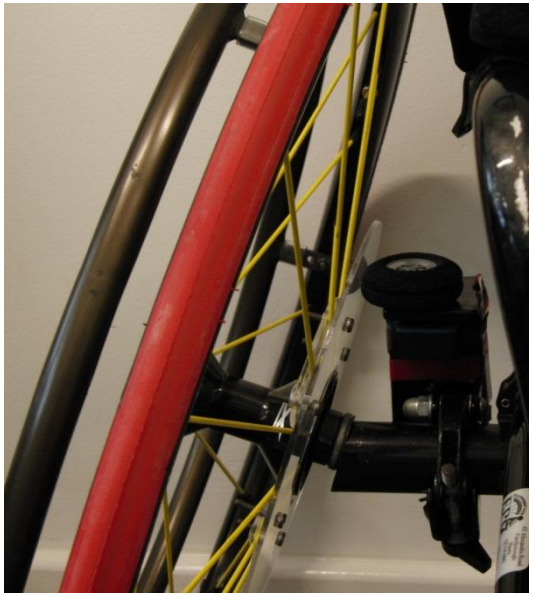
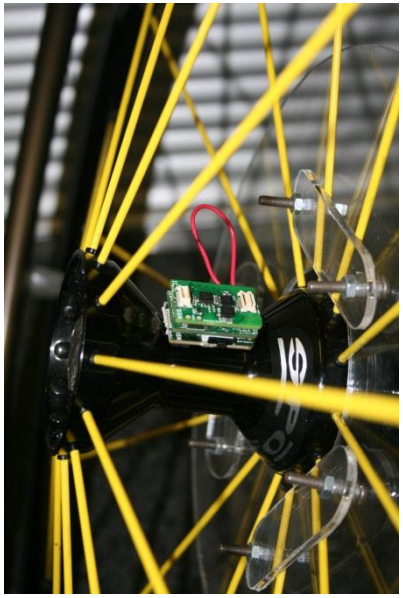
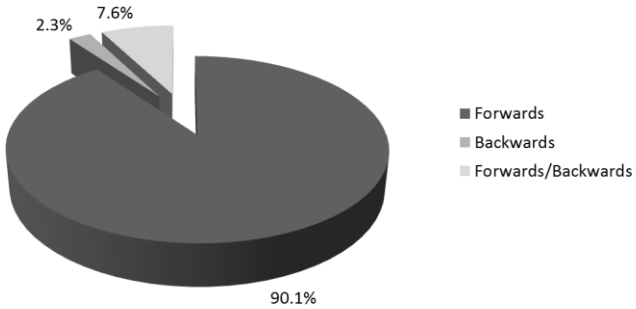
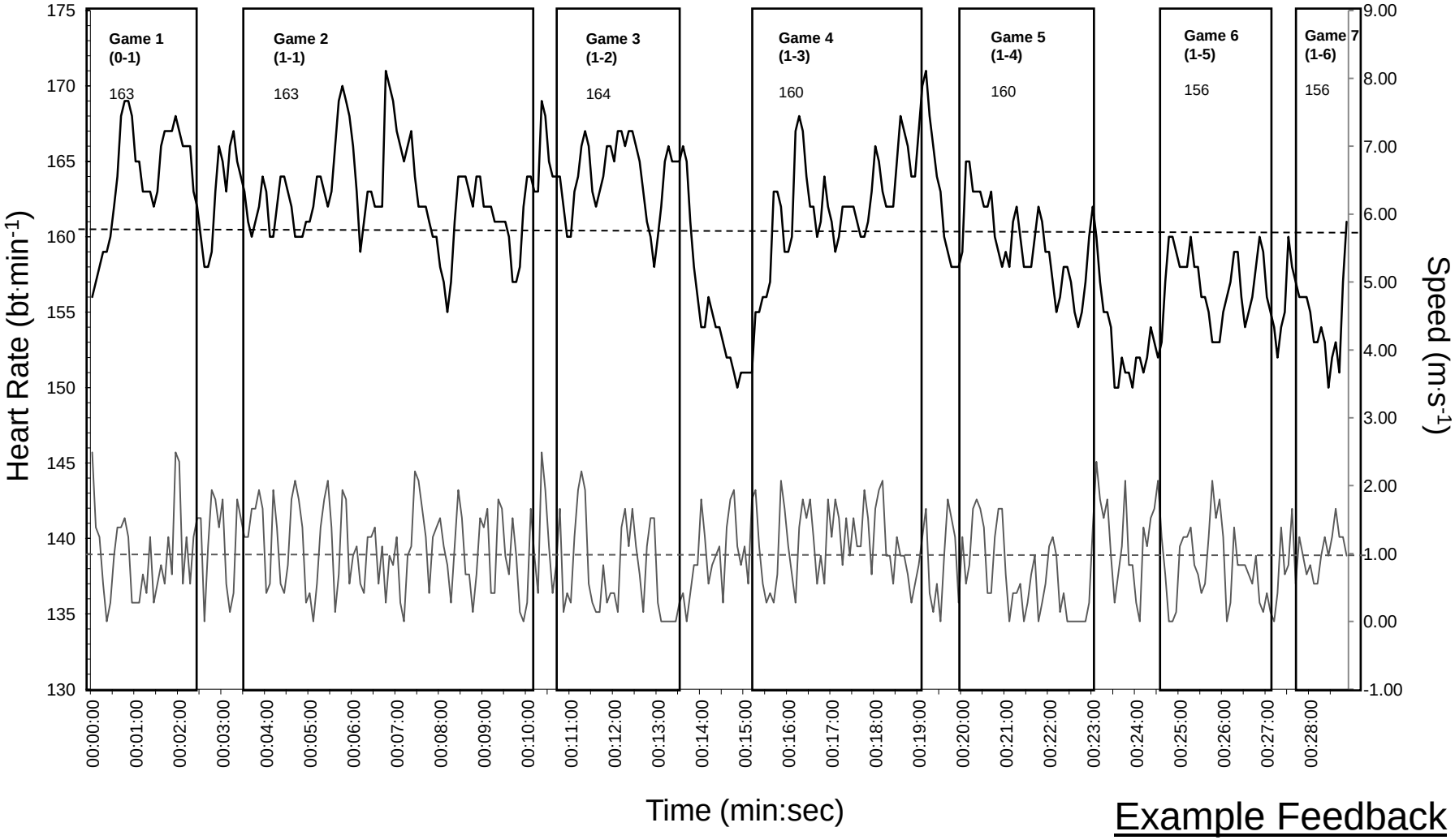
From the Lab to the field…….

Velocometers/ Data Loggers and Gyroscopes









Example Feedback

The lactate threshold (LT) was defined visually as the first workload before there was a sustained increase in BLa above resting values. A second breakpoint known as the lactate turn point (LTP) was identified and is used to describe a second workload where BLa begins to accumulate quickly. Based upon the aforementioned parameters six different HR training zones were identified (Godfrey & Whyte, 2006).

Croft et al., (2010). IJSPP

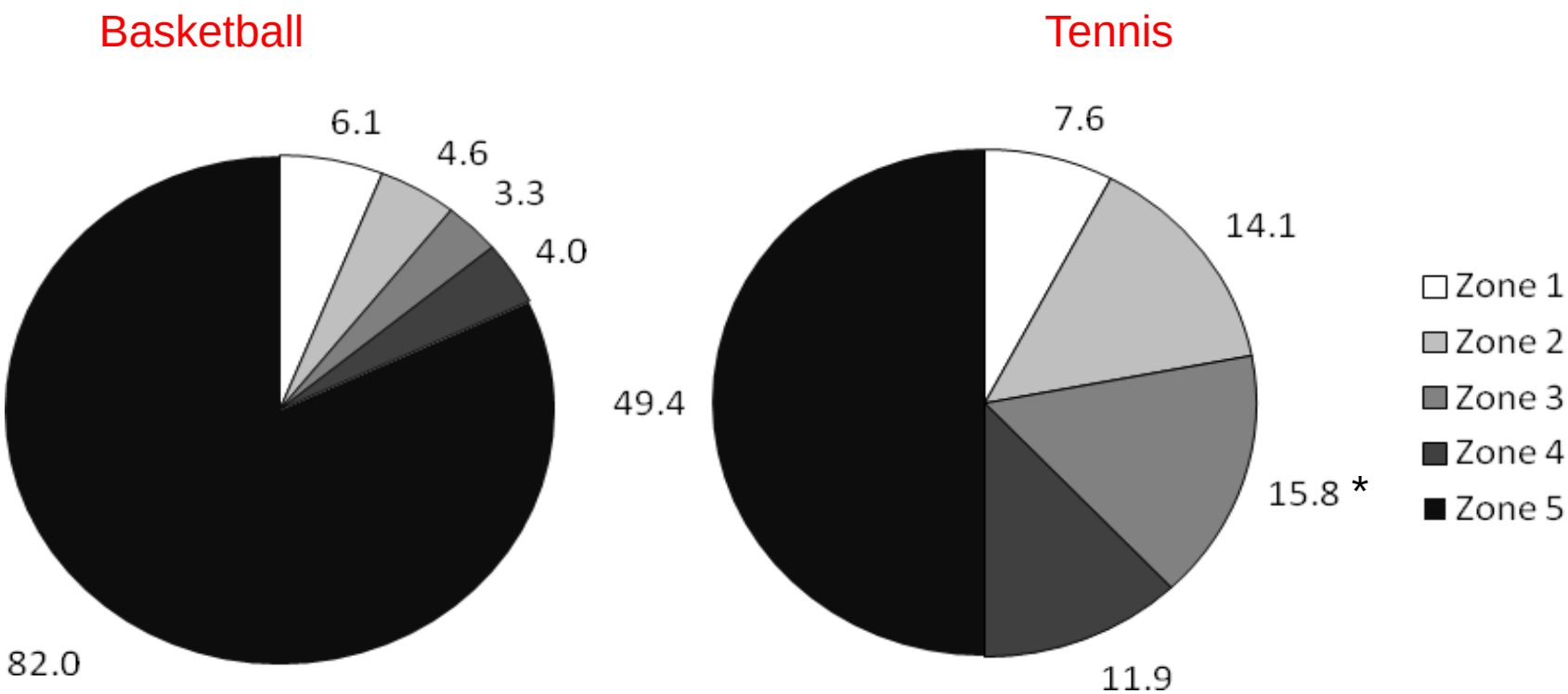


Fig 1. A comparison of the percentage of time spent in the different training zones based on the blood lactate profiles during competitive play with (a) basketball and (b) tennis players.

* Significant difference occurred when compared to zone 5 ($P<0.05$)

Training Methods

Heart rate monitors are common in wheelchair sport training.
Photo taken by John Lenton.

Training Methods
HR zones
Blood lactate concentration (thresholds)
SRM / Power Tap
RPE

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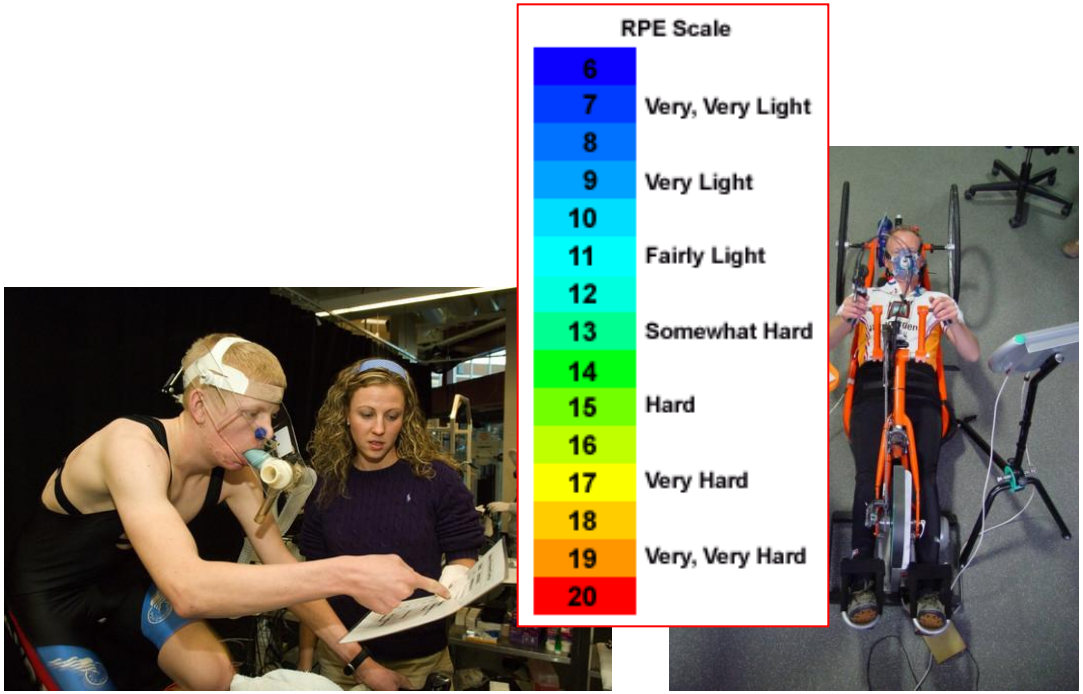
Use of Heart Rate Zones - Questionable

Considerations:

Trained status / Disability groups

Rate of Perceived Exertion (RPE)

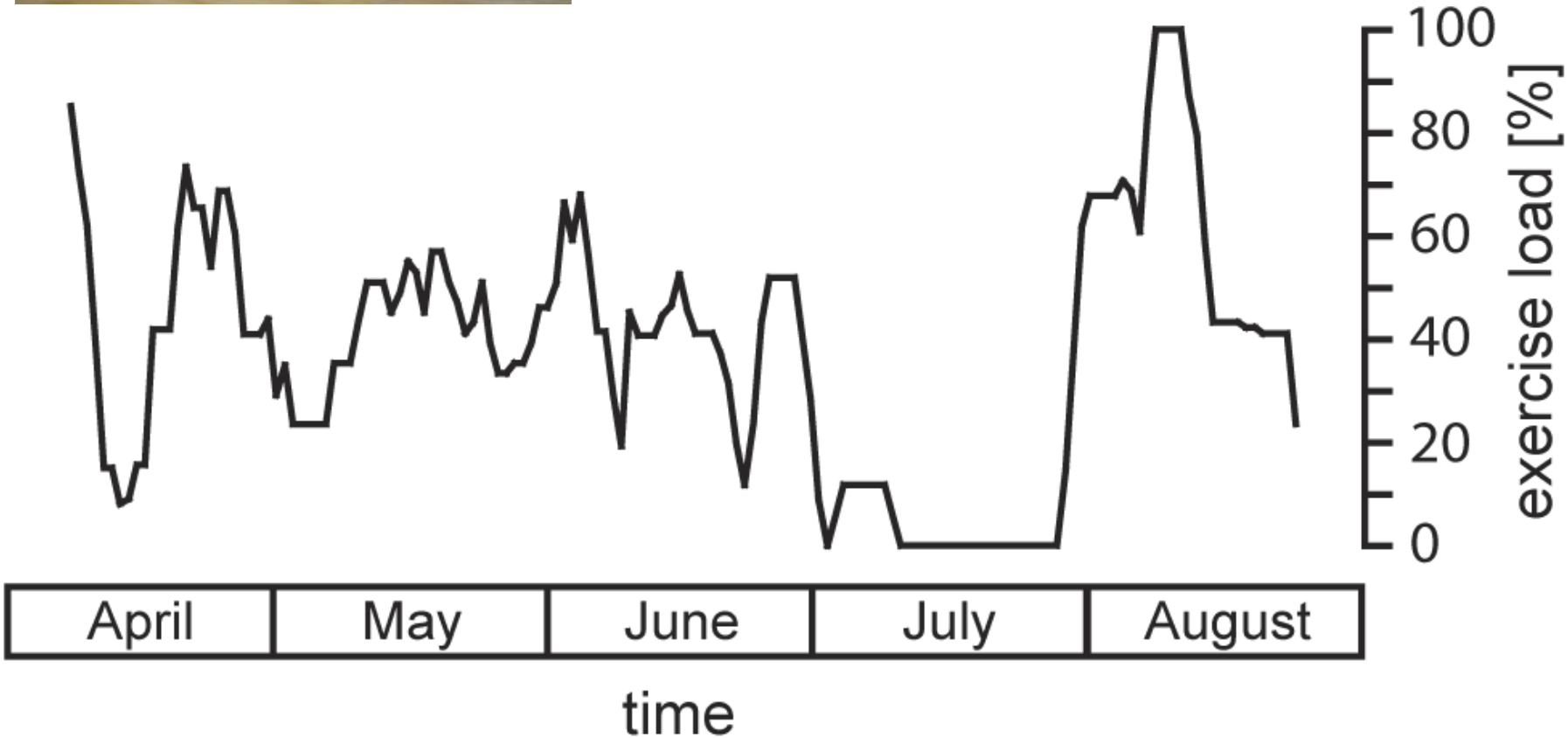


The amount (in minutes) and toughness was rated as a score from 1 to 5 for all training/games.

The ‘training score’ = time x toughness.

These scores were calculated for each player separately.

The highest value (100%) indicates the time point during the 5 month period when training/games were toughest for each player individually.



Leicht et al., (in press)

To examine the validity of perception-based intensity regulation (RPE) during hand-cycling exercise.

8 male, wheelchair-dependent participants with SCI at the T4 level.

All tests were conducted in an adjustable 18-gear recumbent sports handbike mounted on a cycleforce magnetic flow ergotrainer (Tacx).

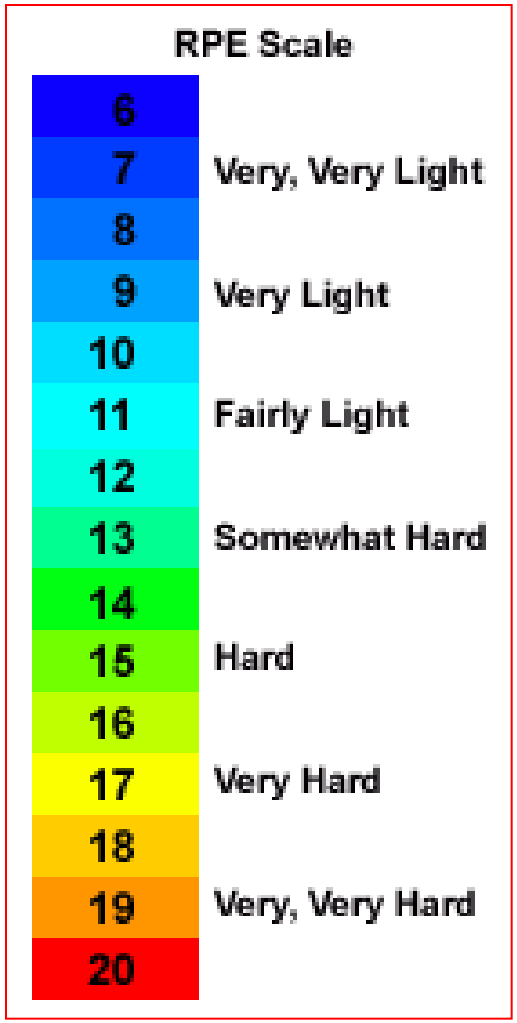
Low rider (Draft)

Goosey-Tolfrey et al., (2010). Regulating intensity using perceived exertion in spinal cord injured participants. *MSSE.* 42(3), 608-613.

Methods

- Two 20-min exercise tests were completed at an individualized power output (PO) at moderate and vigorous intensities (50 and 70% of VO_{2peak}, respectively).

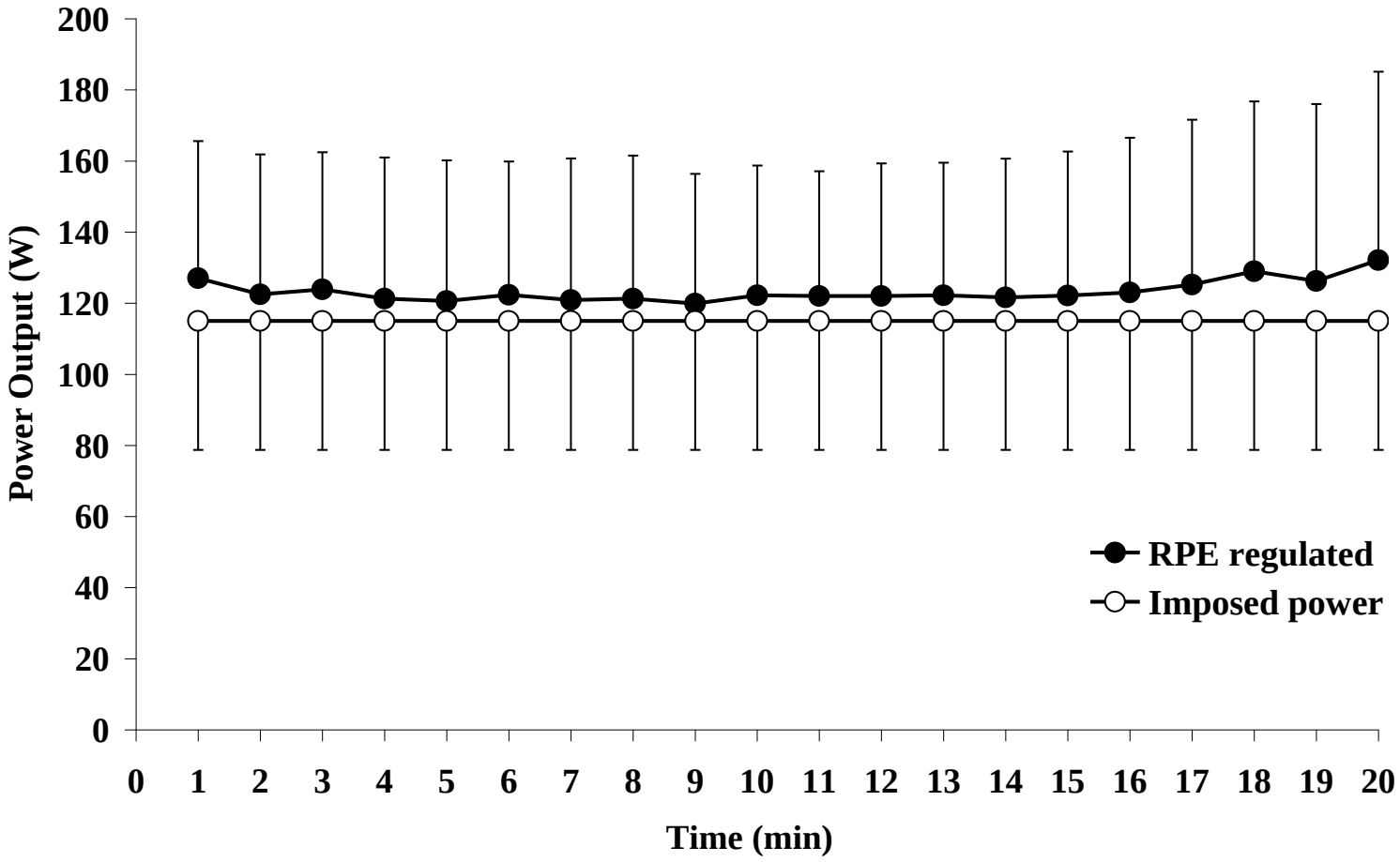
- On a separate occasion, participants were instructed to produce and maintain a workload equivalent to the average RPE for the 20-min imposed condition in a counter-balanced order.



Regulation of Effort

RPE Scale	
6	
7	Very, Very Light
8	
9	Very Light
10	
11	Fairly Light
12	
13	Somewhat Hard
14	
15	Hard
16	
17	Very Hard
18	
19	Very, Very Hard
20	

Power output (mean(SD)) during 20-min of hand-cycling exercise at the vigorous intensity between imposed and RPE regulated trials.



Physiological responses during 20-min of hand-cycling exercise at the vigorous intensity between imposed and RPE regulated trials (n = 8)

	Imposed Power	RPE Regulated	P-value
	Vigorous Intensity		
RPE	16.0(1)	16.0(1)	-
VO_2 ($L \cdot min^{-1}$)	**1.90(0.32)**	**2.00(0.44)**	0.16
% $_{peak}$	**73(4)**	**76(7)**	0.17
HR ($b \cdot min^{-1}$)	166(14)	166(17)	0.97
% peak HR	87(6)	87(7)	0.94
[BLa^-] ($mmol \cdot L^{-1}$)	3.07(1.00)	4.04(2.07)	0.20

Note. same for lower exercise intensity

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Implications

- Potential for the use of RPE to self-regulate exercise intensity in persons with lesions at/below T4.

- Validation with tetraplegic participants - who have sustained greater sensorimotor loss and subsequent functional and mobility impairment is needed.

Photo: Courtesy of Thomas Abel

These data suggest that RPE is effective for controlling moderate and vigorous intensities throughout a 20-min hand-cycling exercise session for SCI participants.

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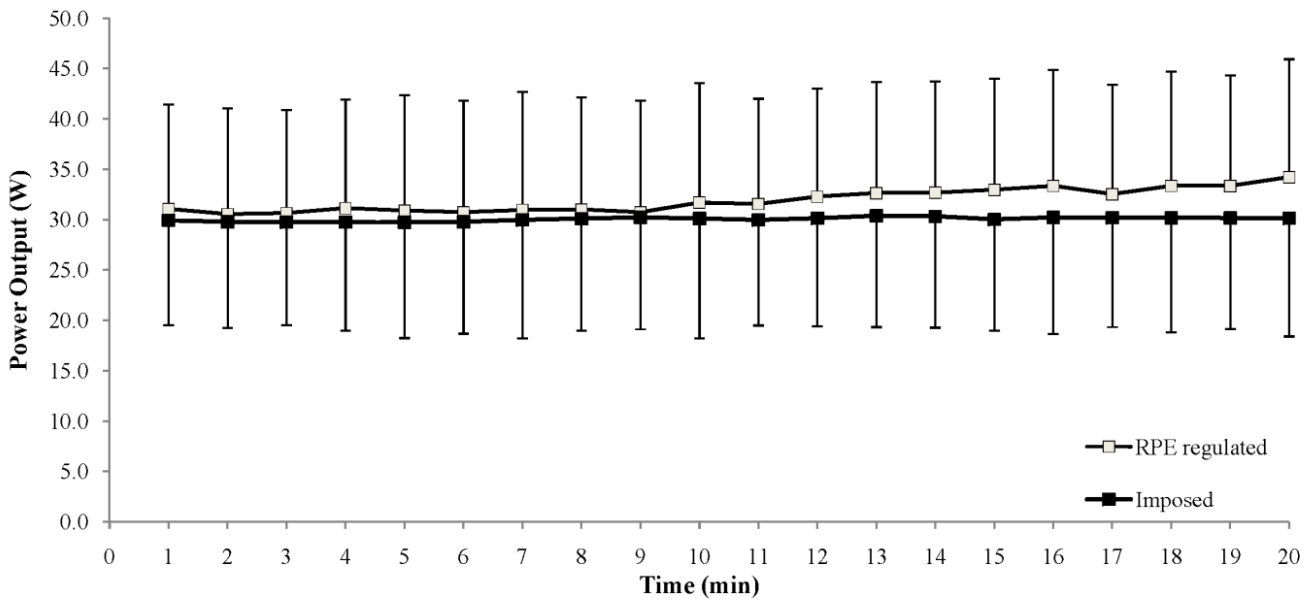
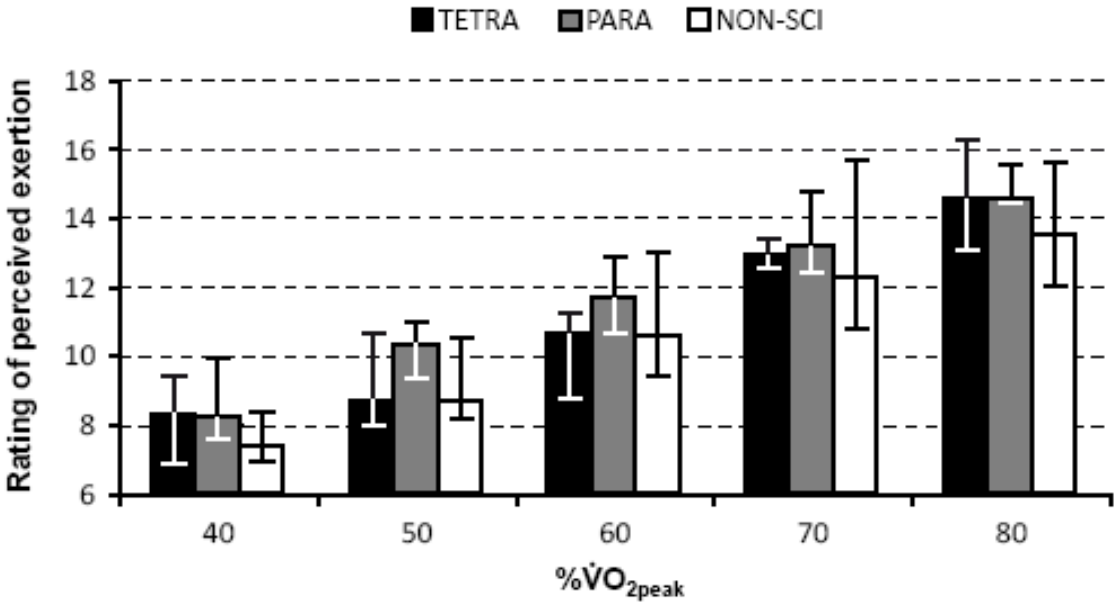


Power output (mean ± SD) during 20-min wheelchair propulsion at 70% VO_{2peak} between imposed and RPE regulated trials for **quadriplegic rugby players**.

Paulson et al., (2011, unpublished)



% VO_2 pk.	[1]RPE	AB RPE
40	7-8	8
50	9-10	9
60	11-12	11
70	12-13	13
80	14-15	15

Rating of perceived exertion vs. during submaximal exercise. Data are medians and interquartile range. Three different disability groups - TETRA, tetraplegic; PARA, paraplegic; NON-SCI, non-spinal cord injured.

[1]Leicht et al., (2011) Scand J Med Sci Sports. May 23. doi: 10.1111/j.1600-0838.2011.01328.x. [Epub ahead of print)

Answer: In general we can employ the same underpinning training principles as for AB athletes yet with subtle but significant alterations.

An understanding of the disability is essential and the assessment of the needs of the individual must be done thoroughly.


The Future: 'The journey from rehabilitation to wheelchair sporting excellence'

The lessons we learn……



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Thank you

Any questions?

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