Institution: University of Chester

Unit of Assessment: 3 Allied Health Professions, Dentistry, Nursing and Pharmacy

Title of case study: Monitoring and prescribing preventive and rehabilitative physical activity for cardiovascular and neuromuscular diseases as a catalyst to being involved in national and international standards of practice

1. Summary of the impact

This research into the effective management of exertion intensity, symptoms and pain in the treatment of cardiovascular and neuromuscular diseases has resulted in the setting of national and international standards for safe and effective education, training and professional practice.

Physical activity forms a core component in the prevention and rehabilitation of cardiovascular disease and in genetically acquired neuromuscular disorders. Physical activity benefits are linked to the volume - frequency, intensity and duration - of participation, which will bring about physiological and/or psychosocial improvements.

2. Underpinning research

Dr John Buckley's research focuses on managing exercise intensity and estimating exercise capacity for the purposes of primary and secondary prevention, both in cardiovascular disease and with McArdle Disease, a neuromuscular disorder. As a result, he has become increasingly involved in national education and training programmes, national specialist services for exercise in disease prevention and the rehabilitation of cardiovascular and neuromuscular conditions.

The special, and sometimes unique, focus of this work has been around the element of managing safe and effective exercise intensity through effort and pain perception using Borg's rating, which measures perceived exertion and pain scales. His work originated at Keele University in 1998 and, in 2006, was transferred to, and has continued at, the University of Chester as Reader.

The concept of using effort and pain perception for people to regulate their own exercise intensity is rooted ultimately in creating self-efficacy and self-management in clients and patients. This approach has recently been advocated in the recent scientific statement published by the British Association for Cardiovascular Prevention and Rehabilitation (BACPR) so that patients are neither over reliant on specialised clinicians nor physiological monitoring devices.

So often, people are rendered long-term patients with perceptions of 'being ill' because clinicians inadvertently apply techniques and measurements that make the patient reliant upon the established healthcare system in the UK.

In relation to cardiovascular disease prevention and rehabilitation, the research specifically focuses on the reliability and concurrently validity of managing exercise intensity safely and effectively. The key finding throughout is that participants need to be exposed to using ratings of perceived exertion at least three times for a given level on the Borg scale to represent the same exercise intensity.

From the perspective of concurrent validity, the Borg scale measures in these studies have been performed in a novel way when compared against set physiological criteria. They have been found to provide valid representations of physiological strain, thus deeming the scale, with practice, to be of good use in managing exercise intensity. Not only has this shown to be true for aerobic exercise but also for use in strength training exercise. This has resulted in the publication of the first study using Borg's CR10 exertion and pain scale in strength training for older people, over 55 years of age. The co-author was himself Professor Gunnar Borg, the inventor of the Borg scale, which has received more than 35,000 citations in the world of sports medicine and exercise science.

In the referenced papers by Morris et al, all based at the University of Chester, the Borg scale was used as the independent variable, where the participant is, in reality, given the responsibility of controlling intensity. In traditional research on the Borg scales, perceived exertion is often used as a response/dependent variable, where the experimenter or clinician controls the intensity. Dr Buckley's group has now extended this research into the area of guiding exercise in older people with heart failure.

In using Borg's scales to manage muscle pain in patients with McArdle disease, Buckley has begun a completely unique area of study. His research has demonstrated the practical use of this pain scale in managing intensity in aiming to avoid exertion levels where serious muscle damage could lead to a clinical emergency.

3. References to the research

References to the research, all of which have appeared in peer reviewed journals:

1. **Buckley J.P.**, Sim J., Eston R.G. Reproducibility of ratings of perceived exertion soon after myocardial infarction: responses in the stress-testing clinic and the rehabilitation gymnasium. *Ergonomics*, 2009 52(4): 421 – 427.
2. Godfrey R.J., Whyte G.R., **Buckley J.**, Quinlivan R. The role of lactate in the exercise-induced human growth hormone response: evidence from McArdle's disease. *Br. J. Sports Med.* 2009; 43: 521-525
3. Morris M., Lamb K., Cotterrell D., **Buckley J.** Predicting Maximal Oxygen Uptake Via a Perceptually Regulated Exercise Test (PRET) *J. Exerc. Sci. Fitness*; 2009 7(2): 122-128
4. Quinlivan R.C.M., **Buckley J.P.**, James M., Twist A., Ball S., Duno M., Vissing J., Bruno C.D., Cassandrini D., Roberts M., Winer J., Rose M., Sewry C. McArdle Disease; clinical review. *J. Neurol. Neurosurg. Psychiatry* 2010 Nov;81(11):1182-8.
5. Morris M., Lamb K., Cotterrell D., Hayton J., **Buckley J.** The validity and reliability of predicting maximal oxygen uptake from a treadmill-based sub-maximal perceptually regulated exercise test. *Eur. J. Appl. Physiol.* 2010: 109: 983 – 988
6. **Buckley J.P.** and Borg G.A.V. Borg's scales in strength training; from theory to practice in young and older adults *Appl. Physiol. Nutrit. Metab.* 2011 Oct; 36(5): 682-92

4. Details of the impact

This research has ensured Buckley is recognised nationally and internationally in the area of health-based and rehabilitative exercise.

Since 1997 he has given numerous conference presentations in the UK and abroad and has been involved in professional development education courses for doctors, nurses, physiotherapists, exercise scientists and exercise practitioners. It was these international contacts, and respect for his practice-based research, which led to him taking on leading roles to produce guidelines, education and training materials for the British Association of Sport and Exercise Sciences (BASES) and the British Association for Cardiovascular Prevention and Rehabilitation (BACPR).

Buckley's work with BASES led to the dissemination of health-based guidance on exercise intensity through the BMJ's ABC of Sport and Exercise Medicine, which is a popular resource for hundreds of general practitioners and non-exercise specialist physicians who are involved in health promotion and rehabilitation (reference 1).

As he joined the University of Chester in 2006, Buckley contributed specifically to the BACPR cardiac rehabilitation Exercise Instructor course training materials and manuals. Since then, this material has been part of educating and qualifying more than 1,500 specialist instructors who work mainly in community health settings throughout the UK. He continues as a tutor on these courses and an advisor to other tutors. More recently, increasingly advanced education materials, manuals, and practice standards on monitoring exercise intensity have been created for clinical practitioners involved in cardiac rehabilitation, including nurses, physiotherapists and clinical physiologists (reference 2).

Similarly, Buckley has provided the BASES guidelines for using ratings of perceived exertion in both sport and clinical populations. These guidelines form the basis of all laboratory and clinical teaching/training for the 20,000+ undergraduate and postgraduate sport and exercise science students enrolled in higher education in any given year (reference 3).

In having made a significant contribution to writing these guidelines and teaching resources of BASES and BACPR, Buckley has also been invited to lead the writing of the National Occupation Standards, at Skills Active, for the Advanced Exercise Instructor working in Cardiac Populations and for Sport and Exercise Scientists. This work has led to the development of the new BASES Certified Exercise Practitioner qualification which is being rolled out across the UK as a means of quality assuring practice in newly qualified sport and exercise science graduates. Some of the work applied to this new qualification has also been part of the recent recognition of BASES as a licensed body of the Science Council. In integrating Buckley's work with BASES, BACPR and the Association of Chartered Physiotherapists in Cardiac Rehabilitation (ACPICR), since 2011 he has played a leading role in an inter-professional forum of these three groups known as the BACPR – Exercise Professionals Group. This inter-professional forum's terms of reference is underpinned by a Memorandum of Collaboration between BASES, BACPR and ACPICR, the writing of which Buckley led. Following this Buckley led in the development of a joint position statement on the standards for qualifications, professional development and experience required for working in the exercise component of cardiac rehabilitation (2010, 2012). (references 2 and 3)

The group then went on to write a set of detailed national core competences for the exercise component of cardiac rehabilitation and, though Buckley was not part of this group, the above work he had previously done with BASES, BACPR and ACPICR was a key catalyst to this document.

Overall, for the past decade Buckley has contributed to national education resources and professional standards of practice in the professional development and national qualifications of thousands of practitioners in health-based exercise and cardiac rehabilitation to best serve clients and patients throughout the UK. For these achievements, he was appointed President of the BACPR from 2009 to 2011, and led the drafting of the organisation's new integrated Standards and Core Components, which were published in the highly acclaimed medical journal, *Heart*. Linked to this development work, Buckley was an adviser to the NHS England & Wales Department of Health Commissioning Pack for Cardiac Rehabilitation (2010) (reference 4).

Buckley dovetails this work with 14 other similar associations from around the world and has played a lead role in establishing an International Council of Cardiovascular Prevention and Rehabilitation, for which he is the current Chair. He has been a lead author of the recently published (March, 2013) International Charter on Cardiovascular Prevention and Rehabilitation. (reference 5)

The above impacts in cardiovascular health and rehabilitation have come about by Buckley being initially recognised, and continuing in this light, for his practice-based research.

In relation to the research on the neuromuscular disorder of McArdle Disease, Buckley has played a lead role in the development and establishment of the National McArdle Disease clinic, which is located at the MRC Neuromuscular Institute of the University College London National Hospital of Neurology and Neurosurgery. His research focus on patients learning to manage their daily activity through pain perception forms a core component of the patient education programme of this national service (reference 6).

5. Sources to corroborate the impact

1. **Buckley J.P.**, chapter author, *Benefits of Exercise in Health and Disease* in: ABC of Sports and Exercise Medicine (eds: G. Whyte, M. Harries, C. Williams), BMJ/Blackwell Publishers, London,2005

2. Impact through the British Association for Cardiovascular Prevention and Rehabilitation

- **Buckley J.P.** Chapters Contributor, *BACR Exercise Instructor Manual**;*** Aerobic exercise and endurance training; Monitoring exercise intensity, Exercise programming and prescription (Human Kinetics, Leeds, 2006).
- **Buckley J.P.** Contributing Author: *Standards for Physical Activity and Exercise in Cardiac Rehabilitation, The Association of Chartered Physiotherapists in Cardiac Rehabilitation*. London 2009, 2013.
- **Buckley J.P.** Contributing Author*: Education and training manual; A Practical Approach to Physical Activity and Exercise in the Management of Cardiovascular Disease* of the British Association for Cardiac Rehabilitation (BACR) (ed. J. Jones). Human Kinetics, Leeds, 2009. (for confirmation, contact the Director of Education at BACPR, www.bacpr.com).
- **Buckley J.P**. Furze G, Doherty P, Speck L, Connolly S, Hinton S, Jones JL. British standards for cardiovascular prevention and rehabilitation; a scientific statement of the British Association for Cardiovascular Prevention and Rehabilitation. *Heart* 2013 Feb 12. [Epub ahead of print] PMID: 23403407
- Position statement of the BACPR on the qualifications and experience required to work in the exercise component of cardiac rehabilitation http://www.bacpr.com/resources/CCZ_EPG_Position_Statement.pdf

3. Impact through the British Association of Sport & Exercise Sciences

- **Buckley J.P.** Commissioned chapter co-Author (with R.G. Eston), *Ratings of Perceived Exertion in the Physiological Testing Guidelines of the British Association of Sport & Exercise Sciences*, Routledge, London, 2006
- **Buckley J.P.**. advisor and author to National Occupational Standards for Level 4; Advanced Exercise Instructor in special populations, the UK Sector Skills Council, London, UK 2008 (Refer to Ben Gittus at Skills Active)
- **Buckley J.P.** Commissioned editor and author from the British Association of Sport and Exercise Sciences*: Exercise physiology in special populations***, (**Series editors Profs D McLaren and N Spurway) Elsevier, London, 2008.
- Lead author of memorandum of collaboration between BASES, BACPR and ACPICR http://www.bases.org.uk/Memorandum-of-Collaborations.
- **Buckley J.P**. advisor and author National Occupational Standards in Sport and Exercise Science, Skills Active, the UK Sector Skills Council, London, UK 2010 (Refer to Ben Gittus at Skills Active)
- Advisor to modernising BASES Accreditation Scheme and lead convenor of the BASES Certified Exercise Practitioner Scheme. http://www.bases.org.uk/Accreditation (contact the BASES Executive Director for confirmation).

4. Panel member for the development of the NHS/Department of Health's commissioning pack on cardiac rehabilitation
http://www.improvement.nhs.uk/heart/HeartImprovementHome/CardiacRehabilitation/CardiacRehabKeyDocuments.aspx

5. Founding chair of the International Council of Cardiovascular Prevention and Rehabilitation Grace S.L.,Warburton D.R., Stone J.A., Sanderson B.K., Oldridge N., Jones J., Wong N., **Buckley J.P.** International Charter on Cardiovascular Prevention and Rehabilitation: A CALL FOR ACTION. *J Cardiopulm Rehabil Prev*. 2013; 33 (2):128-131
www.globalcardiacrehab.com

6. Exercise physiology advisor to National McArdle Disease clinic since 1999 can corroborate the role of Buckley in the development and establishment of the National McArdle Disease clinic.