Issue 79 | Spring 2024

The Sport and Exercise Scientist

The official publication of the British Association of Sport and Exercise Sciences

THE BASES EXPERT STATEMENT

TARGETED TREATMENT OF PATELLOFEMORAL PAIN.

Produced on behalf of the
British Association of Sport and Exercise Sciences
by Dr Jonathan Sinclair FBASES, Dr Lindsay Bottoms FBASES,
Prof Jim Richards, Prof James Selfe, Dr Jessie Janssen,
Dr Marienke van Middelkoop and Dr Hayri Baran.

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FROM THE EDITOR

WELCOME TO TSES ONLINE

ISSUE 79 | SPRING 2024

Dr Adam Gledhill FBASES introduces the 79th and first digital issue of The Sport and Exercise Scientist.

Every new beginning comes from some other beginning's end. This quote from Seneca typifies how we have moved on to the next chapter of our life here at The Sport and Exercise Scientist (TSES) by drawing on our experiences of the previous version. It seems such a long time since I first wrote and let you know that TSES would be moving to a full digital version that would springboard us into 2024 and beyond! We're finally here, with our new format publication! And with even more to celebrate, this first digital issue of TSES is open access!

This notion of new beginnings permeates through this issue of TSES. As well as being the first digital issue, this is also the first issue of TSES that developed by our new look Editorial Advisory Group. I'm delighted to welcome Lauren Forsyth (Biomechanics), Chris Kirk (Physiology and Nutrition), and Eddie Bradley (Learning and Teaching) onto the Editorial Advisory Group to add new dimensions to the excellent work of our incredibly talented existing advisory group members. Thank you all for the contributions you made to this issue of TSES and I'm looking forward to working with you all on future issues!

This is also the first issue of TSES with a regular feature devoted specifically to teaching and learning in sport and exercise sciences. As with our other feature articles, this will address hot topics in such a way that contributes to the professional development of our BASES members. We know that we have many members who work in education environments and many other students and graduate members who wish to do so. Feedback from members has been that you would value more of a focus on teaching and learning related issues. As always, this is now a challenge I'll refer to you. How do you, our BASES community, want to shape this feature? It could take many forms, ranging from contemporary topics in teaching in learning, all the way through to articles written by members in applied practice who supervise students on placement. As always, we're looking to use this feature to help, support and develop you, our BASES community, and we'd really welcome submissions to a teaching and learning feature that will meet your needs.

Throughout this issue of TSES, we have also continued our commitment to EDI in several ways. With articles ranging from the importance of increasing diversity in research participation, to providing support for competitive athletes during Ramandan, to articles that provide advice and support for working with people living with different health conditions, there is a breadth and depth of articles to meet a wide-ranging audience. I am also very pleased to see new contributors to TSES. Several of our contributing authors are writing articles for TSES for the first time and have done so representing a wide range of education institutions, as well as sport, exercise and health environments.

Following this mention of welcoming new contributors to TSES, it is at the point I now want extend heartfelt gratitude to Professor John Saxton FBASES. Regular readers of TSES will know that John has for many years been the physical activity and health columnist for TSES. Such is the excellence of John's work that he has regularly been recognised within the positive feedback we receive about TSES. This issue of TSES will be John's last as a columnist for our publication. As we have all come to expect John's work in this issue is exemplary and thought provoking, and I hope you all enjoy reading it as much as I did. John, I have said this to you privately, but on a more personal - yet public - note from me: Thank you. You and your regular contributions will be missed by everybody, but I do hope we can still read other examples of your work in future issues of TSES. Whilst John's departure from the regular feature will see the end of an era for that feature, it also now creates opportunity for us all to look at how we best develop that feature and I look forward to sharing the new version with you in Summer '24.

Anyway, I'm sure you have all heard quite enough from me now. I hope you all enjoy the new format for TSES and the different ways of engaging with the articles. As always, your feedback is welcome to me via e-mail at editor@bases.org.uk or by sending in your letters to the editor. But, for now, I hope you enjoy the read! ■

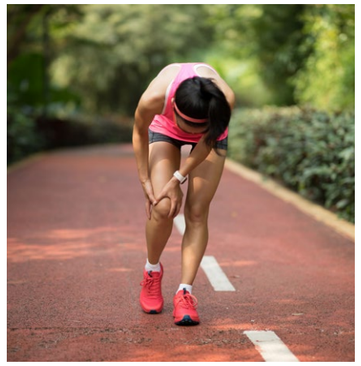
DR ADAM GLEDHILL FBASES | **Editor**

INSIDE THE

Sports and Exercise Scientist

Regulars

On The Cover



Also Inside

Also Inside

THE SPORT AND EXERCISE SCIENTIST
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All copies of The Sport and Exercise Scientist are available in PDF format in the Member Area at www.bases.org.uk. You will need your username (your e-mail address) and password (sent to you via e-mail when you joined BASES).

NEWS

BASES 2023 CONFERENCE

The 2023 Conference took place at the CBS Arena, Coventry, on 16-17 November 2023. Over 230 delegates registered for the conference. Prof Vicky Goosey-Tolfrey FBASES, Professor of Applied Disability Sport, Loughborough University, opened the conference with a keynote on the Past, Present and Future of Paralympic Sports Science. Prof Jason Gill FBASES, Professor of Cardiometabolic Health, University of Glasgow, closed the conference with a keynote on the importance of place: how where you live and where your (grand)parents came from affects your metabolic health. A number of parallel invited symposia took place alongside poster viewing (for which 138 abstracts were submitted this year), exhibitions and networking. The Conference dinner saw a number of the new Fellows receiving their BASES pin and certificate, with awards made to the recipients of the Volunteer of the Year. The conference concluded with the recognition of those members winning awards (details on page 6 News).

BASES 2023 ANNUAL GENERAL MEETING

The 2023 AGM took place on 16 November 2023 at the CBS Arena, Coventry, and remotely via WebinarJam. The meeting opened with a welcome from the Chair of the Board, Prof Zoe Knowles FBASES who then provided an update of the 2021-2025 Strategy and Operational Objectives. Zoe then provided a review of the achievements and performance for 2022-2023, including the Financial Statements for the year ending 31 March 2023. Members supported two special resolutions within the meeting. Members can view the AGM slides and minutes here https://bit.ly/3mKGlFZ

HEADS OF DEPARTMENT FORUM

The 20th BASES Heads of Department Forum will be taking place at the University of Bedfordshire on 15 May 2024. It will be a day of information, insights and networking for those with leadership roles within sport and exercise sciences academia. The theme for the day is Topical challenges in Sport and Exercise Science Higher Education. Please see the advert on page 19 for further details.

RECOGNISING MEMBERS WHO LIVE THE BASES' VALUES, COMMITMENTS AND BEHAVIOURS

BASES would like to recognise and acknowledge those members who live and demonstrate the BASES' Values, Commitments and Behaviours within their day-to-day professional roles, associated with their membership of BASES. Members can now nominate 'Values Champions' who are either professional, graduate or student members of BASES, and who inspire other members because of how they undertake their work and engage with others, clearly demonstrating the new BASES Values, Commitments and Behaviours. Nomination form is here - https://bit.ly/3IM66jS.

HIGH PERFORMANCE SPORT ACCREDITATION (HPSA)

Craig Musham, Newcastle United Football Club

BASES CERTIFIED EXERCISE PRACTITIONER RENEWAL

Brian Begg, Aneurin Bevan University Health Board

BASES UNDERGRADUATE ENDORSEMENT SCHEME (BUES)

Re-Endorsed Courses
Cardiff University, BSc (Hons) Sport and Exercise Science
Leeds Beckett University, BSc (Hons) Sport and Exercise Science
St Marys Twickenham, BSc (Hons) Sport and Exercise Science
University of Edinburgh, BSc (Hons) Applied Sport Science
University of Kent, BSc (Hons) Sport and Exercise Science and (a year in industry)
University of Sunderland, BSc (Hons) Sport and Exercise Science

Endorsed Courses
London South Bank University, BSc (Hons) Sport and Exercise Science

BASES Undergraduate Dissertation of the Year Award
Amy Dent, Portsmouth University

BASES CONFERENCE 2023 AWARDS

Student Awards

Human Kinetics Student Free Communication Presentation Award
Kristin McGinty-Minister, Liverpool John Moores University.

Human Kinetics Student Poster Presentation Award
Obipiseibima Aggokabo, Liverpool John Moores University.

Non-Student Awards

BASES Sport and Exercise Science 5 Slides in 5 Minutes Free Communication Presentation Award
Dr Clare Roscoe, University of Derby.

Sportesse Sport and Exercise Science Free Communication Presentation Award
Dr Laura Basterfield, Newcastle University.

Cranlea Poster Presentation Award
Dr Mike Price FBASES, Coventry University.

Routledge Recently Qualified Researcher Free Communication Presentation Award
Theresa Heering, Coventry University.

STANDING COMMITTEE AND ADVISORY GROUP APPOINTMENTS

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William Donald, Membership Rep
Molly Banks, Undergraduate Student Rep

Sport and Performance Committee
Dr Christopher Kirk, CPD Rep
Matthew Ellis, Membership Rep

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CPD Advisory Group
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Membership Reps Advisory Group
William Donald, member

Student Advisory Group
Molly Banks, member

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Dr Christopher Kirk, Physiology and Nutrition Rep
Dr Eddie Bradley, Teaching and Learning Rep

DIARY DATES

2024

1 Mar	Student Conference Abstract Submission deadline
1 Mar	BASES International Conference Grant submission deadline
1 Mar	BASES SE Application submission opens
14 Mar	BASES SE Application deadline
18 Mar	BASES SEPAR Core workshop - Equality, Diversity and Inclusion
22 Mar	BASES Endorsed CPD Event - Sport Science in Football: Strategic use and application of sided games to improve elite player performance.
28 Mar	BASES Endorsed CPD Event - The Science & Application of Altitude Training.
3-4 Apr	**BASES Student Conference 2024, Manchester Metropolitan University**
5 Apr	BASES/CEP-UK Conference, Manchester Metropolitan University
5 April	BASES SEPAR Core workshop Practice Philosophy
10 Apr	BIG 2024 hosted by Loughborough University
12-19 Apr	BASES SEPAR Core workshop - Counselling Skills Course
23 Apr	BASES SE/SEPAR Core workshop - Safeguarding in Sport and Exercise Sciences
24 Apr	BASES SE/SEPAR Core workshop - Reflective Practice for Sport and Exercise Scientists
27 Apr	BASES SE/SEPAR Core workshop - Professional Ethics for Sport and Exercise Scientists
1 May	BASES Expert Statement Grants deadline
15 May	BASES Heads of Department Forum, University of Bedfordshire

FURTHER INFORMATION: **BASES.ORG.UK**

LETTERS TO THE EDITOR

Get involved in the debate by sharing your views in a letter to the Editor. All published letters will receive a £25 discount off BASES membership renewal. Letters must refer to an article that has appeared in the last issue. Letters should be no longer than 200 words (this word count includes everything, e.g. references) and must include your name. Letters may be edited or shortened for space or clarity. Please send your letter to editor@bases.org.uk **by 8 April 2024.**

GUIDELINES

GUIDELINES FOR CONTRIBUTORS TO THE SPORT AND EXERCISE SCIENTIST.

Q. What is the main aim of The Sport and Exercise Scientist?
To provide a valuable resource that contributes to the continuing professional development of sport and exercise scientists. Please note that The Sport and Exercise Scientist is not a peer-review journal.

Q. What are the key criteria for deciding whether an article is suitable for publication in The Sport and Exercise Scientist?

KEY CRITERIA INCLUDE

1. Does is to contribute to the CPD of sport and exercise scientists by promoting evidence-based practice?
2. Is the work reported original?
3. Is the purpose and scope of the article stated clearly and is it achieved?
4. Is it well-written?
5. Is it constructive?
6. Is it thought-provoking?
7. Does it have obvious take-home messages and answers the "So what?" "Why does this matter to sport and/or exercise scientists?" questions?
8. Is it reflective highlighting what has been learnt from the process and providing practical knowledge that readers can take away and apply?
9. Is it interesting and does it have a wide appeal to BASES members?
10. Is it within the allocated word count, specified by the editor? (please see section below).

Q. What are the word counts for an article?

- For a one-page article it is a maximum of 800 words - this includes everything (for example, the reference list, author profiles, tables and figures).
- For a two-page article it is a maximum of 1,800 words - this includes everything (for example, the reference list, author profiles, tables and figures).

The word counts above are for articles with one photo and one table or figure. If you wish to include numerous photos, tables or figures then you need to reduce your word count accordingly. Please be selective in choosing to include figures and/or tables. They should inform the readers, not confuse them.

CLICK HERE FOR MORE DETAILED INFORMATION ABOUT CONTRIBUTING TO THE SPORT AND EXERCISE SCIENTIST.

BASES EXPERT STATEMENT

TARGETED TREATMENT OF PATELLOFEMORAL PAIN

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Jonathan Sinclair (FBASES), Dr Lindsay Bottoms (FBASES), Professor Jim Richards, Professor James Selfe, Dr Jessie Janssen, Dr Marienke van Middelkoop & Dr Hayri Baran Yosmaoglu

Patellofemoral pain (PFP) characterised by diffuse retro/ peripatellar symptoms, is the most common orthopaedic condition in sports medicine, with prevalence as high as 22.7% (Smith *et al.*, 2018). It is concerning to sport and exercise science practitioners that 21.5% of athletes cease participation in physical activity/ sports due to PFP (Rathleff *et al.*, 2012) and many subsequently develop associated psychological disorders (Maclachlan *et al.*, 2017; Sinclair & Butters, 2021). This statement provides an update on the assessment and management of PFP that should be of interest to sport and exercise science practitioners, those treating PFP and those who are seeking guidance into treatment options.

BACKGROUND AND EVIDENCE

Despite widespread utilization in clinics, current multimodal management approaches do not lead to successful outcomes in the majority of patients. Patients exhibit unfavourable recovery rates in both the short (Stathopulu & Baildam, 2003; Collins *et al.*, 2013) and long-term (Price *et al.*, 2000; Lankhorst *et al.*, 2016), following diagnosis. This indicates that the majority of PFP patients do not respond to treatment and continue their lives with chronic knee pain. The consensus statement from the International Patellofemoral Pain Research Retreat in 2013 speculated that PFP may be a precursor to the development of patellofemoral osteoarthritis (Witvrouw *et al.*, 2014). Individuals undergoing arthroplasty for patellofemoral osteoarthritis were more than twice as likely to report having had PFP as an adolescent than patients undergoing an arthroplasty for isolated tibiofemoral osteoarthritis (Thomas *et al.*, 2010) and 64% of people with knee pain aged over 50 years had clear radiographic patellofemoral osteoarthritis, indicating that there may be specific degenerative processes occurring within the patellofemoral joint (Teng *et al.*, 2015). This makes the development and implementation of effective management strategies particularly pertinent to long term musculoskeletal health.

Based on the above information, identification of the mechanisms responsible for the inadequate success rates of current multimodal management approaches are a priority (Selfe *et al.*, 2013). The most significant factor affecting the efficacy of conventional management approaches is that patients exhibit a variety of musculoskeletal and biomechanical differences, meaning that current multimodal approaches, do not treat the heterogeneous PFP population with the same level of effectiveness (Selfe *et al.*, 2016).

TARGETED TREATMENT OF PATELLOFEMORAL PAIN

Our work has led to the development of a new sport and exercise science-based approach for the management of PFP, based around targeted interventions, to mediate improved outcomes (Selfe *et al.*, 2013). Initial research showed using six specific assessments that can be undertaken by qualified sport & exercise scientists i.e. quadriceps strength, hip abduction strength, patellar mobility, foot posture index, quadriceps flexibility and gastrocnemius flexibility, that there are 3 subgroups in PFP populations. Allowing users to subgroup patients based on the results of the aforementioned assessments and also guide patients themselves to the most appropriate rehabilitation programme. These subgroups were characterised as "strong", "weak and tight" and "weak and pronated foot" (Selfe *et al.*, 2016), where recreational and competitive athletes (most pertinent to sport and exercise science practitioners) are more likely to fit the "strong" group profile.

A new targeted treatment approach for PFP was introduced based on these groupings. For the strong subgroup a suggested targeted treatment program was designed according to the deficits identified by the subgrouping assessments and centred specifically around improving neuromuscular control and coordination ability rather than strength, as it was identified that no deficit in strength was present in this subgroup. This primarily involved using proprioceptive exercises/ devices such as progressive balance training and knee braces which offer improvements in movement control in patients with PFP (Selfe *et al.*, 2011) and reductions in patellofemoral joint reaction forces (Sinclair *et al.*, 2016). Of particular interest to sport and exercise science practitioners is our follow up research, showing that the ''strong'' subgroup responded the least favourably to traditional multimodal approaches (Table 1). In a prospective crossover intervention, we showed that the "strong" subgroup demonstrated a very poor response to initial multimodal treatment but had a significant improvement in pain intensity during activity after targeted intervention (Yosmaoğlu *et al.*, 2019).

CONCLUSIONS AND RECOMMENDATIONS

Implementation of targeted interventions for PFP following six simple sport and exercise science-based tests represents

▲ **Figure 1:** Quadriceps strength and hip abduction strength assessments.

▼ **Table 1:** Multimodal treatment approach.

MODALITY	APPLICATION TYPE
Thermotherapy	Cold packs, 20 min
Transcutaneous electrical neural stimulation	Conventional mode, 20 min 50-100 Hz, 20-60 pulse/s
Therapeutic ultrasound	1 W/cm², 5 min around knee joint
Hamstring/tensor fascia latae/iliotibial band stretching	30 s / 5 rep
Isometric quadriceps strengthening	10 rep × 3 set
Isometric hip adductor strengthening	10 rep × 3 set
Open kinetic chain knee extension exercise	3 sets of patients' 8-10 RM, in painless range of motion
Open kinetic chain hip adductor exercise	Side-lying/3 sets of patients' 8-10 RM

▼ **Table 2:** Targeted treatment program in the strong group.

MODALITY	APPLICATION TYPE
STRONG SUBGROUP	
Progressive balance/proprioception exercises	Standing on 1 leg on wobble board 3 sets of 1 min exercise each leg 1-3 sets per session depending on pain Progression: Eyes closed, bouncing ball against wall, bouncing ball against wall on an unstable surface
Patellar bracing	Patient was asked to put on knee brace during activities of daily living
Activity modification	Activity reduction to fit within envelope of function locally determined and negotiated with individual patient

an easily implemented approach. This innovative strategy, particularly when tailored to the distinctive characteristics of the "strong" subgroup, signifies an important step forward in achieving more favourable treatment outcomes compared to current multimodal programs. By doing so, recreational athletes may be able to sustain their physical activities important to the maintenance of long-term physical and psychological health, and competitive/ elite athletes can maintain their current levels of competition, underscoring the profound impact and potential of this approach on the broader landscape of sports and exercise science. We advocate the adoption of targeted treatments, in particular within the "strong" subgroup pertinent to sport and exercise sciences, as a measure to manage this prevalent condition. ■

▲ **Figure 2:** Patellar mobility assessment.

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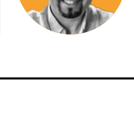


DR JONATHAN SINCLAIR FBASES

Jonnie is a Reader within the School of School of Health, Social Work and Sport at the University of Central Lancashire. His research interests are in sport/ clinical biomechanics as well as the implementation of randomized controlled trials.

DR LINDSAY BOTTOMS FBASES

Lindsay is a Reader in Exercise and Health Physiology in the School of Life and Medical Sciences at Hertfordshire University. Lindsay's main research area is the benefits of physical activity on health in different chronic conditions and special populations

PROF JIM RICHARDS

Professor Jim Richards is Research Lead for the Allied Health Research unit and Associate Dean for Research and Knowledge Exchange within the School of Health, Social Work and Sport at the University of Central Lancashire.

PROF EMERITUS JAMES SELFE

James is Professor Emeritus in the Department of Health Professions at Manchester Metropolitan University. His has an extensive portfolio of research into Patellofemoral problems, identification of Spinal Red flags and cryotherapy with over 400 peer reviewed publications.

DR JESSIE JANSSEN

Jessie is a researcher and Lecturer at the Institute Therapeutic and Midwifery Sciences at the IMC Krems University of Applied Sciences in Austria. Her research topics encompass patellofemoral pain, red flags in musculoskeletal physiotherapy practice and research capacity building.

DR MARIENKE VAN MIDDELKOOP

Marienke is an Associate Professor at the department of general practice at the Erasmus MC Medical University Rotterdam. She has performed multiple epidemiological studies in the field of patellofemoral pain and other musculoskeletal complaints and disorders in primary care.

DR HAYRI BARAN YOSMAOGLU

Dr Hayri Baran Yosmaoglu works as a full-time professor in the Department of Physiotherapy and Rehabilitation at Baskent University Faculty of Health Sciences. His research areas include knee ligament injuries and musculoskeletal rehabilitation.

REVIEWS

BOOKS AND PODCASTS

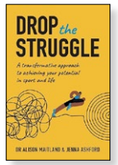
THE BIOMECHANICS OF SPRINTING: FORCE 2

GOODWIN & CLEATHER (2023)

Independently published
Paperback £16.29 **amazon.co.uk**

In this book the authors explain that coaches and athletes seeking to improve sprinting speed must consider force production from the outset. The content is based on sprinting research, yet it is written in a way that makes complicated topics relatively simple to understand. The short chapters make it easy to dip in and out of the book and the supporting figures are helpful to understand the key concepts, such as horizontal and vertical impulse. Despite a chapter on training implications, the book does not include detailed content about training methods to improve sprint performance. However, the book provides S&C coaches with the underpinning knowledge to create better programmes and Chapter 11 highlights the limitations with the practice of constructing power-force-velocity profiles for athletes. The book also explores concepts that are often misunderstood, such as the importance of generating vertical force. This book is a worthy addition to the library of sport science students and S&C coaches.

PAUL HOUGH, OXFORD BROOKES UNIVERSITY
Rating 8/10



DROP THE STRUGGLE: A TRANSFORMATIVE APPROACH TO ACHIEVING YOUR POTENTIAL IN SPORT AND LIFE

Maitland, A. & Ashford, J. (2023)
Sequoia Books
Paperback £13.85 **Kindle** £13.85 **amazon.co.uk**

Drop the Struggle is a fascinating exploration of the complexities surrounding the stressors involved in sport. Under-pinned by Acceptance and Commitment Therapy (ACT), it addresses the challenges faced by athletes who seek to thrive in competition. By intertwining personal examples with practical strategies to navigate the turbulent environment that is sport, the book serves as a guide, advocating for a more holistic approach to success that doesn't sacrifice one's well-being. *Drop the Struggle* will resonate deeply with athletes, coaches and individuals striving to achieve more. This book offers a roadmap and toolkit to help athletes find a sustainable way of dealing with difficult thoughts, emotions and situations, emphasizing the importance of well-being, and redefining success beyond traditional metrics. Its pragmatic advice and strategies make it an invaluable resource for those seeking to flourish within both their sporting and personal lives.

PAUL HOUGH, OXFORD BROOKES UNIVERSITY
Rating 8/10

BIOMECHANICS ON OUR MINDS

Biomechanics On Our Minds (BOOM) is a well-rounded biomechanics podcast that covers topics including aging, exoskeletons, wellness and elite sport. Melissa Boswell and Hannah O'Day from Stanford University have led a total of 69 episodes so far, and each one includes an interview with a researcher or athlete. There is a focus on applied experiences within biomechanics, including stories of leadership and failures the interviewee may have experienced which provides a genuine representation of what biomechanics is like in the relevant contexts. The podcast also includes a selection of episodes that represent a range of student voices. Overall, this podcast is well suited to students with a keen interest in biomechanics, the style of delivery and content is not overwhelming and makes the podcast accessible to many. It showcases the valuable impact biomechanics has had on a wide range of individuals and environments in a positive manner. The podcast is available on both Apple and Google podcast apps, Spotify, YouTube and Soundcloud. New episodes are posted on the first Wednesday of each month. Worth a listen.

DR HELEN GRAVESTOCK, BIRMINGHAM CITY UNIVERSITY
Rating 9/10

THE SPORTS PSYCHOLOGY PODCAST

The *Sports Psychology Podcast* by Dr Patrick Cohn is a well-established monthly show with over 100-episodes. The show follows a short-hand format with each episode only being 5-7 minutes long, so not a show that you will queue up for your daily commute or while walking the dog. Rather than providing overviews or deep dives into sport psychology topics, each episode the host answers a question from an athlete, coach, or parent, providing tips to help the individual improve their mental skills related to a specific issue or context. This show is a rich source for educators or practitioners looking for case examples for classes and to generate ideas to tackle applied issues. It is worth recommending to sport psychologists in training from undergraduate through to postgraduate levels, who will benefit from the real-life examples. Overall, this show highlights the usefulness of the podcast format, not as something to replace textbooks, journals, and professional training, but as a supplementary format that blends science and entertainment into nice bite size chunks.

DR ROSS LORIMER, ABERTAY UNIVERSITY
Rating 7/10

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PARKINSON'S AND EXERCISE

Professor Clyde Williams OBE FBASES, J.D. Hylton, and Dominic Corcoran discuss why people with Parkinson's must adopt an active lifestyle to delay the progress of this degenerative disease.

Imagine having ever increasing difficulty with normal movements for many months before being diagnosed with Parkinson's and then told to do more rather than less exercise: that exercise may be as good as any medication in slowing the impact of the condition on normal living. Here-in lies two major challenges, one, of course, is to discover the biological mechanisms that leads to a cure for Parkinson's. The other is to develop successful strategies to bring about lifestyle changes that focus on physical activity to delay the progress of Parkinson's symptoms. The aim of this article is to provide the rational for recommending that people with Parkinson's become physically active.

Parkinson's is second to Alzheimer's as the most common of neurodegenerative diseases: it affects over 8.5 million people world-wide and an estimated 145,000 in the UK. Ageing is the common denominator in the development of Parkinson's. Most people with the condition tend to be sixty or more years old when diagnosed though it is not uncommon for younger people to develop the condition. In general Parkinson's is more prevalent in men than in women. It is characterised by both motor (neuromuscular) and non-motor symptoms. The motor symptoms most common to the condition are resting tremors (shaking), poor balance, slow movements, such as reduced walking speeds and rigidity. There are also less obvious but nevertheless significant non-motor changes that include constant aching, disruptive sleep, gradual loss of memory and mental flexibility, as well as weight loss. The symptoms, however, vary and develop at different rates in different people. Early diagnosis helps reduce and delay the progression of symptoms, however, there is no complete understanding of the cause nor, at present, any cure for the condition (Murphy & Lynch, 2023).

The impact of Parkinson's on movement is the result of progressive degeneration of the neuromuscular system which is made up of many motor units (MU), each of which consists of motor neurons in the motor cortex of the brain and in the spinal cord, as well as the motor nerves and muscle. Not all motor units are the same because the role of the muscle fibres they innovate have different functions. Skeletal muscles are composed of slow contracting and fast contracting fibres. The slow contracting, slow fatiguing fibres support most of our daily living. The fast fibres are recruited during rapid movements such as walking brisky, stair climbing, running, lifting or when trying to avoid trips and falls by quickly side-stepping obstacles. The energy required to fuel muscle fibres is generated from a series of reactions in small cells, called mitochondria. Mitochondria use oxygen, delivered to skeletal muscles by the normal blood circulation, to 'oxidise' fat and carbohydrate in their production of energy. Slow contracting, slow fatiguing fibres have large numbers of mitochondria and so can use the body's plentiful supply of fat as fuel. In contrast, fast contracting, fast fatiguing fibres have fewer mitochondria and therefore must rely on their small carbohydrate (glycogen) store to produce energy. As a result of having to rely on a relatively small store of glycogen, fast fibres fatigue more quickly than slow fibres.

In Parkinson's the gradual loss of normal voluntary movement and increase in non-voluntary movements (e.g., shaking) is the result of damage to dopamine producing neurons. Dopamine is a neurotransmitter that provides neuron to neuron communication in the brain. There are several dopamine pathways that play significant roles in the normal brain function, one of which is the neuromuscular system. Inside the affected dopamine producing neurons, there is an accumulation of proteins (Lewy bodies), the most abundant is alpha-synuclein (alpha-syn), which become dysfunctional because of a change in their shape (misfolding). With an accumulation of an aggregate of tangled alpha-syn protein, the structure and then the function of the neuron is compromised, reducing, and then halting the production of dopamine. The brain's innate immune system (microglia) attempts to clear the Lewy bodies from the affected neurons and restore the integrity of cell. However, when the neuron can no longer function normally and eventually dies, the microglia appear to go into overdrive and gradually destroys the dopamine producing neuron. As a result, dopamine dependent neural networks gradually become dysfunctional, among which is the neuromuscular system. As a consequence, normal control over locomotion, posture and balance are gradually lost (Nay *et al.*, 2021).

As if these challenges facing people with Parkinson's were not enough, they are compounded by the age-related loss of motor units that gradually reduce muscle mass and strength. This natural wasting (sarcopenia) (Low *et al.*, 2023) begins in early middle age and by the time we reach 80 years it is estimated that men will have lost 40% of their muscle mass. As we get older, we become less active and as a result we lose motor units more quickly (Aagaard *et al.*, 2010). The reasons for the accelerated loss of motor units are at least two-fold, the first is that the energy producing mitochondria are sensitive to use and disuse and as such become dysfunctional with disuse (Joanisse *et al.*, 2020). The second reason is that in the absence of frequent neural stimulation of muscle fibres, the normal dynamic balance between protein synthesis and protein degradation is shifted to protein degradation (McKendry *et al.*, 2020). As a result of decrease protein synthesis, the repair and expansion of muscle fibres as well as strengthening the motor neuron network is insufficient to maintain healthy muscle.

> In designing a programme of lifestyle changes, health professionals must consider the ever-progressing symptoms of Parkinson's, current fitness, and psychological wellness, along with the level of support from family and friends

While there is some medication that helps alleviate specific symptoms of Parkinson's, the most effective countermeasure is exercise. Therefore, adopting a lifestyle of daily exercise helps keep surviving dopamine producing neurons active and strengthens the whole of the neuromuscular system, from the neural networks in the brain to the muscle fibres they innervate. Exercise also maintains the health of the mitochondria and so ensures available energy for tissue and nerve repair as well as protecting the brain from neurotoxins (reactive oxygen species). As well as delaying the loss of muscle mass and strength and improving cardiovascular health, daily exercise reduces the non-motor Parkinson's symptoms such as sleep and memory loss (Ellis *et al.*, 2021). Furthermore, there is growing evidence that the type and range of gut bacteria (microbiota) in those with Parkinson's may have contributed to both the onset and to the progression of the condition via the gut-brain axis. Exercise restores gut health and it is speculated that this will also help delay the progress of Parkinson's symptoms (Zapanta *et al.*, 2022).

Although high intensity exercise appears to produce the most beneficial effect on Parkinson's symptoms and quality of life (Kelly *et al.*, 2014), the early introduction to daily exercise should not include demanding gym sessions because many will have been inactive since being diagnosed with the condition. Nonetheless, it is essential that they understand that exercise stimulates neuromuscular function and strengthens neural networks, within the brain and central nervous system. Therefore, physical activity must become a central part of their lives to delay the progress of Parkinson's symptoms and the compounding influences of sarcopenia. In designing a programme of lifestyle changes, health professionals must consider the ever-progressing symptoms of Parkinson's, current fitness, and psychological wellness, along with the level of support from family and friends. In addition to building strength and cardio-respiratory fitness, the programme must address the gradual loss of balance, agility, manual dexterity, and body mass. Furthermore, how, and where the fitness programmes are delivered must also be considered because not all people with Parkinson's are ready to attend gym sessions, preferring to exercise at home or in familiar surroundings. Therefore, acknowledging individual preferences and customising lifestyle changes to increase daily physical activity will have greater adherence and impact on delaying Parkinson's symptoms. Working with Parkinson's challenges the creativity of health professionals to bring about beneficial lifestyle changes that give sufferers a means of coping with this incurable condition, and as such, it is a worthy challenge. ■

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P.C.D CORCORAN

Dom has Parkinson's: an advocate for the benefits of exercise, and a fund raiser for Parkinson's UK

MR J. D. HYLTON

JD is a Neuro-Physiotherapist at Bridge4rehab, he designs and leads exercise programmes for people with Parkinson's.

CARDIOPULMONARY EXERCISE TESTING AMONG STROKE SURVIVORS

Dr Allie Welsh and Dr Kathryn Mares share their experiences of cardiopulmonary exercise testing (CPET) for people living with moderate to severe movement impairments post-stroke

DR ALLIE WELSH

Dr Allie Welsh is a Senior Lecturer in Physical Activity Health Sciences at Leeds Beckett University, with interests in inclusion, physical activity and neurological populations.

DR KATHRYN MARES

Dr Kathryn Mares is a neuro physiotherapist and Associate Professor at the University of East Anglia. Research interests include developing digital interventions.

There are 1.3 million stroke survivors in the UK, and it is one of the leading causes of disability worldwide (Stroke Association, 2023). People post-stroke experience profound cardiovascular deconditioning, often due to residual movement impairments, which can include hemi-paresis, poor balance, and fatigue (Ivey *et al.*, 2005). Communication impairments, such as aphasia, also typically affect around one third of people with stroke (Gronberg *et al.*, 2022). Although aerobic exercise is known to improve health outcomes, practitioners face challenges in prescribing aerobic exercise, as guidelines currently advocate for the same recommendations as healthy older adults. Much of the research informing these guidelines was carried out with people with mild impairment after stroke, (i.e., those who were able to walk independently), and so may not be either safe, or achievable for people with moderate to severe movement impairments.

For stroke survivors, cardiopulmonary exercise testing (CPET) is a useful way to determine safety to participate in exercise by screening for adverse events, and for proposing appropriate intensities of exercise, tailored to the individual. Currently, there is little consensus on CPET procedures for people post-stroke, especially those with moderate to severe movement and/or communication impairments (van de Port *et al.*, 2015). Often, these populations have been excluded from such research and applied practice. The purpose of this article is to share our experiences of measuring the cardiorespiratory function of people with moderate to severe movement impairments post-stroke.

WHAT WE DID

We designed two novel protocols for CPET: (i) treadmill with body-weight support and (ii) cycle ergometry with specialised pedals. Both protocols were piloted with healthy volunteers, which led to further refinements of how the CPET would be delivered with stroke survivors. We worked closely with service users with experience of stroke to produce participant-facing videos and information sheets about what it would mean to take part and what to expect.

To briefly summarise, the CPET protocols were as follows: The treadmill was set at a 1% incline to simulate the energy spent walking outdoors or on regular surfaces. Participants were suspended to what they deemed comfortable and supportive for walking. The speed was increased by 0.5 km/hr every one minute, until test termination. For the cycle ergometer protocol, participants pedalled at 50 to 60 revolutions per minute, and the resistance increased by five watts, every minute, until test termination. Both protocols allowed time for familiarisation, and we adhered to the American College of Sports Medicine (ACSM) guidance and criteria for CPET.

The viability of the CPET (feasibility, acceptability and satisfaction) was our primary outcome. We were also interested in peak maximal aerobic capacity ($\dot{V}O_2$peak), heart rate, respiratory exchange ratio (RER), test time, ratings of perceived exertion (RPE), maximal walking speed/cycling resistance achieved, and reasons for stopping the test. We also interviewed participants post-CPET to better understand their overall experience and preferences.

WHO TOOK PART?

Eighteen people who had experienced a stroke more than six months ago and were living with moderate to severe movement impairments took part. We quantified this as a someone who required either supervision or manual contact of one person to walk on a level surface (a score of two or three on the Functional Ambulation Category). We adapted our recruitment procedures to enable inclusion of people with a language and communication impairment, as around one third of people who are affected by stroke have aphasia, but are typically excluded from research because of the challenges obtaining informed consent.

The mean age was 64 years, the mean time since stroke was 39 months, sixty-one percent had a left-sided weakness and six people had aphasia.

> “Supporting people with moderate to severe movement impairments post- stroke to become more physically active is an important agenda for population health and rehabilitation”

WHAT WE FOUND

Our study concluded that both CPET protocols were safe for stroke survivors with moderate to severe movement impairments. Other than general musculoskeletal discomfort, we were pleased to report no adverse events.

The mean $\dot{V}O_2$max achieved during testing was 10.81 ± 2.87mL/kg/min and 13.28 ± 2.86mL/kg/min for the treadmill and cycle ergometry protocol, respectively. These were approximately 57% and 45% of the normative values described for healthy adults aged 60 to 69 years for the treadmill and cycle ergometer, respectively (Kaminsky *et al.*, 2015).

Tests were very short (2.13 to 15.32 minutes). The most common reason for test termination by participants was because of leg fatigue, closely followed by inability to maintain the protocol (mostly during the treadmill test). Premature test-termination for reasons other than maximal effort, may mean an insufficient amount of ‘stress’ is applied. True pulmonary, vascular and musculoskeletal responses to incremental exercise may therefore be masked, challenging the utility of CPET to screen for cardiovascular limitations and prescribe exercise in this context.

To our knowledge, this study was the first to undertake a qualitative investigation of stroke survivor’s experience of a CPET. They did not express a preference over either mode of CPET and although there was some apprehension prior to CPET, participants said they felt safe throughout. Participants’ ability to complete an exercise test surpassed their expectations, in terms of both using exercise apparatus and their performance. They expressed a sense of accomplishment and surprise at their ability given their initial perceptions. They said that completing an exercise test prior to participating in exercise gave them confidence that they were safe to participate in exercise after stroke.

WHAT WE LEARNT

As with any early development work, there were many reflections to be had. One of the most important learnings from this work, is the necessity of a holistic approach to exercise testing. Even with pre-planning and a substantive medical history of people taking part, we had to accommodate for the unique characteristics of stroke. People sometimes had rapid changes in experiences of pain, muscular tone, and symptoms of fatigue. We also had to be responsive to emotionalism, memory problems and sometimes frustration from participants, this was particularly apparent from those individuals who were diagnosed with aphasia who struggled to interpret the Borg rate of perceived exertion scale.

To overcome challenges with access to CPET apparatus, specifically, the cycle ergometer seat, we sometimes used a hoist to transfer participants from their wheelchair. However, participants shared that using a hoist was reminiscent of being in hospital, thus created feelings of dependency and a lack of control. As practitioners, we often see such equipment as a tool to promote inclusion in exercise and/or rehabilitation activities, but this is an important learning for us to reflect on the acceptability of using such techniques.

We underestimated the amount of hands-on support people required to initiate and maintain movement. This was both in a physical and psychological sense and ranged from postural support and gait control to verbal cues and encouragement. Moving forwards, it is important to understand in more detail what this was like for people and whether the additional support nullifies the chance of obtaining useful data from the CPET test.

▼ A stroke survivor completing the treadmill with body-weight support harness CPET protocol.
Courtesy: University of East Anglia. Shared with permission of participants.

WHAT IS NEXT?

Stroke survivors who participated in our study expressed a fear of exercise and suggested they were reassured by pre-exercise testing, despite not achieving $\dot{V}O_2$max. We therefore believe that there is merit in pursuing the development of a CPET protocol for people with moderate to severe impairments after stroke.

After stroke, muscle weakness, balance disorders and spasticity are likely to prevent people from achieving maximal capacity. As such, the direct application of protocols developed for able bodied people are unlikely to be suitable for people post stroke.

We believe that the most effective protocol for measuring cardiorespiratory function of people with moderate to severe movement impairments post-stroke is likely to be through the cycle ergometer, but this requires further exploration and validation. We recommend that further work is carried out to create an adapted protocol which can be used with people after stroke. Adaptations to the CPET protocol will need to include all aspects of the test. We found that most people found the Borg RPE scale difficult to interpret and contextualise to the CPET. The complexities involved in test administration must also be developed so that they are inclusive and unambiguous. We encourage practitioners working with people with stroke to undertake supported communication training so that people post-stroke with communications impairments are not further excluded from exercise participation.

CONCLUSION

Supporting people with moderate to severe movement impairments post-stroke to become more physically active is an important agenda for population health and rehabilitation. Immediate conclusions from this work suggest that, although walking is functional and often a preferred physical activity goal of people with stroke, a treadmill based CPET was not an appropriate method for exercise screening, nor exercise prescription. We suggest that a cycle ergometer protocol, ideally in a recumbent position with specialised pedals and postural support, would be a viable mode of CPET.

With several key learnings, and certainly more research and applied practice to be done, this article shares our experiences of measuring the cardiorespiratory function of people with moderate to severe movement impairments post-stroke. We are confident that questions and challenges remain. Gathering insight from both practitioners and participants by means of more qualitative work to further understand experiences, the value of and the application of CPET may be a useful starting point. ■

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20th BASES Heads of Department Forum

Agenda - Subject to change

Wednesday 15 May 2024 • The University of Bedfordshire

A day of information and insights for those with leadership roles within sport and exercise sciences academia.
Theme: Topical challenges in Sport and Exercise Science Higher Education

BASES
The British Association of Sport and Exercise Sciences

Prof Zoe Knowles FBASES

Zoe is BASES' Chair and is Strategic Lead for External Engagement in the School of Sport and Exercise Sciences at Liverpool John Moores University. She is a National Coordinating Centre for Public Engagement (NCCPE) Public Engagement Professional and a Health and Care Professions Council (HCPC) Registered Practitioner Psychologist.

Prof Lars McNaughton FBASES

Lars is the Chair of the Heads of Department Advisory Group. He is Professor of Sport and Exercise Physiology at Edge Hill University and a member of the senior management team in the Department of Sport and Physical Activity where he also manages its undergraduate Sport and Exercise Science team.

Dr Kotryna Fraser

Kotryna is a Lecturer (Sport Psychology) at the School of Health Sciences, University of Sydney and Chair of the BASES Equity, Diversity and Inclusion Advisory Group (EDI AG). Kotryna's interests include equity, diversity and inclusion in higher education and competitive sport, and performance enhancement and wellbeing of athletes, coaches, referees and other support staff.

Dr Romanda Dillon

Romanda is an Impact and Evaluation Support Officer at the University of East London and has held roles within the International Women in Biomechanics and the Black Biomechanics Association groups. She is a member of the BASES EDI Advisory Group.

Dr Martyn Morris

Martyn is Head of School of Sport Science and PA at the University of Bedfordshire. He is BASES Accredited with a broad experience and a research background in applied work in clinical populations through to the elite athlete. He is a member of the BASES Heads of Department Advisory Group.

Dr Andy Smith MBE FBASES

Andy is a retired Professor who invests his time in research and volunteering. In 2022 his research output included five papers in peer reviewed Journals. He chairs the BASES Public and External Affairs Advisory Panel and is Co-Chair of the Science Council's Policy Forum.

09:15 Arrival with refreshments

9:55 Welcome and current updates

Prof Zoe Knowles FBASES, Chair of BASES

10:10 Retaining and Growing the Team

Influencing the budget holders for staff CPD.
Think Tank - Breakout groups with a whole group discussion together at the end.

Chaired by Prof Lars McNaughton FBASES and breakout groups facilitated by BASES Heads of Department Advisory Group.

11:20 Coffee Break

11:30 Embedding EDI principles

Presentation including examples of what HoDs can do to embed those principles, with time for questions at the end - please note this may be delivered as an online presentation.

Dr Kotryna Fraser and Dr Romanda Dillon

12:10 A Word from our Sponsors followed by lunch break

13:10 Optimizing student engagement

Group Discussions within breakout rooms on the changing student demographic and cost of living challenge.

Chaired by Dr Martyn Morris with a representative from the University of Bedfordshire marketing team to provide insights.

14:15 Artificial Intelligence - Horizon scanning.

Presentation on how we use AI to best effect in student learning, including a group discussion

Dr Andy Smith, MBE, FBASES, co-author of the recent Position Stand on Artificial Intelligence and Assessment.

14:55 Close and Depart

Feedback from the day and emerging issues for consideration for future events and forums.

Prof Lars McNaughton FBASES, Chair of the Heads of Department Advisory Group.

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Tickets: **Free for two delegates per institution.** Registration details to follow.

HOW CAN WE ENSURE ADOLESCENTS WEAR AND RETURN ACCELEROMETERS WHEN TAKING PART IN RESEARCH STUDIES?

Dr Maria O'Kane, Dr Angela Carlin, Prof Alison Gallagher & Prof Marie Murphy FBASES outline practical strategies to encourage adolescents to wear and return accelerometers.

Accelerometers can be used to measure physical activity (PA) by recording accelerations of the body over defined periods of time. Advances in the measurement of PA mean that accelerometer devices have evolved and are becoming lighter and less expensive. These devices are often used within large-scale research studies to provide a practical, reliable, and valid means of measuring the volume and intensity of PA (Reilly *et al.*, 2008). Despite the many advantages there are inherent challenges associated with using accelerometers, particularly among children and adolescents. Compliance with wear-time criteria can be problematic and high proportions of missing accelerometer data has implications for research quality (Howie & Straker, 2016). The non-return of devices can also be challenging among this population group (Kirby *et al.*, 2012).

USE OF ACCELEROMETERS IN THE WALKING IN SCHOOLS (WISH) STUDY

In a recent school-based randomised controlled trial, the WISH Study, which tested the effectiveness of a peer-led, walking intervention, 589 girls aged 12-14 years were recruited from eighteen schools (O'Kane *et al.*, 2020). The primary outcome was total PA at the end of the intervention and on four occasions (T0-T3), pupils were asked to wear the ActiGraph accelerometer (GT3x) for 7 days. The device was placed on an elastic waist band and pupils were asked to wear the accelerometer on their right hip at all times, removing it only for bathing, water-based activities and when asleep. Pupils were included in the analysis if they had ≥2 valid weekdays of data (500 min/day) (Sebire *et al.*, 2018).

> Compliance with wear-time criteria can be problematic and high proportions of missing accelerometer data has implications for research quality

STRATEGIES EMPLOYED TO MAXIMISE ACCELEROMETER RETURNS AND MINIMISE THE AMOUNT OF MISSING DATA

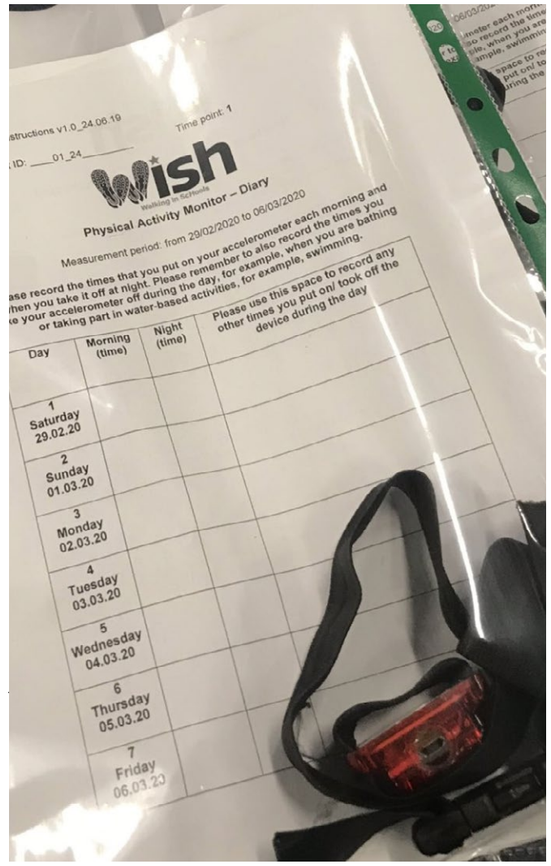
Prior to the study commencement, a comprehensive inventory was set-up to accurately track the location of and any technical issues with the accelerometers. All accelerometers were labelled with the contact information of the research team should a device be lost. During school recruitment visits, the data collection methods were outlined. Pupils could look at, feel, and try on an accelerometer, discuss when/how they would be worn and ask questions before registering for the study. The importance of wearing the accelerometer and the incentives that would be provided when devices were returned was explained. In advance of the first data collection appointment, accelerometers were pre-assigned to participants by the research team. To prevent any potential embarrassment due to the allocation of the incorrect waistband size, as pupils entered the room, a member of the research team visually assessed each pupil and for anyone that may have required a different size of waist band (i.e. smaller/larger), a new accelerometer was assigned without the pupil's knowledge. For subsequent data collection appointments, the size of waistband (small/medium/large) required by each pupil was on record and assigned. At data collection appointments, pupils were asked to try on their accelerometer for comfort and fit and it was possible to swap the accelerometer if there were any issues.

Accelerometers were set up to flash until the following morning when data collection would begin. The contact details for the Research Team were provided, and pupils were advised to ask their parent/guardian to contact the Trial Manager if the device continued to flash (indicating a technical issue). Accelerometers were distributed face-to-face within schools and clear verbal instructions were provided on when to wear the device, how to look after the device and when and to whom they should be returned. On each occasion, pupils were provided with "an accelerometer pack', labelled with their name and school, a wear-time log, written instructions, and a note on coloured paper informing participants when, where and to whom to return the accelerometer. Labelled boxes were left with the staff contact responsible for collecting the monitors.

Ethical approval was in place to send text messages to the parent/guardian on the last day of each data collection period to detail where and to whom the devices should be returned. Throughout the study, we liaised closely with school staff and when necessary, school staff contacted the pupils' parent/guardian to retrieve accelerometers. At each timepoint, the devices were collected from schools as soon as possible and preferably within 1 week meaning there was less time for devices to be misplaced.

Incentives were provided when pupils returned accelerometers. These incentives were chosen (water bottles/earphones/power-banks) and designed (hoodies) by the Youth Advisory Group (YAG) (Gallagher *et al.*, 2023) (total cost £15/pupil). Incentives were delivered to schools once accelerometers had been downloaded for that specific timepoint. School staff were asked to distribute the incentives. Attached to the incentive for each pupil was a label with the pupil's name, school, and a message specific to the number of days the accelerometer had been worn for that timepoint (Table 1). The messages acknowledged/praised those who had complied with the wear-time protocol and provided encouragement for those with lower levels to improve their wear-time during the next data collection period.

Using the wear-time data from the previous timepoint, schools were ranked from 1-18 based on the percentage of



▲ Accelerometer packs' distributed for data collection as part of the WISH Study **Courtesy:** Dr Maria O'Kane

▼ **Table 1:** Messages to pupils based on accelerometer wear-time.

WEAR-TIME (DAYS)	MESSAGE TO PUPIL
7	"When we downloaded the data, we can see that you wore the device for the full 7 days. This is brilliant, thank you!"
5-6	"When we downloaded the data, we can see that you wore the device for [5 or 6] days. Thank you for wearing the device as much as you did, this is really helpful for our research!"
3-4	"When we downloaded the data, we can see that you wore the device for [3 or 4] days. Next time, please try to wear the device for the full 7 days. Thank you!"
1-2	"When we downloaded the data, we can see that you wore it for [1 or 2] days. Next time, please try to wear the device for the full 7 days. We need the devices to be worn more than [1 or 2] days. Thank you!"
0	"When we downloaded the data, we can see that you haven't wore the device. Next time, please try to wear the device for the full 7 days. Thank you."

pupils who met wear-time criteria and could be included in the analysis. This 'leaderboard of wear-time' was used to generate competition and encourage pupils to wear the monitor. It was emphasised that this leaderboard was unrelated to levels of PA and focused on wear-time.

HOW EFFECTIVE WERE THE STRATEGIES IMPLEMENTED?

In total, n2213 accelerometer devices were issued over a 12-month period. Only n3 (0.14%) devices were unreturned. The median overall wear-time was between 5 and 6 days at each time point. The number of pupils meeting the wear-time criteria (≥2 weekdays) ranged from 91% at baseline, to 84% at the end of the intervention. Interestingly, the median wear-time for the control group was higher by one day than the intervention group at T0, T1, and T2. There were no differences in age, height, weight, BMI z-scores, waist circumference, hip circumference, and waist-to-hip ratio between pupils who met and those who did not meet the minimum wear-time criteria. Accelerometer data was available for 74% of participants at T0 and T2, compared to 69% (Girls Active Project, (Harrington *et al.*, 2018)) and 64% of participants (Plan A, (Sebire *et al.*, 2018) as reported in similar studies.

SUMMARY

The use of accelerometers to measure PA is challenging in this population group. However, a multi-faceted approach like the one implemented within the WISH Study can encourage adherence to the wear-time protocol and ensure devices are returned. Of key importance in this context was the provision of incentives (chosen by the YAG), clear return instructions and reminder text-messages to parents/guardians. ■

> "The non-return of devices can also be challenging among this population group"

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EQUITY, DIVERSITY AND INCLUSION

INCREASING RESEARCH PARTICIPANT DIVERSITY IN RESEARCH - WHY IT MATTERS.

Prof Kiara Lewis FBASES, and Drs Faatihah Niyi-Odumosu, Sanjoy Deb, and Christine Smith discuss research participant diversity and provide recommendations to increase diversity.

There is an existing sex data gap in sports and exercise science research, with female participants significantly underrepresented. This picture does not improve when considering the broader aspects of EDI with a lack of representation and voice in certain groups that are "seldom heard". For example, a review of talent development in football found white, adolescent, able-bodied European males dominated the literature (Gledhill *et al.*, 2017). This is replicated across the field and highlights the need to consider intersectionality in sports and exercise science research. Various theories and methods have been posited to improve the diversity of research participation, such as co-production and user-inspired research (Public and Patient Involvement - PPI); in this brief article, we discuss these various approaches to stimulate further reflection on how to embed diversity into research.

HOW CAN RESEARCH INCLUDE PARTICIPANTS?

Research has traditionally been carried out by researchers on participants. It has become more common in healthcare research to involve participants within the research as more than just participants but as stakeholders engaged in the process at various stages of the research process.

Traditional pure research is when the professional makes all the decisions, user-inspired research (also known as PPI) involves participants (stakeholders) at some stages of the research process (but determined by the professional) whereas co-production involves the research participant at all stages (indeed they may *initiate* the process).

WHY SHOULD WE INCLUDE PARTICIPANTS IN RESEARCH?

Engaging a range of individuals in the decision-making in research, including athletes, coaches, exercise and fitness professionals, enriches the research and ensures that studies align with the practical needs and experiences of those involved. This collaborative approach fosters transparency, accountability, and the applicability of research findings. It also promotes inclusivity and a deeper understanding of the lived experience of sport and exercise across diverse communities. By valuing diverse insights, research becomes more relevant, culturally sensitive, and applicable to a wider population.

RECOMMENDATIONS ON HOW TO INCREASE RESEARCH PARTICIPANT DIVERSITY

The inclusion of participants within physical activity for health research is growing. There are examples of using PPI to design an RCT for healthy ageing (Travers *et al.*, 2022) to co-produce PA recommendations for people living with a disability (Smith *et al.*, 2022a) and the Public Involvement in Research Group (PIRG) which facilitates public input at all stages of the research process, from funding applications to project evaluations. To date, this work has addressed more clinical and health applications, and more work is needed across the sport and exercise science sector.

A detailed discourse and guidance on how to incorporate public engagement into the research process in sport and exercise research has been discussed by Smith *et al.* (2022b). Here, we present some brief tips on how to promote research participant diversity in the PPI process:

1. Community Engagement: collaborate with local communities and community organisations by holding research engagement events, workshops, or outreach programs to educate the public about the importance of sport and exercise science research. This can be used to develop a PPI group and/or recruit participants.
2. Diversity of the research team: Consider the project teams' and collaborators' diversity to bring varied perspectives and experiences to the research and support a diverse PPI engagement.
3. Consensus is not always the goal: when encouraging diverse perspectives into the research process, it is important to remember that a consensus may not always be attainable but consider how you can acknowledge and give a voice to these diverse perspectives throughout the research process.
4. Cultural competence: consider cultural competence training or development for the research team to increase awareness of working within local, national and international diverse communities.
5. Practical solutions to make participation accessible: consider how you can make participation easier; for example, do the PPI volunteers require training, is the venue and time convenient, are you providing remuneration or expenses for their time, and is the material provided in a user-friendly accessible manner? ■

> Engaging a range of individuals in the decision-making in research, including athletes, coaches, exercise and fitness professionals, enriches the research and ensures that studies align with the practical needs and experiences of those involved

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REAL WORLD

SUPPORTING MUSLIM ATHLETES IN RAMADHAN

Dr Ibrahim Akubat FBASES discusses the details of Ramadhan, the recent developments in understanding of Ramadhan and outlines some of the challenges and opportunities it may bring.

DR IBRAHIM AKUBAT FBASES

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The Muslim holy month of Ramadhan will already be upon us by the time of this publication. For those unfamiliar with it, Ramadhan is the 9th month of the Islamic calendar and is considered a particularly focal time for Muslims and is mainly known as the month in which Muslims engage in fasting during daylight hours. This will have started on March 12th 2024 (+/- 1 day) depending on the sighting of the new moon that marks the start of each monthly cycle. It is considered obligatory on healthy post-pubescent Muslims to fast. There are approximately 2 billion Muslims worldwide with significant minorities across Western Europe. In the UK there are approximately 4m people that identify as Muslim representing approximately 6.5% of the total population (ONS, 2021). Therefore, it stands within reason to expect Muslim participation at elite performance levels and in elite performance pathways across sports but representation may be sporadic or isolated and therefore awareness is sometimes lacking. Famous athletes who have trained and competed whilst fasting include Kyrie Irving (Basketball), Karim Benzema (Soccer), Mohammed Salah (Soccer), Moeen Ali (Cricket), and Amir Khan (Boxing) to name a few. Representation in some sports is increased where recruitment to domestic teams is international. This is most apparent in the English Premier League with players such as Mohammed Salah, Adama Traore, Wesley Fofana, Ngolo Kante and Sadio Mane to name a few known to have fasted while training and competing. Knowledge of this was brought into sharp focus in 2020 when the game between Crystal Palace FC and Leicester City FC in the English Premier League had the restart after a natural break in play delayed slightly to allow Wesley Fofana and Cheikhou Kouyate to end their fasts and take on some fluids and nourishment. The incident was covered by Sky Sports and can be revisited by clicking here.

This scenario came about as a result of the proactive approach of both the club's doctors before the game who then approached the referee. Dr Zafar Iqbal was the medic for Crystal Palace during this game. On a previous webinar we did he explained how he reached out to his counterpart at Leicester City FC to devise a strategy as players on both sides would be in similar positions. They approached the referee to devise a plan. It was supposed to be discreet and go unnoticed. However, such is the attention on each premier league game that it didn't go unnoticed and it soon came to international attention.

WHAT DOES THE TYPICAL DAY IN RAMADHAN LOOK LIKE?

The day will start early with a pre-dawn meal known as "suhoor". In Birmingham (UK) this year this would mean finishing eating and drinking between 4 and 5 AM. As this is based on solar time there is some variance depending on location and as each day passes. Suhoor is typically followed by attendance to a mosque offering the pre-sunrise prayers. Muslims are required to offer five prayers daily with the other four taking place at noon (12.30 pm), mid-afternoon (3.30pm), after sunset (6-7pm), and in the evening (after 8pm). The ending of the fast takes place at sunset with its associated prayer and is known as "iftar". This represents the first opportunity to rehydrate and replenish. Soon thereafter the evening prayers will be offered with a 6th prayer of the day called "tarawih" which is specific to Ramadhan and lasts typically from 75 to 90 minutes. Therefore, it would be well after 10 pm before an athlete could be home. This would now be the time that some rest is taken before waking up again for suhoor. This would constitute around 5 hours of sleep at night. This short description of the day provides a snapshot of the potential challenges for multi-disciplinary teams. There are many cultural traditions and individual habits that people develop and therefore it is advised to sit down with athletes and ask them about their routine so you can best support them. Doing this may help you identify good opportunities for a bespoke strategy but also other variables such as the demands of family life that may also have an exacerbated detrimental impact (e.g lack of opportunity to nap due to childcare responsibilities etc). This blog posted on the British Journal of Sports Medicine website provides some guidance around this initial conversation.

SO WHY DID IT TAKE UNTIL 2020 FOR PEOPLE TO PAY ATTENTION?

Research on athletes during Ramadhan has been done for many years although studies in elite populations are still limited. In 2012, the Journal of Sports Sciences dedicated a supplement (Vol 30, Supplement 1). As the Islamic calendar operates based on the lunar cycle it moves forward each year (10-12 days) in relation to the Gregorian calendar. The graphic produced by Al Jazeera last year gives a good overview of when Ramadhan will start over the next few years.

Over the last 10 years or so Ramadhan has largely taken place in the football off-season over the summer months. So, it was only in 2019 that Ramadhan started to encroach on the end of the European football season after some years. There was also undoubtedly a shift in climate after the murder of George Floyd in the USA with greater consideration of inclusive practice and the opposition to discrimination. Finally, representation matters! Is it a coincidence that the Crystal Palace medic at the heart of the stoppage of play also happened to have lived experience of the subject matter? In my opinion, these three factors combined to provide a seminal moment in our national sport that has transcended beyond football and the UK.

EXEMPTIONS TO FASTING

Several types of persons can be exempt from fasting during this month.

- Pre-pubertal children
- Those who are ill or have a condition that could be aggravated by fasting.
- ravelling (> 47 miles)
- During menstruation or post-natal bleeding
- During pregnancy or breastfeeding

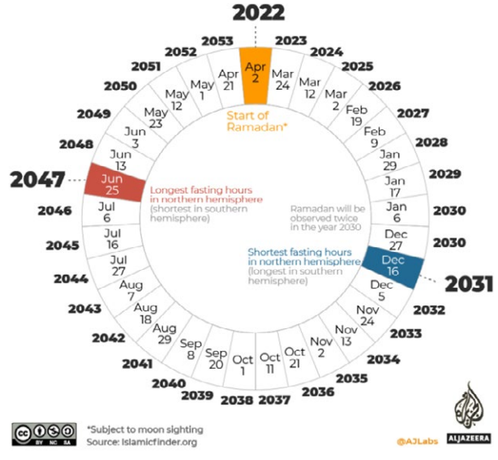
During menstruation or post-natal bleeding, there is a direct ruling for not fasting. There is individual discretion for the rest and therefore the initial conversation with the athlete in developing a strategy is imperative.

DOES FASTING IMPACT PERFORMANCE?

This has been a contentious issue with some coaches sometimes publicly blaming athletes for poor performance or refusing to play them if they chose to fast. On the other hand, footballers have anecdotally touted the benefits of greater focus and determination as a result of the mental and spiritual benefits they perceive. Karim Benzema famously scored three consecutive hat-tricks for Real Madrid in the 2023 season while fasting. Some coaches have highlighted the resilience and character this demonstrates and how these are valued qualities. Thankfully in recent years and especially in the UK there is a growing awareness and player care has been improving to provide a more inclusive environment in which athletes are supported to practice their faith (a protected characteristic in UK law) rather than it being seen as an obstacle. However, this is not universal across the rest of Europe. Across sports, research is relatively scarce with most research available on football. Inferences over endurance activities relying on carbohydrates as an energy source are probably the easiest to make. An impact on performance is to be expected in such scenarios. The impact on performance in football and other team sports is a little less clear. There is evidence regarding sleep disturbance, feelings of fatigue, and potential calorie deficits and dehydration (Trabelsi *et al.*, 2023). Acute performance tests have also been shown to be impacted negatively however assessment of actual match related performanace indices is lacking (DeLang et al, 2021). Research on top-level athletes with current-day support systems is lacking. A case study approach with current monitoring technologies and approaches can provide a rich data set from which we can derive more accurate inferences based on individual circumstances.

PERFORMANCE VS DEVELOPMENT FOCUS

In trying to contextualize support decisions practitioners might find it useful to understand their true focus. To what extent is the micro-cycle or level focused on the development of the athlete versus performance? This should help determine your focus and the development of a plan for the athlete that supports their focus while fasting. It will help you determine if sacrifices need to be made in training to preserve freshness for upcoming performances or if competition can be sacrificed to some degree to prioritize training which could lead to a higher level of fatigue.



▲ **Figure 1:** When is Ramadhan?

CHALLENGES	OPPORTUNITIES
Dehydration	Technical/Tactical execution under fatigue
Glycogen depletion/energy deficit	Fasted training adaptations
Sleep	Transfer of focus/discipline associated with fasting
Fatigue	
Delayed Recovery	

▲ **Table 1:** Potential challenges and opportunities with a fasting athlete.

CHALLENGES AND OPPORTUNITIES

Invariably fasting may challenge certain development and performance priorities. However, it may also provide opportunities to develop areas. The obvious place to start is how training or competition may be affected. A period of fluid, calorie, and sleep restriction can influence competition, training, and recovery negatively. The accommodations that can be made for the individual athlete could potentially be very different to that of a team sport athlete. An individual athlete who could potentially avoid certain competitions could have a very different accommodation strategy in that there may be a greater scope of adjusting demands. Therefore, Ramadhan should be part of the consideration in any annual planning for such athletes. Whereas team sports athletes will already know the competition requirements and would likely have little control over when they are required to compete therefore the strategy will focus on dealing mainly with the likely demands rather than adjustment of them although this could happen through other means such as modified training. Table 1 sets out the potential challenges and opportunities.

TOP TIPS

- Plan early, ideally at the start of annual cycle.
- Include the athlete as early as possible.
- Attend a relevant CPD session.
- Have clear development and/or performance priorities.
- Take advantage of traditional foods used for iftar (dates, nuts, milk) for nutritional strategies. ■

KEY RESOURCE

Aspetar Clinical Guidelines: Ramadhan Fasting and Exercise for Healthy Individuals (2021)

FA Muslim Player Considerations (2024)

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ENTRUSTABLE PROFESSIONAL ACTIVITIES FOR COMPETENCY DEVELOPMENT IN THE SPORT AND EXERCISE SCIENCES

Drs Eddie Bradley, Charlotte Chandler, and Mark Smith discuss a pedagogic approach to practical skill development related to BASES accreditation and curriculum design.

The British Association of Sport and Exercise Sciences (BASES) is the professional body overseeing sport and exercise science (SES) in the United Kingdom (UK); it drives excellence in SES across three key themes of research, applied practical support, and pedagogy. Key to this is the development and maintenance of professional standards which are operationalised through the Supervised Experience (SE) process, accreditation of practitioners, and endorsement of degree programmes. The BASES Sport and Exercise Scientist Accreditation establishes the professional standard within the UK against a set of core competencies. Many activities undertaken by applied practitioners require training specifically aligned to that profession and authentic learning environments are therefore key to supporting student development, especially for those pursuing a practitioner career pathway.

In the SES disciplines, the ability to perform tasks safely and effectively is of paramount importance, and the development of an outcome-based educational approach therefore seems prudent. Competency-based education shifts the learning process from dispensing to applying knowledge, enabling learners to perform tasks with increasing confidence as they progress through programmes of study and into the workforce. In educational settings, these tasks are typically delivered through practical laboratory and field-based activities and assessed by way of competency-based evaluations in the form of, for example, applied practical observation, laboratory reports, or portfolios of evidence. Learners who become competent, being those that have reached a required standard of proficiency in accordance with a learning outcome, are deemed to have the necessary ability to undertake similar forms of activity thereafter.

WHAT ARE ENTRUSTABLE PROFESSIONAL ACTIVITIES (EPAS)?

EPAs are units of professional practice, defined as "tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence" (Ten Cate, 2013, pg 157). EPAs constitute a description of work and define professional activities associated with the day-to-day requirements of a profession and how to undertake these safely and effectively (Ten Cate, 2018). Essentially, EPAs link competencies to work-based actions and when the required level of competency is achieved, the student can be trusted to select and complete the appropriate task (Ten Cate, 2013). However, an EPA is not a singular entity but must incorporate abilities across domains of performance and apply these as an integrated skill when required in the workplace. Within SES, an EPA could be the application of a heart rate monitor and associated documentation of readings, or the set-up, use, and interpretation of a motion capture system. It is important to note that EPAs will differ across the sub-disciplines of SES with regards to what is viable, particularly where the skills developed are less tangible i.e., the interpersonal skills associated with the development of an effective working relationship in sport and exercise psychology practice. This does not mean to say that EPAs cannot be applied across SES, but that we need to be mindful as to how they are embedded and assessed given the nuances of our respective sub-disciplines. This is also of significance in the context of developing students to be able to evidence competence aligned to BASES accreditation.

	EPA DOMAIN AND COMPETENCIES											
	EFFECTIVE IMPLEMENTATION				EVALUATION OF PRACTICE					STUDENT BEHAVIOURS		
BASES COMPETENCY AREA	GOAL SETTING AND PLANNING	COMMUNICATION OF PROCEDURE	SELECTION OF EQUIPMENT / TECHNOLOGY	MEASUREMENT AND DATA HANDLING	MAINTAIN HEALTH & SAFETY	ANALYSIS AND INTERPRETATION	IMPLEMENT VALIDITY & RELIABILITY ASSESSMENT	ENGAGEMENT WITH CLIENT/ ATHLETE	ABILITY TO RESEARCH APPROPRIATE PRACTICE	AUTONOMY OF PRACTICE	MAINTAINING INCLUSION AND DIVERSITY	DUTY OF CARE TOWARDS CLIENT/ATHLETE
SCIENTIFIC KNOWLEDGE			✓			✓	✓		✓			
TECHNICAL SKILLS			✓	✓	✓	✓						
APPLICATION OF KNOWLEDGE AND SKILLS	✓					✓						
USE OF RESEARCH				✓			✓		✓			
SELF-EVALUATION AND PERSONAL DEVELOPMENT							✓		✓	✓		
COMMUNICATION		✓						✓			✓	✓
PROBLEM SOLVING AND IMPACT	✓		✓		✓					✓		
MANAGEMENT OF SELF, OTHERS AND PRACTICE				✓	✓			✓		✓	✓	✓
UNDERSTANDING THE DELIVERY ENVIRONMENT	✓	✓						✓			✓	✓
PROFESSIONAL RELATIONSHIPS AND BEHAVIOURS		✓			✓			✓			✓	✓

▲ **Table 1:** Example mapping of BASES accreditation competencies to EPA domains

EPAS AND BASES ACCREDITATION

In Higher Education, EPAs represent a formal process for recognising and documenting students' capabilities and thus developing their work-readiness. Therefore, embedded EPAs create a development pathway for all students and act as a pedagogic strategy to improve employability. The criteria for BASES Accreditation are based on evidencing competency within the chosen sub-discipline, with the competencies developed through an appropriate SES curriculum. Many undergraduate programmes in the UK are endorsed via the BASES Undergraduate Endorsement Scheme (BUES) which verifies that their curriculum covers the skills and knowledge required to enter the profession. Aligning curricula to BASES accreditation through an EPA framework could be a method to further facilitate student development and thus the enhancement of professionalism within our academic field. Practitioners in this field frequently operate individually and without supervision and thus, the principles of competency-based education and EPAs would be valuable to guide SES education.

EPA EXAMPLES

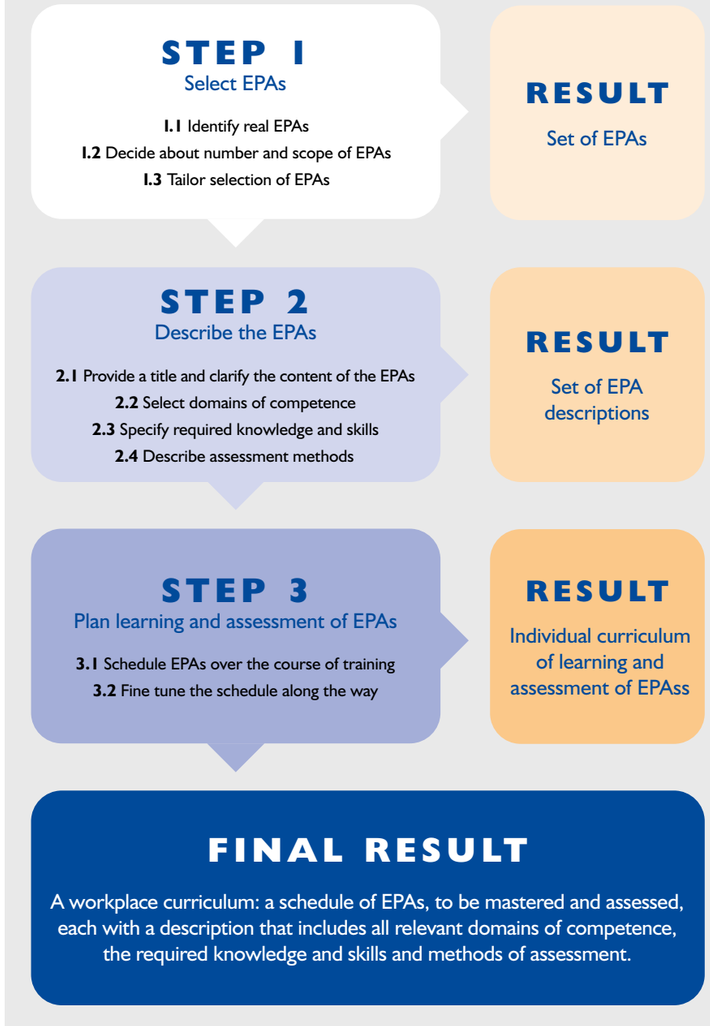
To follow are two examples of how EPAs have been embedded in SES curriculums at both undergraduate and postgraduate level.

The first example (Bradley *et al.*, 2022a) is of an introductory (Level 4) Sport and Exercise Sciences module, which was structured to introduce the three key disciplines of physiology, psychology, and biomechanics by demonstration and practice of test protocols. An EPA framework, or 'competency matrix', was developed, with a list of desired attributes for a sport and exercise scientist defined and assigned to three EPA domains; 'Effective Implementation', 'Evaluation of Practice', and 'Student Behaviours' (Table 1). EPAs were not related to specific tasks and were designed to cover each of the different tests included in the module. Therefore, the EPA framework described attributes that the students should display, rather than specific SES activities the student should perform to show competence due to the level of the module.

The second example (Smith, 2019) relates to EPAs embedded within a Level 7 Sport Physiology module. The module's practical component was assessed through an applied, athlete-centred physiological support evaluation (i.e., live roleplay). The defining module objective for this practical component of the curriculum was that the 'applied sport scientist' (i.e., the student) should be able to complete, without supervision, an athlete physiological assessment in a safe and effective manner, capturing the desired outcomes in accordance with agreed athlete-centred goals. These principles were broadly grouped into EPA1: that athlete safety and welfare were ensured and maintained throughout the assessment period, and EPA2: that the physiological assessment was undertaken effectively. If a student was able to demonstrate both these principles, it was deemed that the module component objective had been met and the overarching professional activity reached (entrustment would be granted to the student).

STUDENT FEEDBACK

Both practical examples of EPAs in action resulted in positive student feedback on the process. For example, most students considered the competency matrix easy



▲ **Figure 1:** Steps in building a practice-based curriculum around EPAs

to understand (93%), clearly defined (97%), well communicated to them (80%), and the listed competencies were distinguishable to the profession i.e. 'maintaining health and safety' and 'communication of procedure' (Bradley *et al.*, 2022b). Qualitative feedback suggested that EPAs developed students' understanding of the role of a sport scientist and requirements of applied practice, their ability to work independently, their knowledge of specific protocols and equipment, and interest in pursuing associated careers (Bradley *et al.*, 2022b; Smith, 2019).

SUMMARY AND RECOMMENDATIONS

EPAs are a well-structured teaching and learning tool with clear alignment of learning activities and practical skill development within the SES discipline. EPAs aid students' professional development and their acquisition of the attributes and skills required for work-ready SES graduates. Competencies provide the pillars of academic knowledge and skill required for applied practice and EPAs provide the bridge between the two.

Individual accreditation as a Sport and Exercise Scientist is a career path many graduates choose to take and there remains, therefore, an opportunity to explore ways to develop and assure practical and professional competency at the undergraduate level of education. While BASES accreditation is at postgraduate level, it is important to provide students with early exposure to the skills and competencies necessary for applied work and an understanding of how these relate to their progression and development within SES. A key part of this developmental process, across all levels, is the documenting of evidence and we propose our recommendations to be of most benefit if students are supported to formalise and record their progress against EPAs. Not only will this encourage students to engage in this practice throughout their development but represent added value to their degree programme as they look to progress.

ARE EPAS APPROPRIATE FOR SES EDUCATION?

The simple answer is 'yes'. EPAs can have a valuable place in a practice-based SES curriculum and can be advantageous to the development of work-ready graduates within and beyond their subject.

Future steps should include consideration of how a range of EPAs could be embedded within SES curriculums (Figure 1), especially in relation to sub-disciplines and the nature of skills required. The EPAs aligned to physiological or biomechanical testing will differ significantly to those required for a psychological consultation, and so too will the way in which they can be assessed. There is opportunity to explore BASES competencies and associated EPAs in terms of degree levels, identifying those most appropriate for assessment at different stages and scaffolding personal and professional development across the student journey. Examples of 'quick wins' to achieve this include:

- Mapping of module content against BASES accreditation competencies.
- Adjust assessment to reflect vocational/ authentic activity.
- Raise awareness of BASES accreditation through modules.
- Document and evidence skill and competency development.

Ultimately, we see EPAs as an opportunity to support the development of future generations of practitioners and promote student progression onto BASES SE from the outset of a degree. ■

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PHYSICAL LITERACY - OUR RELATIONSHIP WITH MOVEMENT AND PHYSICAL ACTIVITY THROUGHOUT LIFE

Dr Lawrence Foweather introduces the Physical Literacy Consensus Statement for England and discusses its relevance for sport and exercise science.

DR LAWRENCE FOWEATHER

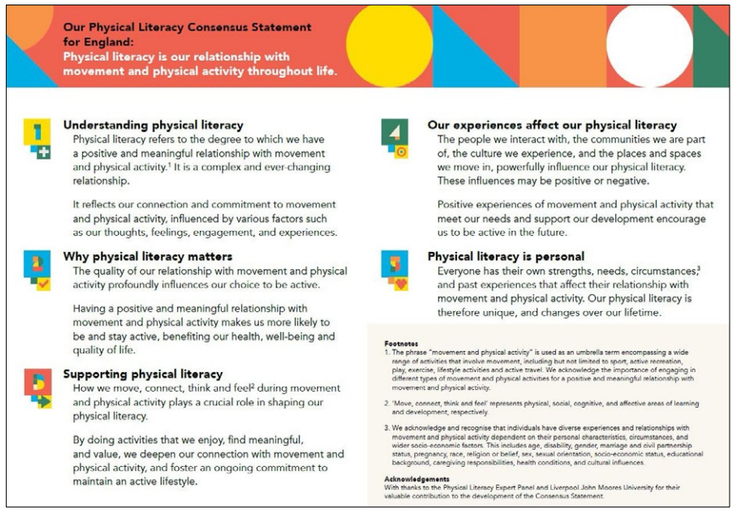
Lawrence Foweather is a Reader in Physical Activity and Health at Liverpool John Moores University and the Principal Investigator on the Physical Literacy Consensus for England project.

The Physical Literacy Consensus for England (Sport England, 2023) was launched last September to facilitate a shared understanding of physical literacy for those working in the sport, education, health, and community sectors. The statement was the culmination of 18 months of collaborative endeavours, including learning and insight work, co-development with an expert panel involving 60 academics and professionals from around fifty different organisations, and two national consultations (see www.ljmu.ac.uk/physical-literacy for more information). The statement offers a broad overview of what physical literacy is, why it is important, and how it can be developed and supported (see Figure 1).

THE RATIONALE BEHIND A CONSENSUS STATEMENT FOR PHYSICAL LITERACY IN ENGLAND

Though the term 'physical literacy' has been around since the late 19th century, it is the pioneering work of Professor Margaret Whitehead that has spurred contemporary interest in the concept. Indeed, physical literacy has gained considerable traction among national and international organisations across physical activity, sport, health, and education sectors (Shearer *et al.*, 2018). In conjunction with this trend, there has been a notable increase in research articles dedicated to physical literacy, resulting in a plethora of definitions and interpretations. For instance, our evidence review (Hurter *et al.*, 2023) uncovered 23 distinct definitions of physical literacy. The abundance of definitions underscores the diversity of perspectives and acknowledges the cultural nuances prevalent worldwide. However, our first national consultation highlighted stakeholder confusion and a sense of disillusionment regarding the concept's perceived academic nature. Ongoing debates around what constitutes physical literacy were seen as hindering its practical implementation. Stakeholders reported that advocating for physical literacy became challenging when the concept held different meanings for various individuals and organisations.

The above insights provided a compelling rationale for a Physical Literacy Consensus Statement for England, highlighting the necessity to 'unite' perspectives on physical literacy. The consensus statement was intended to be accessible for sector professionals and practitioners, and wider system stakeholders who work in policy, research, and practice. In this article, I aim to unpack the definition and key messages of the Physical Literacy Consensus Statement for England. I will also discuss the permutations of the consensus statement for the sport and exercise sciences.



▲ **Figure 1:** Physical Literacy Consensus Statement for England (Sport England, 2023).

UNDERSTANDING PHYSICAL LITERACY

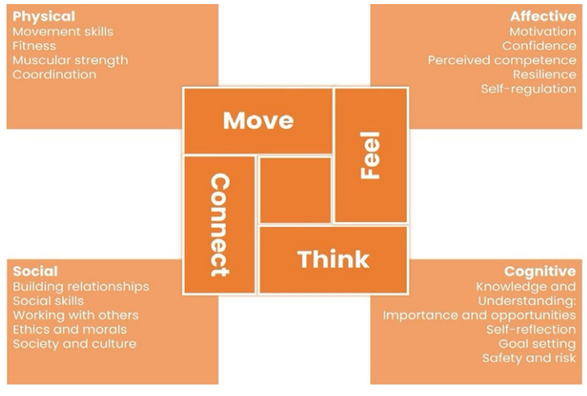
In the statement, physical literacy is defined as "our relationship with movement and physical activity throughout life". The panel reached a consensus that the term 'relationship' best encapsulates the personal, holistic, lifelong, and constantly evolving concept of physical literacy. It highlights that physical literacy goes beyond acquiring capabilities for movement and physical activity, such as competence and confidence, and reflects our connection and commitment to movement. This relational definition reflects evolving and contemporary perspectives of literacy, encompassing interpretation, appreciation, and the discovery of value and meaning (similar to musical literacy). Defined in this way, the notion of being physically literate and physical literacy as an end state is disavowed.

WHY PHYSICAL LITERACY MATTERS

I was intrigued by Professor Stuart Biddle's article in issue 78 (Biddle, 2023), which highlighted the importance of shifting the emphasis in physical activity messaging from solely focusing on health-related motives to those that recognise the importance of feelings and affect. Ultimately, the quality of an individual's relationship with movement and physical activity – their physical literacy - will influence their engagement choices, spanning from birth to old age and from playground to podium. A positive and meaningful relationship with movement and physical activity enhances the likelihood of an individual staying active, enriching their lives. Physical literacy is therefore a driver for the initiation and maintenance of physical activity. Supporting physical literacy becomes pivotal in sustaining engagement across various movement and physical activity contexts.

For instance, physical literacy holds relevance for professionals aiming to improve adherence to exercise prescriptions, such as physiotherapists or strength and conditioning coaches. It also resonates with those seeking to foster better engagement and prevent dropouts, such as physical educators or sports coaches. Moreover, physical literacy extends to individuals working at the community and population levels as it has ramifications for how we promote movement and physical activity in policy and practice, focusing on the quality as well as quantity of participation. Given the above, it becomes apparent that physical literacy has relevance within undergraduate and postgraduate taught programmes curricula across the sport and exercise sciences.

▼ **Figure 2:** Examples of areas of learning and development that support physical literacy.



SUPPORTING PHYSICAL LITERACY

One of the hot topics of debate in the field of physical literacy has been its constituent 'elements' or 'attributes' (Martins *et al.*, 2021). The widespread Whiteheadian International Physical Literacy Association definition (2017) includes motivation, confidence, physical competence, and knowledge and understanding. Many other elements have been offered, for example interaction with others, resilience, self-regulation, and reading the environment (Martins *et al.*, 2021). The panel elected to be inclusive of wider elements and focused on broader domains corresponding to physical, social, cognitive, and affective development (i.e., 'move', 'connect', 'think', 'feel'), rather than being constrained by listing specific attributes. This decision was based on stakeholder and expert panel responses, acknowledging the multitude of capabilities important for physical literacy (see Figure 2). Specifying capabilities would signal to others what should be important and valued, potentially overlooking other important aspects. These four interconnected domains provide the holistic foundation for physical literacy and consequently our engagement in movement and physical activity behaviours (see Table 1).

Perhaps even more important than supporting the areas of learning and development is that individuals are supported to find enjoyment, value and

MOVE PHYSICAL	CONNECT SOCIAL	THINK COGNITIVE	FEEL AFFECTIVE	BEHAVIOUR
✓	✓	✓	✓	Engaged
✗	✓	✓	✓	Frustrated
✓	✗	✓	✓	Excluded
✓	✓	✗	✓	Confused
✓	✓	✓	✗	Apathetic

[1]Modified from Durden-Myers (2020)

▲ **Table 1:** The (inter)relationships between domains of learning and development and movement behaviours[1]

meaning from movement and physical activity. These are indicators of a positive relationship/physical literacy. Future research is needed to explore facets of a positive and meaningful relationship with movement and physical activity across the life course.

OUR EXPERIENCES AFFECT OUR PHYSICAL LITERACY

The physical environment (e.g., green and blue spaces, community facilities) and social environment (e.g., friends, family, teachers, coaches, health professionals, etc.) can powerfully influence physical literacy. We are all aware that this is not a level playing field and the opportunities afforded to individuals are varied and sometimes limited. If physical activity provision is safe, inclusive and provides opportunities to support holistic development, physical literacy will be supported.

> Supporting physical literacy requires adopting a person-centred and inclusive approach that focuses on an individual's strengths and preferences.

PHYSICAL LITERACY IS PERSONAL

Physical literacy is deeply personal, and thus, every individual's physical literacy will be different. Supporting physical literacy requires adopting a person-centred and inclusive approach that focuses on an individual's strengths and preferences. Our past, present, and future experiences of movement and physical activity shape our physical literacy. It is acknowledged that individuals likely have diverse experiences and relationships with movement and physical activity dependent on their personal characteristics, circumstances, and wider socio-economic factors. However, further research is needed to investigate inequalities and structural barriers in physical literacy.

PRACTICAL IMPLICATIONS

The consensus statement aims to address the fundamental questions of 'what' and 'why' regarding physical literacy. As we transition into the implementation phase, there is a need for more evidence on the 'how' – the strategies for supporting physical literacy in real-world settings. As a starting point, some practical implications are offered below:

- Capture the voices of participants to understand their perspectives on movement and physical activity, including what matters to them and what they find enjoyable.
- Build an 'offer' around these perspectives, using them as 'hooks' to win hearts and minds for sustained engagement. Prioritise meaning, value and enjoyment.
- Support holistic learning and development, moving beyond the physical - fitness, skills, techniques, and drills - to also nurture social, emotional, and cognitive development.
- Adopt a strengths-based approach aligned with individual development, encouraging goal-setting, self-evaluation, and reflection on physical literacy and physical activity.
- Recognise that the learning and development contributing to a positive relationship with physical activity vary and may differ among individuals. Tailored, person-centred approaches are therefore essential.

CONCLUSION

England now joins Canada, Australia, New Zealand, China, Ireland and Northern Ireland in founding a Physical Literacy Consensus Statement through a genuinely collaborative effort. It remains to be seen whether the remaining home nations pursue their own consensus or adopt another perspective. In England, fostering physical literacy means nurturing positive relationships with movement and physical activity. By understanding, supporting, and adapting to the diverse needs and preferences of each individual, sport and exercise scientists, and practitioners in participation or performance contexts can play a pivotal role in enhancing physical literacy - an intrinsic driver for engagement in movement and physical activity behaviours. ■

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BASES 2024 Conference

ABSTRACT GUIDELINES

BASES invites abstracts in the following sport and exercise science-related themes.

1. Biomechanics and Motor Behaviour
2. Physical Activity for Health
3. Physiology and Nutrition
4. Psychology
5. Sport and Performance.

The **deadline** for all abstract submissions (free communication presentation, poster and 5 slides in 5 minutes free communication presentation) is **10am Monday 10 June 2024.**

Abstracts should be no more than 400 words, containing no tables or figures, sub-headings or paragraph breaks. Word counts are calculated using the word count tool in Word. Abstract title, authors and institutions are not considered in calculating the wordage.

Studies using qualitative and/or quantitative methods are invited.

Meta-analyses and systematic reviews are invited, but literature reviews are not permitted.

On the on-line submission form the presenting author, on behalf of all of the authors, needs to declare that the material submitted is original and unpublished, and that it is not under consideration for presentation elsewhere. The only exception to this is that BASES student members are allowed to submit the same material to both the BASES Annual and Student Conference in the same year.

Types of abstracts

Two types of abstracts are available:

1. **Scientific communication.** A scientific communication is an opportunity to share findings from scientific research.

2. **Applied practice.** An applied practice presentation is an opportunity to share findings from applied practice. The presentation could include findings from or reflections on applied work. These sessions should be particularly useful for practitioners and those members on supervised experience and/or seeking re-/accreditation. The aim of such abstracts is to allow practitioners to broadcast evidenced-based practice. As such, there should be clear evidence that the work is underpinned by theory and research. The needs analysis undertaken to determine the client's requirements and the content of the resulting support/intervention package should be explained. The results should be presented in a format that is not only practically relevant but academically defendable. Authors are encouraged to explain how the results of the work have contributed to knowledge and practice in the field.

Format of presentation

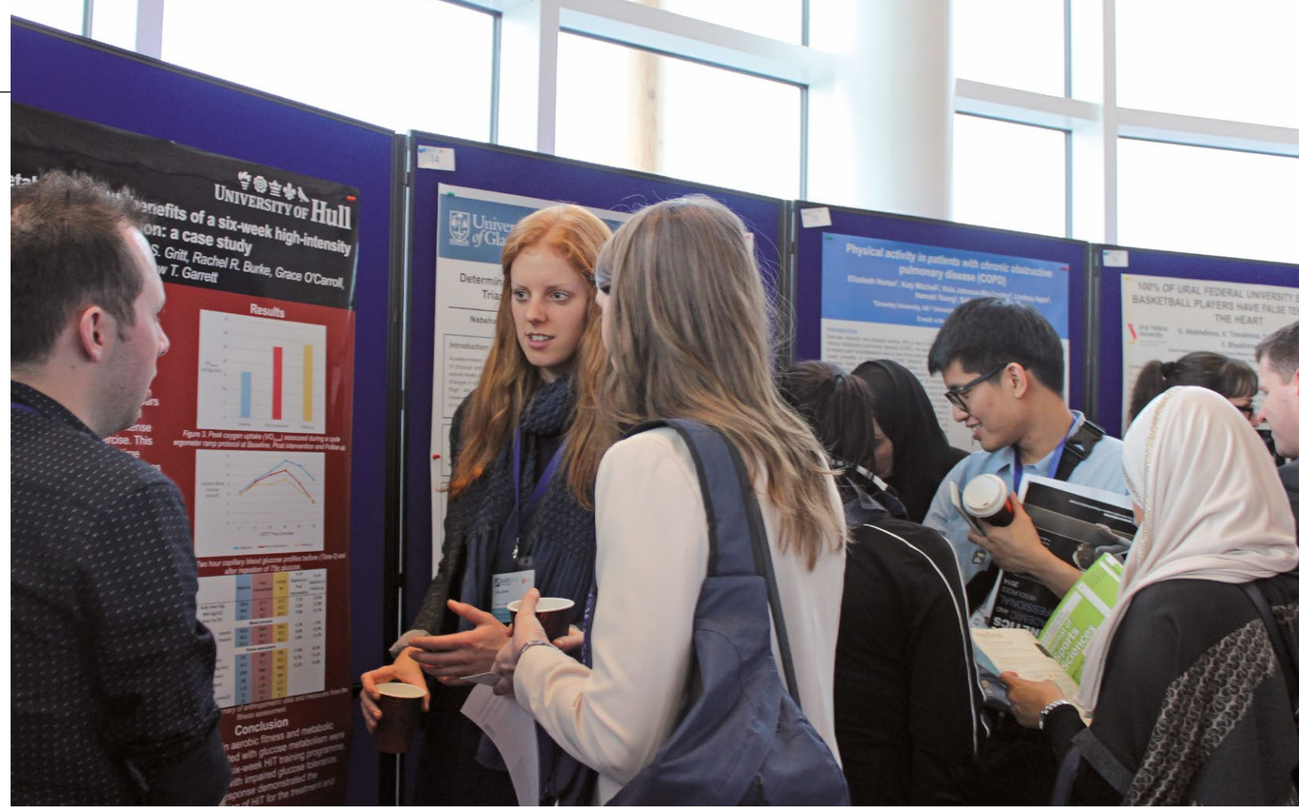
Three presentation formats are available:

1. **Free communication presentation** - a 10-minute presentation of your work followed by questions, in a chaired session with other presenters. For programming reasons, slots for free communication presentations are limited and preference will be given to those demonstrating excellence in terms of originality, significance and rigor.

All accepted conference abstracts will be published in an online supplement of the *Journal of Sports Sciences*. Free-access will be available upon publication of the supplement, until 31 January 2025, at www.tandfonline.com/rjsp. From 1 February 2025 onwards, BASES members can gain online access to the supplement, as well as the current volume of the Journal of Sports Sciences, by subscribing at the discounted rate of: £70 for regular member; and £29 for student members.

Published in affiliation with BASES, *Journal of Sports Sciences* publishes articles of the highest standard.

2022 Impact Factor: 3.4. Ranking: 20/87 (Sport Sciences)



2. **Poster presentation** - your poster will be grouped according to disciplines, with the session chaired to allow a two-minute oral presentation of the poster with Q&A.

3. **5 slides in 5 minutes free communication presentation** - this presentation format entails a 5-minute presentation of empirical results followed by 2 minutes of questions in a chaired session of short communications.

Number of submissions from each person and research team

To assist with programming, each person is only permitted to submit an abstract as first named author for **one** free communication **or** 5 in 5 free communication presentation and **one** poster presentation. Normally only two abstracts from any **one research group** may be presented.

The first named author must present the abstract.

Presenters must pay the delegate fee for the conference by the specified deadlines. Otherwise, their abstracts will be withdrawn from the conference programme. Abstracts will be published in the online supplement of the *Journal of Sports Sciences* following the conference. Abstracts will not be published if the presentation is not delivered at the conference.

Abstract proofs

After the conference, authors of accepted abstracts and who presented at the conference will be sent abstract proofs for minor amends before their abstract is published. Corrections, to be returned by a deadline, must be limited to answers to queries, typographical and essential corrections only. Once the deadline has passed then changes cannot be made to the abstract.

Abstract review process

Abstracts will be reviewed and authors will be notified of one of the following decisions:
1. Accept
2. Accept with minor amends
3. Reject.

1. Abstract format guidelines

1.1 The following guidelines are designed to assist authors prepare their abstracts. Because of the differences across research methods, there is no one prescribed format for an abstract. Authors are encouraged to use a format most appropriate for the methods used.

1.2 Authors must adhere to the *Journal of Sports Sciences* guidelines for authors, extended guidelines are available here: https://bit.ly/3T4qe6y

1.3 Some important style points include:
- British English spelling and punctuation is required.
- Please use double quotation marks, except where "a quotation is 'within' a quotation".
- Present dates in the format: 20 December 2023.
- Abbreviations, units and symbols should conform to Systeme International d'unites (SI units).
- For all abbreviations other than units, write the word or words to be abbreviated in full on the first mention followed by the abbreviation in parentheses.
- Avoid the use of non-standard abbreviations within the text.
- Use capital and italic "P" for p values; use "years" not "yrs"; use "min", "h", "s" for minutes, hours, seconds. See extended style guidelines online for more information.

1.4 Authors are encouraged to include social media contact details, such as X handles, as part of their correspondence details.

1.5 An example abstract is provided overleaf. It is anticipated that most abstracts will follow the format of:

a) A *title* that should be concise and reflect the work being described. Only the first word begins with a capital letter, unless a proper noun is used. Do not include any acronyms in the title.

b) *Author names and affiliations* formatted as per the example abstract. Please also provide an email for the corresponding author and a social media handle handle here if they wish for it to be associated with the abstract.

c) A *brief introduction* in which the authors need to present the theoretical and/or empirical framework that the study builds upon, or is related to.

d) All research should have an *aim/purpose*, which should outline the principal objectives and scope of the study. For a quantitative research design that tests a specific hypothesis, it might be: "Therefore, the purpose of this study was to investigate the influence of A on B". It should be emphasised that the authors are encouraged to state the purpose of the work concisely and if the purpose was exploratory, then this should be stated.

e) The *methods* section describes the sample and how data were collected and analysed so that other researchers could repeat the research. Please use the term 'participants' (not 'subjects'). There needs to be a statement indicating that ethical approval was granted for studies involving human or animal participants. For example, "With institutional ethics approval…" Metrics by which outcomes of analyses are to be evaluated should be stated. Preferred metrics are effect sizes or confidence intervals of differences/change rather than probabilities.

f) Authors must provide a clear explanation of their *results* and are encouraged to use the most appropriate format to do this. Quantitative researchers should report effect sizes and *P* values (e.g. $P = 0.048$). $P < 0.01$ is appropriate for values exceeding 3 decimal places (e.g. $P = 0.000021$). Qualitative researchers are encouraged to use themes and/or quotations to illustrate their findings.

g) In the *conclusion* authors must conclude the relevance of their findings in relation to existing knowledge. This could be theory, research, and/or practice. Authors are encouraged to provide clear recommendations on the value of their work and reflect on the extent to which findings relate to one or more educational, professional development or applied issues for sport and exercise scientists. The concluding sentence should provide a clear "so-what?" i.e. a statement of how knowledge has been advanced or practice should be changed.

1.6 The font should be Arial size 12. Statistical abbreviations should, normally, be italicised.

1.7 References must be kept to an absolute minimum and must be used only if essential. When used, any references must be incorporated into the text of the abstract. The required style of referencing for abstracts is shown in section 2.

2. Referencing

Referencing must follow the APA reference guide provided at: www.tandf.co.uk/journals/authors/style/reference/tf_APA.pdf

The following are examples illustrating the referencing method to be used.

2.1. The resultant hand forces were calculated and projected onto the forward direction (propulsive force) for each phase of the stroke (Schleihauf, A.A., 1979, In J. Terauds & W. Bedingfield (Eds.) *Swimming III* (pp. 300-316). Baltimore, MD: University Park Press). [This illustrates the citation of a paper or chapter in a book].

2.2. A 1% treadmill grade was used, after the recommendations of Jones and Doust (1996, *Journal of Sports Sciences*, 14, 321-327). Our findings were similar to those previously reported (e.g. Jones & Doust, 1996). [This illustrates the first and second citations of a journal paper].

2.3. Propelling efficiency was defined as ... (Toussaint, 1988, *Mechanics and energetics of swimming*. Amsterdam: Rodopi). [This illustrates the citation of a book].

2.4. The differences between groups for the nine release parameters from Best *et al.* ([1993]. *Journal of Sports Sciences*, 11, 315-328) ... [This illustrates the citation of a source, here a journal paper, with more than two authors].

ACKNOWLEDGEMENTS: Dr Claire Hitchings FBASES, Prof Clyde Williams OBE, FBASES, Prof Edward Winter FBASES, James Munro and Dr Daniel Bailey.

BASES 2024 Conference

AN EXAMPLE ABSTRACT

Influence of cold-water immersion on indices of muscle damage after prolonged intermittent shuttle running

DAVID M. BAILEY[1*], SAMUAL J. ERITH[2], P. JONATHAN GRIFFIN[3], ANTHONY DOWSON[4], DANIEL S. BREWER[4], NICHOLAS GANT[5] & CLYDE WILLIAMS[4]

[1]BMC Racing, [2]Manchester City Football Club, [3]Fulham Football Club
[4]Loughborough University and [5]University of Auckland
*Corresponding author: dmbailey1@gmail.com
@baileyDM

Start of introduction, 1.5c

Correct referencing method, do not use abbreviated Journal Titles (see section 2 for examples)

Cold-water immersion (cryotherapy) can aid recovery from muscle-damaging exercise (Eston and Peters, 1999, *Journal of Sports Sciences*, 17, 231-238). Participation in sports that involve prolonged periods of variable-speed running frequently result in damage that is reflected in delayed onset of muscle soreness. Therefore, the aim of this study was to assess effects of cold-water immersion on indices of muscle damage after the completion of the Loughborough Intermittent Shuttle-Running Test (LIST) (Nicholas and Nuttall, 2000, *Journal of Sports Sciences,* 18, 97-104). Participants performed six 15-min blocks of activity that included walking, jogging, cruising and sprinting in a pattern that is common in sports such as football. Completion of the LIST results in muscle damage and soreness (Thompson, Nicholas and Williams, 1999, *Journal of Sports Sciences,* 17, 387-395). With institutional ethics approval, 20 men (mean age: 22.3 ± 3.3 years; stature: 1.80 ± 0.05 m; body mass: 83.7 ± 11.9 kg) (mean ± s) completed 90 min of the LIST protocol. After exercise, participants were randomly assigned to either 10 min cold-water immersion (10 ± 0.5 °C) (n = 10) or a non-immersion control group (n = 10). Ratings of perceived soreness, changes in muscle function and efflux of intracellular proteins were assessed before exercise, during treatment and at regular intervals up to 7 days after exercise. Exercise resulted in severe muscle soreness, temporary muscle dysfunction, and raised serum markers of muscle damage. All peaked within 48 h after exercise. Cryotherapy administered immediately after exercise reduced muscle soreness at 1, 24, and 48 h (P < 0.05). Decrements in isometric maximal voluntary force of the knee flexors were less after cryotherapy at 24 (12 ± 4%) and 48 h (3 ± 3%) than without (21 ± 5%) and mean 14 ± 5% (mean ± sx) respectively; P < 0.05). Exercise-induced increases in serum myoglobin concentration and creatine kinase activity peaked at 1 and 24 h, respectively (P < 0.05). Cryotherapy had no effect on the creatine kinase response, but reduced myoglobin 1 h after exercise (P < 0.05). The results suggest that cold-water immersion immediately after prolonged intermittent shuttle running reduces soreness and indices of exercise-induced muscle damage and could be a useful aid to recovery.

Start of aim/purpose,1.5d

Start of method,1.5e

There should be a statement indicating that ethics approval was granted

Start of main measurements

Start of results,1.5f

Start of conclusions and recommendations, 1.5g

Checklist

- ☐ The abstract is no more than 400 words, contains no tables or figures, sub-headings or paragraph breaks.
- ☐ Abstract title.
- ☐ Author names (no titles such as Prof/Dr/FBASES).
- ☐ Authors' affiliations/institutions. Please don't include departments.
- ☐ Corresponding author's email address.
- ☐ Corresponding author's social media handle (optional).
- ☐ The abstract contains: a brief introduction to the study; aim/purpose; participants, design and methods and treatment; main measurements; results (effect sizes and confidence intervals of difference/change are preferred to *P* values); conclusions and recommendations.
- ☐ A statement indicating that ethics approval was granted.
- ☐ References are in the correct format.

SAXTON SURMISES

FROM THE PLODDING TO THE PURPOSEFUL: TIME TO PUT THE SPRING INTO YOUR STEP?

Prof John Saxton FBASES is the physical activity for health columnist for The Sport and Exercise Scientist.

PROF JOHN SAXTON FBASES

John is Head of the Department of Sport, Health & Exercise Science at the University of Hull and has been researching the health benefits of structured exercise and physical activity for over two decades.
He is a BASES Accredited Sport and Exercise Scientist.

The popularity of wearable technologies means that step-counting is now a regular daily activity for many. What's more, the *broad-brush* public health message promoting 10k daily steps seems to have stuck, despite lacking a robust evidence-base. This daily step-count threshold can be traced back to a marketing strategy for the Japanese *Manpo-Kei* pedometer in the 1960s. However, now that we have much greater access to objective movement data and linkage to clinical outcomes in large cohorts, how does this 'holy grail' daily stepping target stack-up against the evidence? What does current research tell us about how daily step counts are linked to future health outcomes?

Recent cohort studies and meta-analyses have asked the question of how many daily steps are needed to reduce the risk of future mortality and other clinical outcomes over varying years of follow-up. These studies show that the answer to this question depends on the cohort you are studying, the outcomes being assessed and the technology you are using to measure step-counts. A large-scale meta-analysis of 17 cohort studies published in December 2023 made a concerted effort to make sense of it all (Banach *et al.*, 2023). The study synthesised data from over 200,000 participants (adults aged≥ 18 years from the general population) whose step count had been monitored objectively with a range of different tools (pedometers and accelerometers) for at least seven consecutive days. A key finding was that individuals achieving >5000 daily steps had a dramatically reduced risk of all-cause mortality, but with risk reductions also being apparent for 4000 daily steps. Even fewer steps were associated with risk reductions for cardiovascular mortality. Another recent robust meta-analysis (Paluch *et al.*, 2022) and large-scale cohort studies for adults and older women (Lee *et al.*, 2019; Saint-Maurice *et al.*, 2020) reported significant risk reductions for all-cause mortality in the range of 6000-8000 steps per day. So, could we be edging towards an evidence-based recommendation that is appreciably less than 10k daily steps?

But what about step intensity? Alarmingly, it seems that Banach *et al.* (2023) dismissed the potential importance of step-intensity rather too readily, citing cohort study data presented by Saint-Maurice *et al.* (2020). The latter showed that step intensity was inversely related to all-cause and cardiovascular mortality but not when controlling for total daily step count. A similar conclusion was drawn by Lee *et al.* (2019) for older women, strongly suggesting that step count, rather than step intensity, has a more important bearing on health outcomes. But this message is incongruent with evidence that self-reported walking pace is inversely associated with mortality outcomes (Stamatakis *et al.*, 2018) - so, could it be misleading? Quite probably, if population-based step-count data becomes mistaken for purposeful moderate or vigorous intensity ambulation, defined as continuous stepping intensities of > 100 and > 120 steps per minute, respectively (Tudor-Locke *et al.*, (2018).

Dall *et al.* (2013) showed that although accelerometry-based measures of step intensity and walking cadence have the same units (steps per minute), they can be quite different. Using an activity monitor that records the duration of walking cadence in addition to step-counts, they showed that step accumulation in the free-living context mostly consists of broken-up sporadic stepping, rather than purposeful continuous walking. Accordingly, averaged peak 1-minute and peak 30-minute step-counts (not necessarily in consecutive minutes), which were used as measures of step-intensity in both previously cited cohort studies (Lee *et al.*, 2019; Saint-Maurice *et al.*, 2020), could reflect the peak number of sporadic or incidental steps per minute of observation rather than the number of purposeful ambulatory steps taken during a minute of continuous stepping. Other cadence-intensity measures used in these cohort studies (i.e., ≥2 consecutive minutes at ≥60 steps per minute; highest cadence across any consecutive 5-minute span of the day) could also be also problematic, as they may not represent continuous purposeful ambulation at the right intensity for health benefits - a cadence of 60-79 steps per minute actually reflects slow walking (Tudor-Locke *et al.*, 2018). Therefore, dismissing the potential importance of step-intensity on the basis of the intensity measures used in these studies seems tenuous. And from the public health perspective, there is danger that such dismissal could detract from the widely acknowledged health benefits of purposeful moderate or vigorous intensity continuous ambulation.

Although evidence-based daily stepping thresholds for different sectors of the population have clear potential as a means of simplifying the physical activity message and serving as a motivational tool, ostensibly there is still work to do in defining these thresholds. Current evidence suggests that the 10k daily step-count benchmark has been over-egged, while step-intensity messages could be misleading and need to be considered in light of the types of movements being represented by device-based stepping data. While sporadic and incidental steps all seem to count, intuitively (and supported by self-report data) a good complement of purposeful continuous ambulatory striding (ideally at moderate to vigorous intensities), alongside residual plodding, seems more likely to be keeping in step with the best available evidence for health benefits. ■

> Although evidence-based daily stepping thresholds for different sectors of the population have clear potential as a means of simplifying the physical activity message and serving as a motivational tool, ostensibly there is still work to do in defining these thresholds.

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LONG STORY SHORT

BUT, WHY?

Dr Robert McCunn is the sport and performance columnist for The Sport and Exercise Scientist

British tennis star, Emma Raducanu, has worked with five different coaches in the last two years. In a recent interview with BBC Sport she explained that she tends to ask her coaches a lot of questions and she implied that not always receiving satisfactory answers to them may be part of the reason that there has been such a high turnover (https://www.bbc.co.uk/sport/tennis/67166854). She went on to say: "It's something I've always done. I keep provoking and asking questions to coaches and challenging their thinking as well. I'm not someone that you can just tell me what to do and I'll do it, I need to understand why and then I'll do it." I have certainly worked with athletes who are also this way inclined and while sometimes challenging they can also be amongst the best to work with. This attitude demonstrates engagement and an active interest in the training process. I'd guess (since most of my experience has been within team sports) that within individual sports, athletes tend to be more towards this end of the spectrum; however; when it comes to team sport there are definitely some athletes who are relatively apathetic and ambivalent towards the training process. While they may not make your life as a practitioner difficult, they are not a very motivating or exciting sub-group to work with either. Whether it's on the grass or in the gym, working with athletes who want to be there is always better.

Having just praised athletes with an inquisitive streak there are some legitimate challenges that this mindset poses to performance practitioners. I'm going to lean heavily on a fascinating article by John Kiely published in Sports Medicine to hopefully illustrate some of these challenges (Kiely 2018). Kiely (2018) discussed training periodisation theory and, in his own words, confronted an inconvenient truth by highlighting that much of the theory underpinning traditional models has developed and moved beyond some of the original assumptions. For example, the idea that only mechanical and biological stress applied by a training stimulus are responsible for subsequent training adaptation is patently not correct. Psycho-social factors an athlete is experiencing can clearly impair or enhance training response and recovery (Kiely 2018). Accepting that something as fundamental as training periodisation models may not actually be built on particularly solid scientific foundations is quite humbling as a sport scientist. The upshot is that it would be quite non-sensical to argue that one traditional periodisation model is 'better' than another given that the reality is neither is likely grounded in much evidence. This could be quite hard to explain to an athlete who is questioning you as to why their training programme is designed in one particular way versus another. The truth will often be that the programme probably could look quite different and elicit the same results…but you have to decide on something eventually. Heuristics like there being 'more than one way to skin a cat' or 'horses for courses' are quite apt when having these conversations.

As an aside, a common narrative around sport science as a discipline is that the scientific process is too slow and applied practitioners are often ahead of the game, implementing novel practices for which there isn't yet supporting evidence. Kiely (2018) provides a stark example of the opposite being true – theory and research around stress and adaptation within humans has moved beyond what traditional periodisation models are founded on yet applied practice has lagged well behind and relied on old training paradigms for too long. Something for those of us working in applied settings to bear in mind.

Depending on what aspect of training/recovery an athlete is asking about specifically the chances are that there isn't a definitive correct answer. Beware the practitioner who speaks in absolutes or purports to have the best training strategy or system (huge red flag). At the same time, no athlete wants a coach or performance practitioner who is outwardly unsure or hesitant in their instruction. Giving athletes confidence in your programme through your answers to their questions is, honestly, partly theatre. We do need to provide clear and authoritative explanations but we must always acknowledge the uncertainty that undeniably exists. The following excerpt from Kiely (2018) sums up perfectly how messy the reality of training programming is. I would recommend we all reflect on how best to convey this complexity when speaking with athletes.

"Beyond these broad rubrics, however, we have no empirically validated rules, and few specific guidelines. Instead, we are faced with a series of complex trade-offs and negotiations...We need a structured training framework, yet one that is flexible and tolerant of change... Insufficient variation (training monotony) amplifies the probability of negative outcomes, yet too much variation disperses adaptive energy and dilutes training gains. Persistent change drives positive adaptation, but sudden change elevates injury risk. We need a focus on event-specific movement skills, but excessive specificity accentuates structural wear and tear and amplifies the probability of overuse syndromes. Effort must be balanced with recovery. Desired benefits must be weighed against inevitable risks.

Despite periodization theory's implicit assumption that there is a one best way, contemporary evidence compellingly illustrates that there are no generalized formulaic solutions to these planning puzzles." (Kiely 2018). ■

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FINAL WORD

WITH PROF BARRY DRUST FBASES

ONE PERSON WHO INSPIRED ME

Of course there are loads of people I could pick here both from my past and currently. I can't really not pick my old PhD supervisor from a sport science perspective - Prof Tom Reilly FBASES. Tom gave me a chance to do my PhD after working with him as an undergraduate student. I wasn't a particularly great student in that time so I have no idea why he offered me the opportunity. He would give me so many opportunities that I probably wasn't really ready for during the time we worked together which has really shaped my thinking about the need for me to do this for others too. While working with him on my PhD it was amazing to see his work ethic and benefit from his breadth of knowledge. I would leave chunks of my thesis on an evening in his pigeon hole as I left work and in the morning when I would come back in it would be back in my pigeon hold corrected. I am pretty sure that I wasn't the only person who would have completed drafts and work for in that time. Its really influenced me to think about timelines to engage students with around their work (though I suspect that some of my students reading this will tell me that I don't deliver to these timelines). Tom was also incredibly down to earth and completely passionate about sport science. This engagement with everyone who he met (student or famous scientist) in the same way really gave me a model to follow in my professional interactions.

ONE JOURNAL ARTICLE OR BOOK THAT I THINK ALL SPORT AND EXERCISE SCIENTISTS SHOULD READ

As someone who has worked in the area of football research it would have to be Jens Bangsbo's doctoral thesis published in 1994. I remember getting a copy of it when I was thinking about my research ideas for my PhD and just getting blown away by the amount and quality of the research he had done. This also seemed to span the spectrum of very applied projects and really detailed physiological studies. While inspiring, it also made me a little worried that I wouldn't be able to find anything else to research that he hadn't done. I spoke to some new doctoral students the other day and they had never heard of it. Hopefully they'll go and track it down now and have a look. I found my hard copy the other day in a cupboard and took it out to flick through. It brought back a lot of personal memories as well, which I'm sure impacted on me as I still remember those years very fondly.

ONE THING I DO NOW THAT I DIDN'T IN MY EARLY CAREER

Fit the task to the time! Understanding how much time and effort you need to give to a given task is key to doing lots of things. Knowing when something is "good enough" rather than perfect helps you scale and do other things. Of course you get this wrong sometime but you'll hopefully only make that specific mistake once and the overall benefits should off-set the odd error.

ONE CHALLENGE THAT I THINK SPORT AND EXERCISE SCIENCE FACES

I guess I started my early research career focussed on physiology. As I have had more experience and seen a little more of the challenges that sport and exercise faces I have realised that multi-disciplinary and inter-disciplinary research is probably the only way that we will really impact the issues that are important. Doing this type of research is so difficult though and so finding a way to create systems that facilitate this type of activity is a challenge we should really try and address.

ONE PROUD MOMENT

My proudest moments in my career have frequently been associated with seeing the people that I have been lucky enough to work with develop, change their thinking and fulfil their goals. I work a lot with doctoral students, often from diverse backgrounds and experiences. Watching these individuals take on a long term project (3-6 years, sometimes longer) along side professional and personal commitments and develop as a practitioner/researcher/person always brings a great sense of pride. These journeys are always different but no one comes through it without a significant amount of hard work and personal challenge. As a supervisor in these situations you obviously contribute in some way but seeing the capacity for people to find the abilities to respond to the opportunities that are provided to them is an amazing thing to be a part of. I think most of the doctorate students I have supported have better jobs than me now!

ONE THING THAT MADE ME WANT TO BE A SPORT AND EXERCISE SCIENTIST

Not being very good at sport!

ONE QUOTE THAT I REALLY LIKE

I quite like collecting quotes. I am always amazed at how someone has been able to capture the essence of something in a few words better than I ever could even though I have thought about it a large number of times! Its maybe a little cheesy I know but my son made me watch Ted Lasso recently and one of his many quotes in the series is around staying curious rather than judgemental. Feels like if we all did a little more of that in our personal and professional lives we would all get on a lot better

ONE PIECE OF ADVICE FOR UP AND COMING SPORT AND EXERCISE SCIENTISTS

Get involved in anything and everything at the start of your career and see where it takes you

ONE REGRET

That I thought I knew more than I did and that I was personally more skilled than I was to handle my first experiences in professional sport. ■

PROF BARRY DRUST FBASES

Barry is the Head of the Graduate School of Sport and Professional Practice at The university of Birmingham and a Fellow of BASES.

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A HISTORY OF THINKING FORWARD