

Institution: Oxford Brookes University		
Unit of Assessment: 3, Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Condition-Informed Framework for Exercise and Physical Activity		
Period when the underpinning research was undertaken: 1 January 2007–1 July 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Helen Dawes Johnathan Collett Patrick Esser	Professor Senior Lecturer Senior Lecturer	[text removed for publication]
Period when the claimed impact occurred: 1 August 2013–31 July 2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact		
<p>The Centre for Movement, Occupation and Rehabilitation (MOReS) researches the support and delivery of exercise and physical activity for people with long-term neurological conditions (LTNCs). Approximately 16,500,000 people in the UK have an LTNC, for whom exercise has previously been discouraged or poorly supported. Our research has enabled people with Parkinson's disease to benefit from exercise, having been translated into the exercise pillar of the UK-wide 'First Steps' intervention delivered by Parkinson's UK for people just diagnosed, which it rates as 1 of its 8 stand-out achievements since 2015. We have played a key role in increasing the activity levels of people with chronic disabling conditions in Oxfordshire, which now has the lowest county rates of inactivity in this group in England (34.8%; national average 44.0%). We have also developed the UK National Occupational Standard for exercise prescription and influenced curriculum development for the training of professionals in five countries.</p>		
2. Underpinning research		
<p>To better understand exercise response and recovery, and address the safety concerns of patients and clinicians, the MOReS research team have, since 2001, led developments in safe, effective exercise for people with LTNCs. The research has been supported by 26 competitive external grants and resulted in 65 publications. Since 2013, our research has improved understanding of dose-response and safe effective delivery of exercise in the community, leading to the development of evidenced, individualised exercise prescription. We have developed condition-specific altered exercise response and recovery profiles that need to be considered when prescribing for people with LTNCs including Parkinson's disease (PD) (R1), multiple sclerosis (MS) (R2) and young people with neurodevelopmental conditions (R3).</p> <p>Our research has demonstrated that the altered physiological, neurophysiological and perceptual responses to different exercise doses found in people with MS (R2) underpin the heightened effort required during exercise and the longer recovery periods experienced. This improved understanding confirmed that high intensity exercise for people with MS is safe - and improves functioning and fitness more than lower intensity exercise - but is especially fatiguing for muscles, slowing recovery from exercise and thus is badly tolerated. We subsequently developed condition-informed individualised exercise prescription to achieve better symptom management. This has been implemented in a pragmatic community-based, remotely delivered MS Society-funded study at Cardiff University (https://www.leapms.org/information-suite/physical-activity-and-fatigue/).</p>		

Building on evidence produced from the 'Long-term Individual Fitness Enablement in people with long-term neurological conditions' (LIFE) study, which identified key components needed to support people with LTNCs to exercise (**A**), we conducted a trial of self-directed community exercise for people with PD (**B**). Importantly, for those developing services we found that unsupervised exercise was safe, well adhered to and produced sustained benefits regarding motor symptoms in people with PD for 1 year (d -0.30 (95% CI 0.07 to 0.54)) (**R4**).

Our research in young people with neurodevelopmental disorders has identified barriers to participation in physical activity (**R5**) and resulting low physical activity levels (**R6**). Research revealing altered motor control (that results in children performing activities less efficiently) and exercise responses (which manifest in children perceiving exercise to be harder) has informed five further studies of interventions from MORES, designed to provide young people with the confidence and skills to participate in physical activity (including **C**). Intervention components have been designed to be delivered at scale and evaluated in schools nationwide (104 schools, $n=18$, 299 children) (**D**). In order to target resources, our research has also produced a screening system for schools to identify young people who may benefit most from intervention (**R6**).

3. References to the research

R1. Mavrommati F, **Collett J**, Franssen M, Meaney A, Sexton C, Dennis-West A, Betts JF, Izadi H, Bogdanovic M, Tims M, Farmer A, **Dawes H**, (2017) Exercise response in Parkinson's disease: insights from a cross-sectional comparison with sedentary controls and a per-protocol analysis of a randomised controlled trial. *BMJ Open*. 26;7(12):e017194. DOI: 10.1136/bmjopen-2017-017194

R2. **Collett J**, Meaney A, Howells K, **Dawes H**, (2016) Acute recovery from exercise in people with multiple sclerosis: An exploratory study on the effect of exercise intensity. *Disability and Rehabilitation*. 39 (6): 551-558. DOI: 10.3109/09638288.2016.1152604

R3. Liu F, Morris M, Hicklen L, Izadi H, **Dawes H**, (2018) The impact of high and low-intensity exercise in adolescents with movement impairment. *PLoS One*. 26;13(4): e0195944. DOI: 10.1371/journal.pone.0195944

R4. **Collett J**, Franssen M, Meaney A, Wade D, Izadi H, Tims M, Winward C, Bogdanovic M, Farmer A, **Dawes H**, (2017) Phase II randomised controlled trial of a 6-month self-managed community exercise programme for people with Parkinson's disease. *Journal of Neurology, Neurosurgery and Psychiatry* 88 (3): 204-211. DOI: 10.1136/jnnp-2016-314508

R5. Barnet A, **Dawes H**, Wilmut K, (2013) Constraints and facilitators to participation in physical activity in teenagers with Developmental Co-ordination Disorder: an exploratory interview study. *Child: Care Health and Development* 39(3): 393-403. DOI: 10.1111/j.1365-2214.2012.01376.x.

R6. Weedon BD, Liu F, Mahmoud W, Metz R, Beunder K, Delextrat A, Morris MG, **Esser P**, **Collett J**, Meaney A, Howells K, **Dawes H**, (2018) The relationship of gross upper and lower limb motor competence to measures of health and fitness in adolescents aged 13-14 years. *BMJ Open Sport & Exercise Medicine*. 8;4(1):e000288. DOI: 10.1136/bmjsem-2017-000288

Key Grants

A. Dawes H (PI). LIFE study: Long-term Individual Fitness Enablement in people with long-term neurological conditions. Department of Health, GBP243,889 (2007–2009)

B. Dawes H (PI). The effect of a longer period of exercise in people with Parkinson's disease. National Institute of Health Research, Research for Patient Benefit, GBP187,481 (2011–2014)

C. Dawes H (PI). EPIC: Engagement Participation Inclusion Confidence in Sport, Oxfordshire Sports Partnership and CLEAR Trust. Sport England. GBP72,130 (2014–2017)

D. Dawes H (Co-I). Fit to Study. Education Endowment Foundation and Wellcome Trust. GBP970,477 (2015–2019)

4. Details of the impact

MORes has been at the forefront of a paradigm shift: from fear that exercise might trigger and aggravate symptoms in people with LTNCs towards the determination of specific condition-informed prescription for therapeutic benefits of physical activity and exercise. Exercise is now seen as an essential part of managing these conditions to benefit function, health and well-being, and in children to also benefit skill and academic development. We have produced evidence and developed interventions for safe, effective exercise across a number of conditions including, but not limited to, PD, MS and demyelinating conditions, Huntington's, stroke, acquired brain injury, cerebral palsy and development coordination deficiency. Our work has made a major contribution to the transformation that has taken place worldwide and directly influenced those recommending, supporting and providing exercise, and those involved in informing and training health and exercise professionals.

Helping people with PD benefit from exercise: Collett et al. 2017 (R5) established that people with PD were able to safely self-manage and adhere to exercise in the community. These results were rapidly translated into the exercise component of the First Steps programme, which was conceived by people with PD to provide information and support and empower self-management for those newly diagnosed. We designed the exercise component of the programme and, in 2017, Parkinson's UK funded Dawes to develop First Steps into a program that could be offered to all people newly diagnosed with PD in the UK (S1). The First Steps service was adopted by Parkinson's UK and has been running at nine UK sites (S2). Unfortunately, roll out to all 21 regional excellence network centres has been delayed due to COVID-19. However, Parkinson's UK rates First Steps as 1 of its 8 stand-out achievements since 2015, and report that participants gave it a 100% satisfaction rating (S3). In conjunction with this, the team's research insights into exercise-altered responses in people with PD (R1) have informed dose and intensity guidance as part of the Parkinson's Exercise Framework created by Parkinson's UK (S4). The Framework complements First Steps in supporting approximately 200 health professionals to prescribe exercise for those with PD.

Because of the team's unique insight into the metabolic response to exercise in people with PD (R1), the team were able to successfully support Robin Abby (who has young-onset PD) row across the Indian Ocean. The team assessed his exercise response and recommended individualised safe exercise training parameters and intensity limits to enable him to complete the row (more people have been to the Moon than have completed this challenge). Robin benefitted at an individual level, with his crewmates noticing that his limp had gone at the end of the row and the monitoring teams showing that his motor symptoms (rigidity and gait) had improved. The purpose of the challenge was to raise awareness of young-onset PD, with the empowering message of what you can achieve with PD. It achieved excellent public and media engagement worldwide across TV, radio and print, with articles in The Express, The Telegraph and Huffington Post, and coverage by the BBC, ITV and ABC in Australia (S5).

The overall contribution of our research impact on people with PD was externally recognised by Universities UK in 'Made at Uni: 100 ways Universities are saving lives and keeping us healthy', a campaign showing how universities improve everyday lives (S6).

Improving local community physical activity provision: Our research identified barriers and facilitators for people with long-term conditions and disabilities participating in physical activity (A). This research has informed the physical activity care pathway in Oxfordshire. We ensured the pathway (GO Active), commissioned by Sport England in 2014 for the general sedentary population (S7), was appropriate for those with chronic disabling conditions through providing specific training to eight motivational interviewers and advising on activities. Since the implementation of GO Active, there has been an increase in those with chronic disabling conditions being active in Oxfordshire (S8) equating to 46,349 people with disability in Oxfordshire in 2018 being active and the county having the lowest rates of inactivity in this group in England (34.8% compared with the national average of 44.0%) (<https://www.sportengland.org/know-your-audience/data/active-lives/active-lives-data-tables>).

Subsequently, Oxfordshire Clinical Commissioning Group funded the pathway for people with diabetes (between July 2018 and November 2019, the programme recruited n=1,035), with 29% meeting UK physical activity guidelines at baseline increasing to 41% at 3months.

In addition, our pioneering research has revealed altered perceptions of effort in children with movement difficulties, whereby exercise feels harder and more fatiguing (**R3**). This, combined with our research that identified the support required for children with movement difficulties (**R5**), has led to improved understanding and adapted programmes to support exercise. We have implemented these programmes through our Clinical Exercise and Rehabilitation Unit to support local schools. The direct benefit to young people was demonstrated in an OFSTED report (**S9**) that states '*... This provides these students with highly specialised clinical exercise and rehabilitation support. There is detailed, effective and frequent communication between staff of the resource base and staff at the university. Consequently, these students make good progress.*'

Furthermore, these insights have been incorporated into interventions that can be delivered at scale through schools and the community (**R6, C**). This research is being used by the Iranian Ministry of Education to support Physical Education (**S10**). Dawes delivered training that was incorporated into Shad (<https://www.shad.ir/>) the online learning platform used by Iranian schools, watched by 46,000 people live and available to approximately 14,000,000 users. The Deputy Minister of Education advised that these materials be used to increase physical activity.

Leading the training of professionals: We developed the UK National Occupational Standard '*Design, agree and adapt a physical activity programme for adults with long-term neurological conditions*' (NOS D522- <https://studylib.net/doc/7685627/d522---skillsactive>) predicated on the body of research across various LTNCs and specifically the findings of the LIFE study (**B**). Previously, we were the only accredited provider to deliver these standards, training 136 professionals and enabling them to prescribe exercise for people with LNTCs through the registered qualification. Since 2019, the Wright Foundation (a community interest company and training provider) has also been accredited to deliver the National Occupation Standard we developed. Running four intakes a year, the new course will provide the opportunity for the number of exercise professionals with this expertise being trained each year to be increased by approximately 80 (<https://www.wrightfoundation.com/Neurological.php>).

Internationally developed curriculums for professional use have been delivered in China, Brazil, Australia, Iran and Jordan. For example, our training standards have been incorporated into the first Rehabilitation MSc in Jordan, funded by Erasmus+ to support the refugee crisis (**S12**). The team trained lecturing staff from Hassemite, University of Jordan and Jordan University of Science and Technology, and developed the lecturing materials. Further to the 30 physio and occupational therapists trained so far on the MSc, a face-to-face training workshop was delivered in the UK to 11 clinical academics from three universities and one hospital in Jordan, with the aim of further dissemination to approximately 1,000 physio and occupational therapists in Jordan. This will empower them to support exercise in adults and young people living with neurological or multiple conditions.

OnLineTraining Ltd, a training provider for teachers and teaching assistants who support children and young people with special educational needs, which operates in 104 countries, recognised our work and asked to incorporate our research insights into their motor coordination difficulties course (**S11**). The course now includes content, directly informed by our research, on assessing gross motor skills and identifying children with problems, considering exercise capacity and the perception of exercise and fatigue, identifying appropriate activities and interventions to improve fitness and coordination, as well as suitable techniques. Despite COVID-19, 156 people (n=28 in the UK and n=128 in Australia) have completed the training since 13 January 2020 and have improved knowledge of how to support exercise in these children.

5. Sources to corroborate the impact

S1. Dawes H, The First Steps pathway. Service improvement grant, £29,973 Parkinson's UK awarded 2017.

S2. Parkinson's UK web page for First Steps program

<https://www.parkinsons.org.uk/professionals/first-steps-people-newly-diagnosed-parkinsons>

S3. Parkinson's UK reporting on the '8 remarkable things' they have achieved since 2015

<https://www.parkinsons.org.uk/news/8-remarkable-things-we-achieved-together-2019-and-recent-years>. (Reference to First Steps - Quality services and standards)

S4. Ramaswamy B, Jones J, Carroll C, (2018) Exercise for people with Parkinson's: a practical approach *Practical Neurology* 2018, 18(5), 1–8. DOI: 10.1136/practneurol-2018-001930, (Dawes acknowledged, page 7)

S5. Examples of media interest in Parkinson's Row:

- <https://www.bbc.co.uk/news/av/uk-england-leicestershire-46840541>
- <https://www.telegraph.co.uk/news/2017/04/08/parkinsons-sufferer-plans-record-breaking-ocean-row-reveal-clues/>

S6. Made at UNi '100+ ways Universities are saving lives and keeping us healthy'

<https://madeatuni.org.uk/oxford-brookes-university/physical-exercise-support-parkinsons-patients> (Recognition for contribution in Parkinson's research.)

S7. Contract between Oxford Brookes University and Oxfordshire Sport Partnership to support

Go Active, Get Healthy project, page 20, <https://sportengland-production-files.s3.eu-west-2.amazonaws.com/s3fs-public/get-healthy-get-active-project-summaries.pdf>

S8. GO Active evaluation report (2016): <https://www.activeoxfordshire.org/uploads/go-active-get-healthy-evaluation.pdf?v=1594628910>

(Key finding that the program is supporting effectively people with chronic disabling conditions.)

S9. OFSTED report for Marlborough school <https://files.ofsted.gov.uk/v1/file/2393237>

(References the Oxford Brookes team's impact, pages 2-4.)

S10. Letter from Sport Sciences Research Institute of Iran, Ministry of Science, Research & Technology confirming inclusion of training on SHAD.

S11. Contract between OnLineTraining Ltd and Oxford Brookes University for use of content in dyspraxia and motor coordination difficulties course. The course can be found here:

<https://www.oltinternational.net/dyspraxia-and-motor-coordination-difficulties> (cites **R5** and **R6**).

S12. Erasmus+ Establishment of an Interdisciplinary Clinical Master Program in Rehabilitation Sciences at JUST (JUST – CRS) <http://crs.just.edu.jo/Pages/>