

Institution: Edinburgh Napier University		
Unit of Assessment: Unit of Assessment 3 – Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Exercise-based Cancer Rehabilitation: Enhanced International Professional Practice and Better Patient Care.		
Period when the underpinning research was undertaken: April 2015 – February 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Anna Campbell	Role(s) (e.g. job title): Professor	Period(s) employed by submitting HEI: April 2015 – ongoing
Period when the claimed impact occurred: January 2016 – December 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words) Research at Edinburgh Napier University (ENU) on the positive health benefits of exercise throughout cancer care has impacted thousands of UK cancer patients' lives and raised clinical awareness internationally. Findings have shaped the development of 'Move More' by Macmillan Cancer Support, which delivers exercise programmes accessed by an estimated 10,000 cancer patients per year in the UK. Clinical awareness and acceptance of exercise as part of the cancer journey has increased, and the quality of exercise support has improved through delivery of award-winning cancer exercise training courses delivered to over 1,300 health and fitness professionals across the UK, Europe and the Americas. Collaboration with 17 world-leading cancer and exercise organisations from around the world has shaped international policy, with findings cited in World Health Organisation Physical Activity guidelines (2020). An international registry of validated cancer exercise programmes, which currently hosts 1,635 programmes across 29 countries, has improved patient and professional awareness of and access to quality assessed cancer exercise programmes worldwide.</p>		
<p>2. Underpinning research (indicative maximum 500 words) Cancer is a leading cause of premature death in every country in the world, responsible for 9.6 million deaths globally in 2018, with an estimated socioeconomic cost of GBP7.6 billion annually to the UK. Chronic side effects of surgery and chemotherapy treatments include fatigue, physical deconditioning and depression, leading to reduced quality of life. Studies have shown that exercise and physical activity offer a powerful and cost-effective way to reduce these side effects, leading to estimated reduction in healthcare costs of GBP6,000 per patient. Despite this, 80% of cancer survivors in the UK are not physically active to recommended levels. Research by Professor Anna Campbell at ENU has focused on the need for better awareness by patients and professionals of the benefits of cancer exercise and better integration within the cancer care pathway. Key collaborators include the National Health Service (NHS), University of Dundee, University of Stirling and American College of Sports Medicine (ACSM).</p>		
<p>1) Feasibility of referring cancer patients to cardiac rehabilitation Referring cancer patients to established cardiac rehabilitation (CR) programmes was explored in a randomised controlled trial (RCT) by Campbell, University of Stirling and NHS partners [O1]. Of 41 post-surgery colorectal cancer (CRC) patients, 21 were randomised to CR, of which 13 (62%) completed the 10-12-week programme with high levels of attendance (75-142%). No adverse events were reported, suggesting referral to CR is safe and feasible. Positive outcomes included increased confidence and motivation to become more physically active.</p>		
<p>2) Assessing implementation of cancer exercise rehabilitation A qualitative study exploring attitudes and beliefs of 12 lung cancer patients towards exercise both pre- and post- surgery identified barriers such as lack of confidence, cost, lack of time and inadequate access to guidance and education [O2]. Another study exploring weight gain in 409 breast cancer patients during chemotherapy over a 3-month period with 12-month follow up,</p>		

revealed the timing of referral and the type of exercise intervention play significant roles in adherence [O3]. Results showed that a community programme (which included a supervised circuit exercise class with 30 minutes of moderate intensity aerobic physical activity) prevented weight gain more successfully than remote support, with significant reductions in cholesterol, blood pressure and serum insulin, and improved quality of life. The physiological changes have direct implications on disease-free survival and all-cause mortality.

3) Investigating the benefits of prehabilitation

Further assessment of a pre-surgery intervention (prehabilitation) was explored as part of the TreatWELL study in collaboration with researchers at the University of Dundee, the first study of its kind to assess support for patients before, during and after treatment for colorectal cancer [O4]. The intervention period of 31 weeks targeted exercise, smoking, alcohol and weight management, with results showing that physical activity levels were successfully increased with no other lifestyle changes detected. The study highlighted many variables to consider for implementation including appropriate training of NHS staff and additional intervention requirements due to the complexities of patient health status.

4) Exploring barriers to exercise referral by clinicians

An international roundtable involving 17 key international cancer and/or exercise organisations met to explore ways to improve clinician engagement and encourage referral to exercise programmes [O5]. The study identified specific evidence-based pathways to programme delivery (clinical, community and self-directed) and the need for a cultural change amongst cancer clinicians. It also demonstrated the need for clinicians to routinely screen and assess the physical activity levels of their patients and to refer to appropriate exercise programmes.

3. References to the research (indicative maximum of six references)

O1-O5 have all been published following rigorous peer-review.

- [O1] Hubbard G, Adams R, **Campbell A**, Kidd L, Leslie SJ, Munro J, Watson A (2015). Is referral of postsurgical colorectal cancer survivors to cardiac rehabilitation feasible and acceptable? A pragmatic pilot randomised controlled trial with embedded qualitative study. *BMJ Open*, 6(1), <http://dx.doi.org/10.1136/bmjopen-2015-009284>. **Submitted to REF2.**
- [O2] Crandall K, Maguire R, **Campbell A**, Kearney N (2018). A qualitative study exploring the views, attitudes and beliefs of patients and health professionals towards exercise intervention for people who are surgically treated for lung cancer. *Eur J Cancer Care*. 27:e12828. <https://doi.org/10.1111/ecc.12828>
- [O3] Harvie M, Pegington M, McMullan D, Bundred N, Livingstone K, **Campbell A**, Wolstenholme J, Lovato E, Campbell H, Adams J, Speed S, Morris J, Howell S, Howell A (2019). The effectiveness of home versus community-based weight control programmes initiated soon after breast cancer diagnosis: a randomised controlled trial. *Br J Cancer* 121, 443–454. <https://doi.org/10.1038/s41416-019-0522-6>. **Submitted to REF2.**
- [O4] Macleod M, Steele, RJC, O'Carroll RE, Wells M, **Campbell A**, Sugden JA, Rodger J, Stead M, McKell J, Anderson, AS (2018). Feasibility study to assess the delivery of a lifestyle intervention (TreatWELL) for patients with colorectal cancer undergoing potentially curative treatment. *BMJ Open*, 8: e021117 <https://doi.org/10.1136/bmjopen-2017-021117>
- [O5] Schmitz KH, **Campbell A**, Stuijver MM, Pinto BM, Schwartz AL, Morris SG, ... Matthews CE (2019). Exercise is medicine in oncology: Engaging clinicians to help patients move through cancer. *CA Cancer J Clin* 69:468–484 <https://doi.org/10.3322/caac.21579>

4. Details of the impact (indicative maximum 750 words)

This research has impacted five key areas as outlined below.

1) Direct positive benefit to cancer patients by shaping cancer exercise programmes delivered by leading UK Cancer Charity, Macmillan Cancer Support

Campbell's research on recruitment, intervention design and training strategies continues to contribute significantly to the development of Macmillan Cancer Support's 'Move More' programme, which provides exercise programmes ranging from 'gentle movement' and local

walks, to tailored gym programmes for an estimated 12,000 patients a year in the UK. Online support includes a suite of information leaflets written and edited by Campbell with an estimated 50,000 distributed per year [C1]. As the UK's leading cancer charity, the scope for reach is significant with Macmillan engaging 8.3 million people in the UK in 2019. Quotes below highlight Campbell's role in the implementation of Move More:

"Macmillan is a multifaceted organisation and not just nurses. We now understand and value the role of exercise and we have physical activity teams in Macmillan who have engaged with Anna. Anna's work has helped us inform physical activity guidance and work with others and many of our reports have quoted or been influenced by Anna." **June Davis, Allied Health Professional Advisor, Macmillan Cancer Support [C2].**

"Anna has supported Macmillan and our Move More programme consistently, especially influencing the Scottish Government and key stakeholders in both Scotland and across the other UK nations to embrace the benefits of physical activity for people living with cancer." **Joanne Adamson, Lead for Move More Scotland, Macmillan Cancer Support [C3].**

Following the O1 research, Campbell assisted in the evaluation of the Move More programme which looked at its impact on 4,734 cancer patients, 168 healthcare providers and stakeholders in 18 Move More programmes across the UK, leading to the publication of the Macmillan Physical Activity Evaluation Report in 2018 [C4]. The report demonstrated that the 4,734 participants gained significant improvements in physical activity levels, quality of life, perceived health, and clinically important reductions in fatigue over the one-year Move More programme. It also revealed that services based in NHS settings engaged better with healthcare professionals which in turn helped generate more referrals. Cost per completer was estimated at GBP291, representing a very cost-effective model to improve patient outcomes. Quotes from Move More participants below:

"I would not have made such progress with my post-op recovery without attending these classes. They are so vital and have helped me physically and also psychologically." **Move More Participant, Lothian, Scotland.**

"Well, I love the exercise. So, even on days when I don't feel like getting out there and doing anything, you feel so much better afterwards, having done it. So, it works regardless of if you've got side effects from chemotherapy, or are going through anything" **Move More Participant, Cardiff, Wales.**

2) Improved awareness and acceptance of the benefits of exercise for cancer patients by cancer care professionals, both nationally and internationally

Campbell's research studies [O1-O4] and work with Macmillan's 'Move More', have been communicated to front line health service providers, for example through GP masterclasses and international workshops and CPD for surgeons, oncologists, medical practitioners, nurses, physiotherapists and other AHPs working in the area of oncology and cancer care. The implementation research in O5 on linking oncology clinics with exercise specialists has changed the referral pathway from NHS to community programmes in the UK, and it is now influencing the development of similar pathways and services in Europe. For example, **Katharine Malhotra, Rehabilitation Operational Lead at The Royal Marsden Hospital** (a leading specialist cancer treatment centre in London) said that annual training courses delivered by Campbell have *"supported the team to explore and reframe the service provision and set the basis of ongoing service improvements ensuring adherence to evidence – based practice... has significantly influenced the service we continue to provide and enhanced our patients' quality of life"* [C5].

International impact in Europe is evidenced in Denmark, where **Elisabeth Berents, Educational Officer, Association of Danish Physiotherapists** (which represents over 16,000 physiotherapists) said *"Professor Campbell's implementation research, cancer rehabilitation is now a standard part of cancer care here in Denmark. This means that every person going*

through treatment is offered a local exercise-based programme provided by physiotherapists” [C6].

Wider international reach was achieved through **O5**, which resulted from the gathering of a key group of 17 high-profile cancer organisations from USA, Canada, Australia and Europe to discuss ways to better integrate exercise in clinical cancer care plans and address the need for cultural change to drive the prescription of physical activity as a cancer therapy. The study findings are cited in World Health Organisation (WHO) Guidelines on Physical Activity and Sedentary Behaviour, the first time WHO have provided recommendations on the association between sedentary behaviour and health outcomes for those with cancer **[C7]**. The **O5** study led Campbell and an international team to establish a 5-year implementation plan ‘Moving Through Cancer’ which included an international survey, disseminated by Campbell, that led to the development of an international registry to which all cancer exercise programmes are invited to register and be validated **[C8]**. The registry now holds details of 1,635 programmes across 29 countries, improving awareness of and access to programmes for both patients and clinicians.

This work received significant high profile media attention, with extensive engagement and coverage across 50 international news outlets, including The New York Times who have seven million online subscribers, and the paper was chosen by Medscape, a popular online information source for clinicians, as one of the ‘Cancer Top 6’ of 2019 (<https://www.medscape.com/viewarticle/922447>).

3) Improved safety and quality of exercise programmes for cancer patients through delivery of evidence-based training programmes and development of workforce

Campbell’s research findings continue to inform the development and running of training programmes delivered by her spin-off company CanRehab (<http://canrehab.co.uk>), established to train health and fitness professionals to deliver safe, effective and evidence-based exercise programmes tailored to individual cancer patients. CanRehab was the first UK training provider to offer the vocational Level 4 Cancer and Exercise Rehabilitation qualification, which was awarded UK Active’s ‘Specialist Training Programme of the Year’ in 2017 and has been endorsed by The Chartered Institute for the Management of Sport and Physical Activity (CIMSPA) which has 19,000 members.

To date, CanRehab has trained over 1,300 health and fitness professionals in the UK, Europe and North and South America. **Dr Andreia Capela Marques, Medical Oncologist in Portugal** commented: *“Anna trained up a team of ten professionals from multi-disciplines (in 2019) and a further 26 in October 2020 in a course designed for the Portuguese professionals (including exercise professionals, Rehabilitation doctors, physiotherapists, and Professor of exercise). We have used [these techniques] in a cohort of circa 80 patients... patients appear to be more comfortable and happier. Recovery, through a number of measures, has also improved, including timescales” [C9].*

The vocational CanRehab qualification is embedded in Masters in Clinical Exercise Physiology (CEP) degrees at four UK academic institutions, providing standardised competencies in exercise oncology within the UK health sector. Campbell is one of 14 international advisers on the CEP Steering Group. All CEP MSc graduates will be listed in the Registration Council for Clinical Physiologists (RCCP) register, a government approved Professional Standards Authority (PSA) Accredited register. This improves the employability of these registered graduates within the NHS setting **[C10]**.

4) Informed guidance on prehabilitation

In recognition of Campbell’s research in prehabilitation, she was invited to be part of the Delphi process to compile the UK “Cancer Prehabilitation Principles and Guidance” document (2019), which is the template for all prehabilitation programmes currently being established and running in NHS settings **[C11]**. This guidance document has been produced to provide health and social care professionals with the evidence and insight they need to support and influence the inclusion of physical activity in commissioning or reviewing services in cancer care. **Zoe Merchant,**

Programme Lead for the Greater Manchester Prehab4Cancer and Recovery Programme, Christie's NHS Trust said *"In 2020...over 1400 patients have gone through this service. As far as outcomes of our programme... it is clear that there are strong improvements in patient's cardiorespiratory and muscular fitness making them more able to cope with surgery and with further cancer treatments. Indeed, in some cases patient's functional wellbeing is better post-surgery than it was post baseline – for example one lung cancer patient's discharge functional test results were better post lobectomy surgery than they were at diagnosis"* [C12].

5) Enabling remote access to tailored cancer exercise during COVID-19 pandemic

Campbell co-led the development, implementation and evaluation of a new pilot service and clinical trial called SafeFit with University of Southampton and Macmillan. This programme has received GBP1.3 million to provide exercise for between 1,100 and 1,300 people with cancer. Launched during the COVID-19 quarantine period to provide 6 months of free exercise, nutritional and psychological support, it has already provided support to 400 cancer patients with numbers continuing to rise. **June Davis, Allied Health Professional Advisor, Macmillan Cancer Support** said *"For many, this has been a real lifeline. Cancer sufferers are in the high-risk category and have been self-isolating or shielding. The support from the NHS has diminished over this period, less one-to-ones, clinical sessions and connectivity. They are increasingly feeling cut-off and need human contact to help them through very trying times. It is clear that having these people available, providing virtual sessions, listening to their needs, updating their regimes and providing support, has been critical"* [C2]. Increased engagement with online exercise materials has been noted during the pandemic, for example an exercise video Campbell was commissioned to make for Macmillan in 2016, has had over 9,000 views between April and December 2020, across the pandemic timeframe (https://youtu.be/Oo_mbNBDCI8).

5. Sources to corroborate the impact (indicative maximum of 10 references)

- [C1] Macmillan Move More Physical Activity Information Leaflet
<https://be.macmillan.org.uk/Downloads/CancerInformation/LivingWithAndAfterCancer/MAC12515E05physical-activitylowresPDF20190128HS.PDF>
- [C2] Testimonial letter from June Davis, Allied Health Professional Advisor, Macmillan Cancer Support.
- [C3] Testimonial letter from Joanne Adamson, Lead for Move More Scotland, Macmillan Cancer Support.
- [C4] Evaluation of the Macmillan Physical Activity Behaviour Change Care Pathway
<https://www.macmillan.org.uk/assets/evaluation-of-macmillan-physical-activity-behaviour-change-care-pathway-2018.pdf>
- [C5] Testimonial letter from Katharine Malhotra, Rehabilitation Operational Lead, The Royal Marsden Hospital, London.
- [C6] Testimonial letter from Elisabeth Berents, Educational Officer, Association of Danish Physiotherapists.
- [C7] WHO Guidelines on physical activity and sedentary behaviour:
<https://www.who.int/publications/i/item/9789240015128>
- [C8] Moving Through Cancer online Exercise Program Registry for patients, families and health care providers: https://www.exerciseismedicine.org/support_page.php/moving-through-cancer/
- [C9] Testimonial letter from Dr Andreia Capela Marques, Medical Oncologist at Centro Hospitalar Vila Nova de Gaia, Portugal.
- [C10] Testimonial letter from Professor Helen Jones, Chairperson of Clinical Exercise Physiologist Steering Group.
- [C11] Prehabilitation Principles and Guidance Document
<https://www.macmillan.org.uk/healthcare-professionals/news-and-resources/guides/principles-and-guidance-for-prehabilitation>
- [C12] Testimonial letter from Zoe Merchant, Programme Lead for the Greater Manchester Prehab4Cancer and Recovery Programme, Christie's NHS Trust.