Institution: University of Wolverhampton

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

Title of case study: Improving health and wellbeing of patients with cancer through exercise-based rehabilitation

Period when the underpinning research was undertaken: 2015 - 2018

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:
Dr Ian Lahart	Senior Lecturer in Clinical Exercise Science	2010 - Present
Professor George Metsios	Professor in Clinical Exercise Physiology	2007 - Present
Professor Alan Nevill	Professor in Sport	1999 - Present

Period when the claimed impact occurred: 2016 - 2020

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact

The University of Wolverhampton's sustained commitment to research into the therapeutic effects of exercise on sequelae associated with cancer and its treatment has significantly influenced rehabilitation of cancer survivors, regionally, nationally and internationally. The research was instrumental in establishing Action Health in 2016, an innovative exercise-based cancer rehabilitation service based at Russells Hall Hospital, Dudley Group NHS Foundation Trust, with subsequent evidence of improved quality of life in service users. The findings have also informed the development of a pioneering training course, 'Cancer and Exercise Rehabilitation', administered through the organisation CanRehab UK, with 720 exercise practitioners having gained their Level 4 award to date. Furthermore, contributions have been made to key best practice documents and guidelines from some of the world's leading health organisations and cancer bodies, including the American College of Sports Medicine (ACSM) and MacMillan Cancer Support.

2. Underpinning research

There are currently over 228,000 women in the UK living with breast cancer who were diagnosed in the past five years. Women who undergo treatment for breast cancer (surgery, radiotherapy and chemotherapy) experience a variety of side effects impacting on their Health-related Quality of Life and functional abilities. As a result of a projected rise in incidence and improved survival rates, the prevalence of breast cancer in the UK is estimated to rise by 20% in the next 20 years. Exercise oncology is a major area of growth, creating new opportunities to support women with breast cancer to improve their health and wellbeing.

The role of exercise in cancer treatment and management (exercise oncology) has been a strong focus of research at University of Wolverhampton for more than a decade. We have developed a strong international reputation for robust research that has informed and influenced educators, policymakers, and practitioners globally. Our research stems from long-standing and productive collaborations between researchers from the University of Wolverhampton's Institute of Human Sciences (Lahart, Metsios, and Nevill), clinicians at Russells Hall Hospital, Dudley Group NHS Foundation Trust (Professor Amtul Carmichael, Consultant Breast Surgeon; and Professor George Kitas, Head of Research and Development) and Action Heart Cardiac Rehabilitation Centre (Russell Tipson, Action Heart Director). The following key findings [F] underpin the impact claimed for this innovative work on exercise oncology:

F1. Exercise reduces premature mortality in women diagnosed with breast cancer

Using a systematic review and meta-analysis of epidemiological studies, Lahart et al. [found that breast cancer survivors who reported higher levels of physical activity had a lower risk of premature all-cause and breast cancer-related mortality, and breast cancer recurrence or progression [R1]. Although higher levels of physical activity reduced these cancer outcomes at all time-points, stronger associations were found for post-diagnosis physical activity compared with pre-diagnosis physical activity. This latter finding suggests that pre-diagnosis physical activity may not have as large an influence on breast cancer prognosis, and physically active breast cancer survivors experience reductions in premature mortality and disease recurrence or progression.

F2. Exercise increases quality of life in patients with breast cancer

Lahart et al. conducted a Cochrane Collaboration review comprising over 60 RCTs and determined that women with breast cancer allocated to exercise interventions post-adjuvant therapy, experienced small-to-moderate beneficial effects on quality of life, along with improved anxiety, cardiorespiratory fitness, emotional, perceived physical and social function [R2].

F3. Improving the health of breast cancer survivors

Lahart et al. conducted a RCT of a home-based physical activity and behavioural counselling intervention (PHAB-study) in breast cancer survivors powered to detect moderate changes in self-reported total physical activity levels [R3 and R4]. Patients were allocated via centralised (blinded) randomisation to either a behaviour change intervention with motivational interviewing or usual care. Trial results revealed statistically significant small-to-moderate positive changes in self-reported physical activity, Body Mass Index (BMI), breast cancer-specific quality of life, total cholesterol, and low-density lipoprotein-cholesterol in the intervention cohort. In an analysis of a subgroup of participants from the main trial, small statistical increases in cardiorespiratory fitness were also observed in the intervention versus control group.

Lahart collaborated with Carmichael and Williams from Russells Hall Hospital, Dudley, on a single group pilot study [R5] of a physiotherapist-led 6-month physical activity promotion intervention in women diagnosed with breast cancer. Patients improved self-reported physical activity, 6-min walk test distance, and quality of life from baseline to post-intervention. The improvements in 6-min walk test and quality of life were considered clinically meaningful important changes.

3. References to the research

All the papers were published in journals with stringent peer-review processes. Cochrane collaboration reviews [R2] are considered the gold standard of meta-analytic reviews, and are published in two peer-reviewed stages.

R1. Lahart, I.M., Metsios, G.S., Nevill, A.M., & Carmichael, A.R. (2015). Physical activity, risk of death and recurrence in breast cancer survivors: A systematic review and meta-analysis of epidemiological studies. *Acta Oncologica (Stockholm, Sweden)*, 54(5), 635–654. DOI: https://www.doi.org/10.3109/0284186X.2014.998275. (UoA24 REF 2 Output).

R2. Lahart, I.M., Metsios, G.S., Nevill, A.M., & Carmichael, A.R. (2018). Physical activity for women with breast cancer after adjuvant therapy. *The Cochrane Database of Systematic Reviews*, 1, CD011292. https://www.doi.org/10.1002/14651858.CD011292.pub2.

R3. Lahart, I.M., Metsios, G.S., Nevill, A.M., Kitas, G.D., & Carmichael, A.R. (2016). Randomised controlled trial of a home-based physical activity intervention in breast cancer survivors. *BMC Cancer*, 16, 234. https://www.doi.org/10.1186/s12885-016-2258-5. (UoA24 REF 2 Output).

R4. Lahart, I.M., Carmichael, A.R., Nevill, A.M., Kitas, G.D., & Metsios, G.S. (2017). The effects of a home-based physical activity intervention on cardiorespiratory fitness in breast cancer survivors; a randomised controlled trial. *Journal of Sports Sciences*, 1–10. https://www.doi.org/10.1080/02640414.2017.1356025. (UoA24 REF 2 Output).

R5. Williams, S., Lahart, I.M., & Carmichael, A.R. (2016). Does a pragmatic physiotherapist-led physical activity intervention work to improve the physical activity behaviour of breast cancer survivors? *European Journal of Surgical Oncology*, 42(5), S16. https://www.doi.org/10.1016/j.ejso.2016.02.070.

4. Details of the impact

Through high-quality research on the benefits of exercise for improving cancer health outcomes, there have been a range of impacts [I] leading to changes in policy and practice in organisations around the world.

I1. Benefiting the wellbeing of patients with cancer through an exercise-focused intervention

Action Health is a collaborative exercise-based cancer rehabilitation service at Dudley Group NHS Foundation Trust, based at Russells Hall Hospital. Patients with various cancers at all clinical stages complete a 12-week programme of professionally supervised exercise. Lahart was key to setting up the programme, using his research on the benefits of exercise in breast cancer patients [F2 & F3] to underpin its design. The programme was initiated in 2016 with over 60 patients enrolled in the first year and has averaged over 50 patients each year since. Patients completing the course experienced clinically meaningful changes in quality of life and perceived physical and emotional wellbeing [C1]. In a focus group of patients who have completed Action Health, comments included: "I've exceeded every consultant's expectation... I'd say a good 50% is down to Action Health and it's certainly got me my life back" and "To me fitness is so important because without it, my mind was dying for about three weeks, until I came here [Action Health] and I'm now in my fourth year" [C1]. Action Health is a prime example of how exercise can directly benefit people with cancer.

I2. Impact on professional practice

CanRehab UK is an evidence-based, specialist training programme, which delivers a Level 4 award in Cancer and Exercise Rehabilitation. To date, 720 practitioners from the UK and internationally have completed the course. These individuals come from professional backgrounds such as fitness instructors, allied healthcare professionals and oncology specialists. The course won 'Specialist Training Programme of the Year" from UKActive and its founder Professor Anna Campbell received an MBE for her work. Professor Campbell highlighted R2 as a "main resource" for the course, which "enables us to help the students understand the importance of exercise in cancer care" [C2]. She indicates that most of those qualified from the course "work in public or privately funded community-based leisure centres or in oncology/rehabilitation clinical centres with patients with cancer" [C2].

I3. Impacts on health policy and guidelines

Lahart's Cochrane Collaboration review was used by the ACSM to underpin the support of exercise guidelines for patients with cancer, seeking to improve feelings of anxiety and quality of life, and also guidance regarding the safety of exercise in this population [C3]. Specifically, the research was utilised to generate targeted exercise prescription that can be used by professionals to develop programmes to improve quality of life, anxiety, lymphoedema, and exercise tolerance in people with cancer. The ACSM has a membership of 55,000, and certifies professionals from 90 countries who work with clinical populations, including patients with cancer. The certified courses provided by the ACSM are offered to over 70 occupations within the sport and exercise medicine field, including personal trainers, physicians, sports medicine doctors, exercise scientists, and allied health professionals. These guidelines have been disseminated to health professionals and patients across social media and form a part of the content delivered to health professionals on an ACSM certified course (e.g., ACSM Certified Clinical Exercise Physiologist) [C4]. One of the authors of the guidelines highlighted the contribution of the findings [F1] as "essential" in their development [C4].

The findings on the contribution of exercise in reducing premature mortality [F1] were used to underpin recommendations by the American Cancer Society/American Society of Clinical

Oncology for patients with cancer to increase their physical activity levels. This was disseminated through the 'Breast Cancer Survivorship Care Guideline', that provided "recommendations to assist primary care and other clinicians in the care of female adult survivors of breast cancer" [C5]. The society is an organisation of nearly 45,000 oncology professionals across over 150 different countries, and its clinical practice guidelines serve to provide an overview of appropriate evidence-based methods of treatment and care for these professionals. The guidelines have been distributed to the entire membership of the society.

Similarly, the findings [F1, R1], were used to underpin recommendations on physical activity for patients with cancer in a position statement published by the Clinical Oncology Society of Australia (COSA) [C6]. COSA is the largest national organisation in Australia that represents health professionals who care for patients with cancer and the exercise recommendations were used to underpin training given on COSA professional development courses, attended by a range of cancer clinicians and practitioners [C6]. This research was also used by Macmillan Cancer Support in an evidence review report entitled 'Physical Activity and Cancer' whereby the charity highlighted the research findings indicating lower risk of death in patients with increased physical activity [C7]. This document is shared on the Macmillan website and was distributed to the 12 Macmillan 'Move More' exercise services located throughout the UK.

The findings on improving quality of life through exercise [F2, R2] were used in an American Heart Association (AHA) statement about the prevalence, cause and treatment of cardiovascular disease in people diagnosed with breast cancer [C8]. The AHA is the largest heart disease and stroke related organisation in the United States, with more than 40 million volunteers and supporters.

5. Sources to corroborate the impact

C1. Contact details of Director of Action Heart

C2. Testimonial from CanRehab course founder

C3. American College of Sports Medicine (ACSM) statement

C4. Testimonial from ACSM representative

C5. ACS/ASCO Breast Cancer Survival Guidelines

C6. Clinical Oncology Society of Australia (COSA) statement

C7. MacMillan Physical Activity and Cancer evidence review document

C8. AHA statement