

Impact case study (REF3)

Institution: Liverpool Hope University		
Unit of Assessment: A6 Agriculture, Food and Veterinary Sciences		
Title of case study: Increased uptake of exercise and improved nutritional status to improve muscle strength in older adults.		
Period when the underpinning research was undertaken: 2016 - 2020		
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 Farzad Amirabdollahian	Associate Professor	2011 - Present
Omid Khaiyat	Professor	2013 - Present
Kate Mooney	PhD Student	2014 - 2019
Ben Kirk	PhD Student	2014 - 2018
Period when the claimed impact occurred: 2016 - 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words) With an ageing population comes an increase in frailty traits, notably muscle weakness and its clinical consequences such as frequent falls. This emphasizes the vital need for prevention strategies to avoid mobility issues and promote healthy ageing.</p> <p>We demonstrated that a training programme including resistance and functional exercises together with a balanced diet comprising adequate amount of protein significantly enhances musculoskeletal health, aerobic capacity, and the quality of life of older adults.</p> <p>We used our findings together with the framework of the Health Belief Model to improve health behaviour of older adults, through enhancing health knowledge, improving the perceived benefits of exercise and optimum nutrition, and producing success stories as cues for action.</p>		
<p>2. Underpinning research (indicative maximum 500 words) See paragraphs 318 to 326.</p> <p>This impact case study is based on the research undertaken at Liverpool Hope University since 2014 on lifestyle interventions to enhance the health of older adults. The majority of work has been conducted as part of an internal and interdisciplinary collaboration between researchers with expertise from Nutrition and Sport disciplines, within the registered Clinical Trial NCT02912130, together with a further systematic review and meta-analysis conducted in collaboration with Isfahan University of Medical Sciences, Isfahan, Iran. The Clinical Trial investigated the multidimensional effects of exercise and nutritional interventions on musculoskeletal functioning, nutritional status, and quality of life in prevention of Age-related Sarcopenia and was conducted between 2015–19; while the supplementary systematic review and meta-analysis investigated the association between different dietary patterns and frailty between 2017-19.</p> <p>Age-related loss of muscle mass and strength, together with an increase in fat mass, are the key physiological changes of ageing. The phenomena, broadly labelled as sarcopenia, substantially enhance the risk of frailty, and adversely affect the quality of life through increasing the frequency of falls, fracture, hospitalisation, cognitive dysfunction, and activities of daily living in older adults.</p> <p>Within our Clinical Trial, we investigated the impact of exercise, in combination with, or without, amino acid leucine-enriched whey protein supplement on measures of musculoskeletal and</p>		

cardiometabolic health and quality of life of older adults. For this, we recruited 100 community dwelling older adults and randomly assigned them to one of four groups (arms): Control (C), Exercise (E), Exercise + Protein (EP), and Protein (P). Groups E and EP received 16 weeks of supervised exercise programme, comprising twice weekly resistance training and once weekly functional exercises designed by expert practitioners. Groups P and EP were given leucine-enriched whey protein supplements for 16 weeks, three times a day based on the body weight (1.5 gr per kilogram body weight). The systematic review and meta-analysis were designed to go beyond the potential impact of a single nutrient (protein) and consider the association between the general dietary patterns and risk of frailty.

Our Clinical Trial revealed that exercise programme led to a significant increase in indicators of muscle strength for leg press, chest press and bicep curl, a significant improvement in physical functioning and aerobic capacity, and a decrease in muscle fatigue independently of muscle mass (which did not statistically change in any group). These findings were consistently seen in both E and EP arms, with no significant difference between the two arms. This is an important outcome as this confirms the effectiveness of our exercise regimen for improving muscle strength and capacity in older adults, and in helping to prevent frailty. Our study showed that high dose protein supplementation proposed by the previous literature did not confer any additional benefits to those already consuming ample amounts of dietary protein at trial enrolment, suggesting that a sufficient amount of protein from food sources (1.1 +/- 0.4 g/kg/d) can improve physical strength when combined with physical activity. Our trial also showed an improvement in the health-related elements of the quality of life in the E arm, and this together with the maintenance of an exercise regimen in 86% of older adults after the completion of the trial suggest the positive impact, and the long-term effectiveness of our exercise programme in improving the overall quality of life and wellbeing. While our trial did not show a beneficial impact of a single nutrient (i.e. protein) supplementation for older adults consuming sufficient amounts of it, our collaborative systematic review and meta-analysis showed that the dietary patterns with high quantity of fruits, vegetables and whole grain are associated with reduced risk of frailty.

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

1. Kirk B, Mooney K, Cousins R, Angell P, Jackson M, Pugh JN, et al. Effects of exercise and whey protein on muscle mass, fat mass, myoelectrical muscle fatigue and health-related quality of life in older adults: a secondary analysis of the Liverpool Hope University-Sarcopenia Ageing Trial (LHU-SAT). *Eur J Appl Physiol.* 2020;120(2):493-503.
2. Kirk B, Mooney K, Amirabdollahian F, Khaiyat O. Exercise and Dietary-Protein as a Countermeasure to Skeletal Muscle Weakness: Liverpool Hope University - Sarcopenia Ageing Trial (LHU-SAT). *Front Physiol.* 2019;10:445.
3. Mooney K, Kirk B, Khaiyat O, Amirabdollahian F. Effects of protein supplementation alone and in combination with exercise on cardiometabolic health markers in older adults. *Proceedings of the Nutrition Society* 2019;78(OCE1):E39.
4. Mooney K. The effects of protein supplementation alone and in combination with exercise training on musculoskeletal strength and functioning, cardio-metabolic health and nutritional status in older adults: Liverpool Hope University; PhD Thesis 2020.
5. Kirk B. Impact of concurrent exercise with, or without, a leucine-enriched whey protein isolate supplement on skeletal muscle function in older adults: Liverpool Hope University; PhD Thesis 2019.
6. Rashidi Pour Fard N, Amirabdollahian F, Haghghatdoost F. Dietary patterns and frailty: a systematic review and meta-analysis. *Nutr Rev.* 2019;77(7):498-513.

4. Details of the impact (indicative maximum 750 words). The 'Panel criteria', Annex A, Table 1 provides an illustrative list of evidence that could be provided.

Context

Frailty is a syndrome that incorporates the impact of the natural physiological changes of ageing with multiple long-term comorbidities and loss of fitness and reserves. Previous studies demonstrated that frail community living older adults have the highest risk score of the falls, making them the most vulnerable group in this regard. At least one third of community dwelling older adults fall each year. Within the UK only, hip fractures resulting from fall, in isolation,

account for more than 1.8 million hospital bed days and annual costs of £1.1 billion to the health system, and this is excluding the exponential additional costs such as high cost of the social care. Falls and fractures commonly reported in older adults are preventable. Change of health behaviour and lifestyle modifications in nutrition and exercise can reduce the risk of osteoporosis and sarcopenia, to prevent fall and improve the quality of life of older adults.

Pathway to impact:

Our research contributed to change of health behaviour in older adults. We have used the conceptual framework of the Health Belief Model (1952) as a pathway to impact and consciously targeted key areas of health belief in older adults in producing impact from our research.

The Health Belief Model is one of the most widely used applied theories, which has also successfully fitted the health behaviour of older adults. The model postulates that perceived disease susceptibility, perceived disease severity, perceived self-efficacy, perceived benefits of preventative action and perceived barriers of preventative action together with external cues for action are the key constructs that predict an individual's health behaviour. Demographics, socioeconomic status, and health knowledge are the key modifying factors of the model that affect the perceptions, and the efficacy of the cues for action.

Several previous studies demonstrated that older adults usually receive fall prevention messages as theoretically important but not personally relevant, while the results of interventions focusing on delivering messages on severity and susceptibility have been inconclusive. We used the knowledge generated from our research to produce positive messages about improvement of nutrition and exercise habits to affect the perception of benefits and self-efficacy, while producing strong and relatable success stories as cues for action.

Impact:

1. Changing behaviour with enhancing knowledge and positive health messages

A series of easily understandable workshops with positive and practical messages were produced and delivered in community settings across Liverpool including Breathe Easy (NHS Chronic Obstructive Pulmonary Disease support group), Calderstones Active in Retirement (CAIR), The Central Library community centre, St Leonards Youth & Community Centre, The Florrie Community Centre, and Bridge Chapel Centre. The workshop addressed the importance of both exercise and nutrition to improve and maintain muscle health in ageing, briefly discussing the key research findings, together with positive and relatable messages and practical suggestions to start and maintain an exercise regimen and a high protein but balanced diet. These community engagement activities were followed by a more practical workshop at host HEI in which more than 40 engaged older adults joined a practical laboratory sessions to further examine their hands-on solutions at food research and development lab, and sport and biomechanics lab together with expert practitioners (S1).

Referring back to the Health Belief Model, the workshops aimed to enhance health knowledge as modifying factors for change and improve the perception of the benefits of the preventative changes, and provide cues for action. The impact is evident as an overwhelming majority of 94% said they had gained some new knowledge, and when questioned if they would make changes to their exercise and dietary habits, most of respondents answered that they were likely to do so (S2). Regarding the cues for action, the verbal feedback of an elderly participant attending the session provides evidence for contribution to behaviour change: *“The morning was informative and fun in a practical way and I left feeling stimulated and motivated to make changes in my life which can only enhance my future years.”*

We followed up with those who attended sessions (talks, workshop) to see if they had changed any of their exercise or dietary habits because of their attendance after a few weeks, and the majority (>90%) of respondents reported to have made a change to exercise and/or dietary intake. These findings support the positive impact of community engagement events on behaviour change (S2).

2. Changing behaviour with relevant success stories as cues for action

In order to facilitate the behaviour change, we supported older adults in setting up social media (e.g. whatsapp group) and helped to cost group prices at local gyms. This was successful as it led to production of a group that were exercising together 2-3 times per week, where peer support and constant motivation and accountability to each other ensured better compliance in behaviour change. The following quotes demonstrates the change of behaviour *"I've always been active but I'd never set foot in a gym before and thought it was a man's thing really,"* said one of the female participants. *"But by the end I got into it so much I was constantly pushing myself."* Another quote showing the behaviour change is that *"My goal was to do 160kg on the leg press and I did it. I don't think I realised how determined I actually was."* (S3)

To demonstrate the impact of peer support on the behaviour change, a quote from a female older adult can be considered: *"When you are ageing you can be quite isolated from other people sometimes and miss that communication,"* she said. *"But meeting up twice a week to do the training meant we built a good rapport and all became friendly."* A retired investment manager 86-year-old male was the oldest member of the social group, and said *"I used to be a keen tennis and squash player but as with the rest I'd never been a gym-goer or weight-lifter,"*. *"But I liked the routine of working out and the social aspect too. I got to meet men and women I didn't know and we bonded over our aches and pains after a session"...* Some of the ladies said they'd used muscles they didn't know even existed" (S3).

A 74-year-old from West Derby who became motivated to run her first ever full marathon, and completed the race in five hours and 24 minutes, produced one of the strongest success stories. To quote, *"Seeing the eyes of my husband, my 10-year-old grandson ..., and my other family light-up at the finish line made it all worthwhile."* (S4)

The positive messages and success stories contribute to behaviour change, evident in this feedback from two other older adults who reported an upsurge in motivation *"You renewed my enthusiasm to return to my gym class, which I was intending to do anyway after several weeks of being committed to other things, and it felt great to know I was helping myself to live a more active and beneficial lifestyle."* And, *"I have already used the new information to adjust today's breakfast and lunch! This evening's meal should fulfil the remaining daily requirement."*

3. Impact beyond Merseyside

Our success in improvement of health behaviour through interactive communication of positive and relevant health knowledge, enhancing the perception of benefits of preventative action and motivational success stories as cues for action, produces a conceptual framework easily extrapolated in other settings and communities. We have produced easy to understand educational resources for raising health knowledge and awareness in older adults. Examples of these resources are the handbooks of high protein food options for older adults (S5) and resistance training for older adults (S6), and strength and balance exercises for older adults (S7), and these resources are made freely accessible from the weblog 'Improving quality of life in older adults' (S8).

Our information packages were distributed to the individuals and community groups that hosted us, and also bulk distributed to a number of organisations across the country. The early signs of uptake are promising. For instance, the Tidal Training group (<https://www.tidaltraining.co.uk>), which trains NHS staff and delivers health and safety training for care workers and those working with older adults, were delighted when we reached out, and will consider using our resources. They work with 700 partners and train more than 16,000 trainee a year, and we hope to delivery our message to those health professionals. HC-one Care Homes (<https://hc-one.co.uk/Carehomes.aspx>) with a large number of care homes across the country; Omega Care for Life group (<https://www.omega.uk.net/>) as a small organisation working with caregivers, and the Healthbox CIC (Ellelsmere Port) who provide falls prevention classes to older adults, are other organisations who showed an interest in implementing our resources. Our research findings have also been reported in several media, such as the Daily Express (S9) and engaging online platforms for older adults – for example the websites of Nursing Times, Total Health, Woman and Home and Psych Reg (S10).

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- S1 Community engagement activities and practical workshops
- S2 Change in response to community engagement activities and workshop
- S3 Testimonials - Users' contact information provided separately for verification
- S4 Success story of running a full marathon
- S5 Handbook of high protein food options for older adults
- S6 Handbook of resistance training for older adults
- S7 Handbook of strength and balance exercises for older adults
- S8 Weblog of improving the quality of life of older adults
- S9 Daily Express report of the research findings
- S10 Reach of findings through several online communication platforms