Optimising Exercise Prescriptions for Individuals with Mild Cognitive Decline

Faculty of Wellbeing Education and Language Studies (WELS)

Call for doctoral projects starting in October 2027

The Open University

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Project description

Project Type

This is a PhD project

Please note that a research proposal aligned with this research project will be required from applicants in addition to an application form.

School

Education, Childhood, Youth and Sport

Unit

Institute of Educational Technology

Members

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Aim

The overall aim of this research project is to develop the understanding of the optimal dose and modality of exercise for improving cognitive function and slowing disease progression in older adults with MCI.

The specific aims of the research project are to:

1. Determine the dose-response relationship between exercise volume and cognitive function.
2. Compare cognitive effects of aerobic, resistance, dual-task exercise and combined exercise modalities.
3. Identify biological mechanisms underpinning dose-related cognitive improvements.
4. Determine individual factors influencing responsiveness to exercise.
5. Establish the feasibility of translating optimal exercise doses into clinical practice.

Methodology

The project will primarily use the newly developed sports and exercise science laboratory at The Open University campus in Milton Keynes (UK). The facilities include laboratory and portable metabolic carts (Cosmed K5 and Cortex MetaLyzer), lactate and glucose analysers (Biosen), force plates (Kistler, AMTI, and VALD), motion capture system (Qualisys), treadmills (Saturn h/p/cosmos and Kickr), bikes (LodeBike, Wattbike, and Kickr turbo trainer), NIRS device, EMG system (Delsys), dynamometers (Biodex, VALD), balance system (Biodex) ultrasound system (GE HealthCare), DEXA scanner (GE HealthCare), activity trackers (activePAL) strength and conditioning equipment, and several other devices that could be used as part of the doctoral research project.

Methodologies could include observational, cross-sectional, longitudinal, or randomised control trial study designs to investigate the dose-response effects of exercise in older adults with MCI. For example, community-dwelling adults with a confirmed diagnosis of MCI could be randomly allocated to low-, moderate-,

or high-dose exercise groups, with interventions delivered over a 12-week period. Cognitive assessments could be conducted pre- and post-intervention using validated measures of executive function, attention, processing speed, and memory. Secondary outcomes could include gait performance, physical function, quality of life, exercise adherence, and participant acceptability. Where feasible, exploratory mechanistic measures such as cardiorespiratory fitness, blood-derived biomarkers (e.g., glucose, BDNF and inflammatory markers), and measures of functional mobility could be collected to investigate potential pathways linking exercise and cognitive change. Statistical analyses could compare changes between dose groups and model dose-response relationships to identify the minimum and optimal exercise dose for improving cognitive outcomes.

Contribution

The proposed project will make an important contribution to the understanding of exercise as a non-pharmacological intervention for cognitive decline by addressing one of the most significant gaps in the current literature: the absence of evidence-based exercise dosing guidelines for cognitively impaired populations. Current evidence demonstrates that exercise can improve cognitive function and brain health, but it remains unclear how much exercise is required to achieve optimal benefits and whether increasing exercise dose results in proportionally greater improvements. The specific contributions for the proposed project aim to target;

Establishing the minimum effective dose: Most exercise studies compare an intervention against a control group but do not systematically investigate dose-

response relationships. As a result, clinicians currently know that exercise is beneficial, but they cannot confidently prescribe the optimal frequency or volume of exercise for individuals with MCI.

Advancing knowledge of the effects of exercise modalities: Compared with aerobic exercise, dual-task training remains relatively underexplored despite growing evidence that it may specifically target executive function, attention, and divided attention domains often affected early in cognitive decline.

Improving understanding of mechanisms: A major challenge within exercise-cognition research is understanding why exercise improves cognitive function. Current theories propose that exercise influences cognition through improvements in neuroplasticity, cerebrovascular health, neurotrophic factors, inflammation, and functional brain network efficiency The project could provide further insight into the pathways linking dual-task exercise to cognitive improvements. Understanding these mechanisms is essential for developing more effective interventions and strengthening the biological rationale for exercise as a therapeutic strategy.

Informing larger clinical trials: The proposed project could provide foundational data needed for future multicentre trials. Specifically, it could generate evidence on recruitment feasibility, intervention adherence/retention rates, effect sizes for cognitive outcomes and optimal intervention dosage. This could provide further understanding to inform the design of larger studies capable of examining whether exercise can slow progression from MCI to dementia.

Supporting dementia prevention strategies: MCI represents a critical intervention window during which individuals remain functionally independent but are at elevated risk of developing dementia. Exercise interventions delivered at this stage may have the greatest potential to alter disease trajectories. By identifying an effective and achievable exercise dose, the project could contribute to delaying cognitive decline, maintaining independence, reducing falls risk, enhancing quality of life and potentially delaying progression to dementia. Although the project will not directly assess dementia incidence, it will provide evidence regarding modifiable behavioural strategies that could contribute to risk reduction.

Enhancing clinical translation: One of the barriers to implementing exercise as a treatment is that recommendations are often too broad to be actionable. Healthcare professionals require specific prescriptions similar to those used for medications. The project's focus on dose optimisation would help translate research into practice by providing evidence that can inform memory clinic programmes, community-based interventions, physiotherapy services, dementia prevention pathways and future exercise guidelines. This increases the likelihood that exercise could be adopted as a routine component of cognitive health management.


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