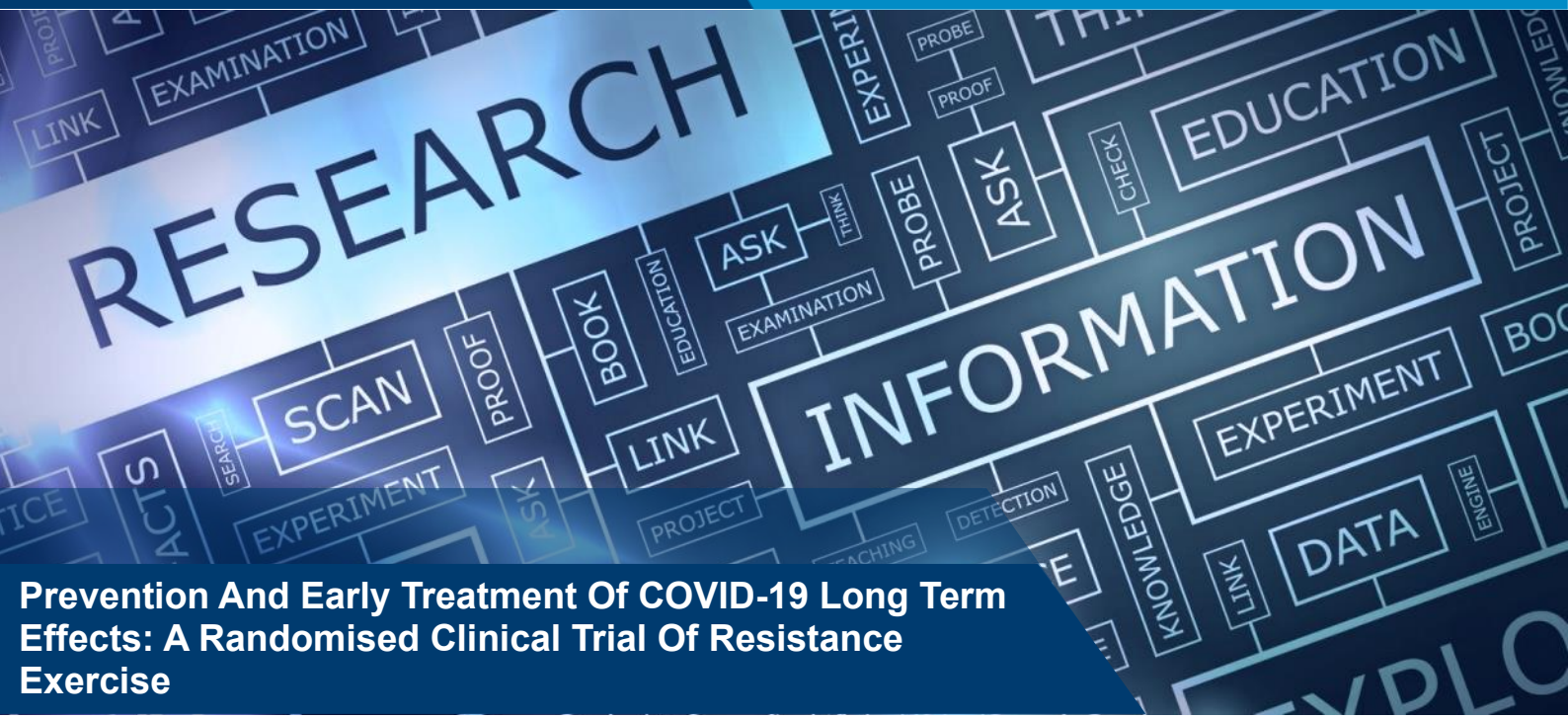

Prevention And Early Treatment Of COVID-19 Long Term Effects: A Randomised Clinical Trial Of Resistance Exercise

AIMS

- Long COVID involves persistent symptoms, including breathlessness and fatigue, for weeks or months after COVID-19 infection. There are few treatments for Long COVID.
- In this study, the effects of a simple, personalised exercise activity on exercise capacity, health and wellbeing in individuals with Long COVID were assessed.

KEY FINDINGS

- Between May 2021 and April 2024, 233 adults (average age 54 years; 63% female, 39% hospitalized with COVID-19) were included; 117 were randomly assigned to the exercise group and 116 were included in the standard care group (no additional exercise). The therapy involved simple types of ‘resistance exercise’ i.e. lifting a bottle of water, or walking up a few upstairs, with a level and frequency that suited the individual as per their preference.

- After 3-months (reflecting the time-limit of our protocol), walking distance, health-related quality of life and mental health, as measured by questionnaires, and handgrip strength improved in the exercise group, relative to the control group.
- Adherence with the exercise programme was high and there were no between-group differences in post-exertional malaise or adverse events, which was encouraging.
- A 3-month personalised exercise plan undertaken by individuals with Long COVID improved exercise capacity, health and wellbeing, and there were no safety concerns.

WHAT DID THE STUDY INVOLVE?

An exercise programme was co-designed by exercise therapists, physiotherapists and individuals with lived experience of Long COVID. Specifically, the exercise therapy was developed through discussions with patient groups around the potential needs of the individual to tailor the design of the exercise therapy to the needs of the individual. The approach involved one-to-one staff contact, the option for a seated (chair-based) approach, to provide a personalised plan that worked for the individual.

Following NHS and Research Ethics Committee approval, patients who expressed an interest to participate were provided with a study information sheet. If they continued to be interested to participate then they could discuss the study with a member of the research team and if they wished to take part, written informed consent would then be provided. Participants were assigned at random to a control or intervention group for a period of 3 months. For participants assigned to the intervention group, an information pack was provided to each participant and they were contacted by research staff every two weeks to provide guidance and support, as needed. The level of support was more frequent for people who had been admitted to hospital for COVID-19.

The exercise therapy was tailored according to the preferences of the individual and their progress. When a participant attained over 15-20 repetitions of each exercise daily, they were invited to move to the next level, if they wished to do so. Similarly, if they did not manage 15-20 repetitions, they could change to an easier level.

Exercise options:

- **Bed-bound:** lying chest-press, lying row, lying plantar flexion, lying leg press and performing a basic bridge (lifting of hips);
- **Up-to-sit**: seated chest-press, seated row, seated lateral raises, seated leg extension, seated ankle exercises, squats;
- **Walking:** press-ups, standing lateral raises, seated rows, lunges, calf-raises, squats.

Participants completed exercise logs and the incremental shuttle walk test (involving walking between two cones at increasing speeds signalled by an audible bleep). The research team also measured breathing function, physical function, quality of life measures, post-exercise malaise, fatigue, frailty and any adverse events e.g. accidents, hospital visits.

WHAT WERE THE RESULTS AND WHAT DO THEY MEAN?

- Personalised resistance exercise for 3-months in individuals with persisting symptoms and exercise impairment at least one month after COVID-19 improved exercise capacity. Participants would have to walk at least a further 35m in order for us to conclude the programme gave meaningful benefits. In our study, we found that this was indeed the case.
- Health-related quality of life, anxiety and depression, and grip strength were also improved.
- Adherence with resistance exercise was reasonably high and post-exercise malaise and adverse events were not increased with the exercise intervention, differentiating this therapy from graded exercise.
- The intervention cost was relatively inexpensive (£189 per individual) and less expensive than other nonmedicinal therapies for Long COVID e.g. REGAIN costs £1987 per individual.

WHAT IMPACT COULD THE FINDINGS HAVE?

Patients - This personalised therapy option can be tailored to the individual and is safe.

Policy - The intervention incurs less cost than other lifestyle interventions for Long COVID, such as REGAIN, a rehabilitation programme currently used in the NHS. The REGAIN intervention was delivered online over eight weeks and consisted of weekly home based, live, supervised, group exercise and psychological support session.

Practice – The intervention is relatively easy for clinical staff to support, needs no specialist equipment and the documents to support the patients with the intervention has already been developed by our study.

HOW WILL THE OUTCOMES BE DISSEMINATED?

Public registration: Clinicaltrials.gov ID NCT04900961 https://clinicaltrials.gov/study/NCT04900961

The study design manuscript has been published, Open Access: Morrow A, Gray SR, Bayes HK, Sykes R, McGarry E, Anderson D, Boiskin D, Burke C, Cleland JGF, Goodyear C, Ibbotson T, Lang CC, McConnachie, Mair F, Mangion K, Patel M, Sattar N, Taggart D, Taylor R, Dawkes S, Berry C. Prevention and early treatment of the long-term physical effects of COVID-19 in adults: design of a randomised controlled trial of resistance exercise-CISCO-21. Trials. 2022 Aug 15;23(1):660. doi: 10.1186/s13063-022-06632-y. PMID: 35971155; PMCID: PMC9376905.

Our study was presented as a Late Breaking Clinical Trial at the Scientific Sessions of the American Heart Association congress, November 2025: https://professional.heart.org/en/meetings/scientific-sessions and published in the Open Access journal of the Journal of the American Medical Association: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2841264

Our team continues work to develop additional manuscripts for open access publication. Future work will assess the health economic implications of a resistance exercise program in Long COVID.

CONCLUSION

In this multicentre, randomised trial, a 12-week programme of personalised resistance exercise in a population of community- and post- hospitalised individuals with or at risk of Long COVID led to

improvements in exercise capacity, health-related quality of life, wellbeing and physical strength. Exercise therapy was safe and post-exertional malaise was not increased. This low-cost, personalised, simple therapy option may be helpful to many individuals with Long COVID.

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