Early experiences of rehabilitation for individuals post-COVID to improve fatigue, breathlessness, exercise capacity and cognition – A cohort study

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Abstract
Individuals with lasting symptoms of COVID-19 should be offered a comprehensive recovery programme. 30 individuals (mean[SD] age 58[16]) that completed a 6 week, twice supervised rehabilitation programme demonstrated statistically significant improvements in exercise capacity, respiratory symptoms, fatigue and cognition. Participants improved by 112 m on the Incremental Shuttle Walking Test and 544 seconds on the Endurance Shuttle Walking Test. There were no serious adverse events recorded, and there were no dropouts related to symptom worsening. COVID-19 rehabilitation appears feasible and significantly improves clinical outcomes.

Keywords
COVID, rehabilitation, breathlessness, fatigue, exercise

Introduction
COVID-19 can lead to a number of lasting symptoms such as breathlessness, fatigue and reduced ability to engage in activities of daily living.1 It became apparent that a recovery or rehabilitation programme would be necessary to support those to return to normal following infection. The European Respiratory Society taskforce identified a need for a formal assessment to understand physical and emotional functioning to determine rehabilitation needs following COVID-19 infection.2 This statement identifies the need for a rehabilitative intervention following hospital discharge and includes a comprehensive programme. It has been acknowledged that a unidimensional programme will not meet the needs of COVID-19 survivors who will present with a variety of different symptoms.3 However, there is invariably some overlap between the needs of COVID-19 survivors and a Pulmonary Rehabilitation (PR) population. PR is a highly evidenced based intervention and addresses many symptoms reported in those suffering
from long-COVID (symptoms lasting ≥3 months post infection), such as breathlessness, low energy, ability to perform daily tasks, sleep disturbance and confidence; but it will likely need modifications. Therefore this model was adapted when developing COVID-19 rehabilitation to meet the complex needs of these individuals. This study presents the results of the initial COVID-19 rehabilitation programme using exercise and education.

Methods

This study reports the experiences of the first 32 individuals that completed rehabilitation following COVID-19 infection. This observational study was approved by the National Health Service Research Ethics Committee (reference 17/EM/0156) and registered through the ISRCTN (ISRCTN45695543). Individuals were referred through a discharge follow up pathway; at COVID-19 medical follow up or; a referral from their GP. Individuals were included if they self-identified rehabilitation needs, whereby they displayed physical and/or psychological symptoms that were affecting their daily activities. Individuals were excluded if they demonstrated acute symptoms or were not medically stable or had only symptoms that were deemed not modifiable from a rehabilitation programme (i.e. loss of taste only). Individuals that had COVID-19 but managed in the community were eligible for the programme and were referred by their GP. All individuals were screened for unexplained symptoms and unstable cardiovascular disease.

The rehabilitation programme was 6 weeks in duration, with two supervised sessions per week. The programme comprised of aerobic exercise (walking/treadmill based), strength training of upper and lower limbs and educational discussions with handouts from the www.yourcovidrecovery.nhs.uk website. The education sessions included: breathlessness, cough, fatigue, fear and anxiety, memory and concentration, taste and smell, eating well, getting moving again, sleeping well, managing daily activities and, returning to work. Pacing advice was provided and reinforced alongside the exercise component. The Borg breathlessness scale and rate of perceived exertion were used alongside self-reported symptoms (including fatigue) to determine progression of the exercises. The outcomes were: the incremental and endurance shuttle walking test (ISWT/ESWT), COPD Assessment Test (CAT), Functional Assessment of Chronic Illness Therapy Fatigue Scale (FACIT), Hospital Anxiety and Depression Scale (HADS), EuroQual 5 domains (EQ5D) and the Montreal Cognitive Assessment (MoCA). The ISWT and ESWT were completed in line with gold standards on a 10 m course and performed a familiarisation test at baseline.

Data was analysed using SPSS v25. Individuals were considered completers if they attended 8 out of 12 scheduled sessions. A paired t-test was used to compare changes before and after rehabilitation.

Results

30 individuals completed the COVID-19 rehabilitation programme (52% male, mean [SD] age 58[16] years). 26 (87%) individuals were admitted to hospital with a mean[SD] length of stay 10[14] days, and 5 (14%) individuals required mechanical ventilation during their admission and were managed in an ITU setting. 4(13%) individuals had a pre-existing respiratory condition (n = 3 asthma, n = 1 COPD). The mean[SD] time from confirmed infection to enrolment onto the programme was 125[54] days. The mean[SD] number of sessions completed was 11[1] out of a scheduled 12 sessions. 30 individuals completed at least eight sessions of rehabilitation, with two drop outs due to social circumstances. Baseline scores identified reduced exercise capacity and health related quality of life compared to healthy controls but relatively well preserved anxiety, depression and cognition as measured by the HADS and MoCA respectively. The mean[SD] SpO2 at baseline was 96.3[1.2] and resting heart rate 80.9[12.2]. Individuals that completed rehabilitation had a mean [SD] within group improvement in the ISWT of 112[105]m (p < 0.01), and 544[377] seconds (p < 0.01). The FACIT improved by 5[7] points (p < 0.01), the EQ5D thermometer improved by 8[19] (p = 0.05) and MoCA by 2[2] points (p < 0.01) The CAT score improved by a score of 3[6] (p < 0.05). The HADS anxiety and depression scores improved by 0[4] and 1[4] respectively which was not statistically significant, however the baseline scores were low (Table 1). Figure 1 demonstrates the changes in FACIT and ISWT.

Discussion

This adapted rehabilitation programme for individuals following COVID-19 has demonstrated feasibility and promising improvements in clinical outcomes. There was a high completion rate of COVID rehabilitation in the first 32 individuals as demonstrated by
this study, with no dropouts attributed to a worsening of symptoms, indicating acceptability to the participants of the intervention. There were significant improvements in clinical outcomes of walking capacity and symptoms of fatigue, cognition and respiratory symptoms (measured by the CAT). Whilst there are no known minimal important differences for these outcomes in individuals with COVID-19; the ISWT, ESWT, CAT, FACIT and, MoCA all exceed the known minimal important differences in individuals undergoing conventional pulmonary rehabilitation, or with a chronic respiratory condition. It is possible that there is some natural recovery in this cohort of individuals, however, as the mean length of time between infection and enrolment onto the programme was 125 days it is likely that natural recovery had slowed down. This cohort is believed to be generalisable to individuals suffering with long-COVID who identify limiting symptoms, though this sample size is small and there is no...
comparator group. This study includes both individuals post discharge and who were managed solely in the community.

There has been concern that rehabilitation may worsen or trigger symptoms of post-viral fatigue and that exercise therapy may exacerbate fatigue. The exercise element of this programme is progressed (by staff experienced in delivering pulmonary and cardiac rehabilitation programmes) in line with patient’s symptoms throughout the programme and provides a holistic and pragmatic approach to exercise therapy. The educational component of the programme supports management techniques useful for these symptoms (such as pacing and prioritising). There were no serious adverse events during the course of the programme supporting the safety of this intervention. The majority of individuals improved both the symptom of fatigue and exercise capacity. One patient did not improve either fatigue or exercise capacity (due to a previous stroke). The remainder (n = 4) who reported an increase in fatigue recorded meaningful improvements in their exercise capacity. COVID-19.

Rehabilitation programmes should aim to provide a holistic and multi-faceted approach to managing post-COVID symptoms. Clinicians should aim to individualise programmes and to monitor adverse events and symptoms, given the limited evidence in the field.

To conclude, a rehabilitation programme to support individuals with symptoms of long-COVID is safe and demonstrates improvements in exercise capacity and symptoms of breathlessness, fatigue and cognition.

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Supplemental material
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