ACCEPT – Accessible Community COVID-19 Education and Physical Therapy: A preliminary report

Summary

This project was a small-scale feasibility trial to evaluate participant recruitment, safety, acceptability, and adherence to a community-based rehabilitation programme for COVID-19 survivors. People living with long COVID-19 entered into group-based rehabilitation sessions where they received individual health and lifestyle advice (smoking cessation, physical activity promotion, alcohol consumption, nutrition) and took part in three 1-hour group-based exercise alongside educational sessions on managing exertional fatigue and breathlessness symptoms of long COVID-19. The project was delivered in collaboration with Healthworks, a community health charity, and the Newcastle-upon-Tyne Hospitals NHS Foundation Trust, Royal Victoria Infirmary Long COVID-19 clinic, who acted as the source of referrals to the community-based rehabilitation service. The majority of participants reported symptoms of breathlessness (71%) and fatigue (100%), with over half reporting problems with short memory loss (57%). A small number of participants conducted a semi-structured interview with a member of the research team. In addition, the project included patient and public involvement (PPI) to examine perceptions, needs and expectations of participants. The interviews consisted of several key themes including symptoms, motivation to participate, anxiety about participation, exercise choice, exercise progression, motivation to continue, session frequency, monitoring and confidence, programme exit and impact of data collection. Interviews were also conducted with four members of the study delivery team (Northumbria University and Healthworks) to evaluate the feasibility and acceptability of the intervention and understand any perceived barriers and facilitators to its delivery. Through this small project we have seen that attendance to a community-base exercise facility is feasible and exercise sessions are safe with only mild exertional symptoms for the participants. Via questionnaires we have also seen that quality of life and cognitive function improve. Importantly, via activity diaries and questionnaires we have seen that participants become more physically active in daily life and that daily activities are performed with less fatigue. Importantly via priori sample size calculations for a number of examined outcome measures that were sensitive to significant change after the rehabilitation programme, we have made preliminary sample size estimations for a future randomised controlled trial. Thinking ahead, we may argue that thousands of people with long COVID-19 in the UK cannot be accommodated to hospital-based rehabilitation programmes, so community-based rehabilitation is one of the ways forward.

Overview/aims and objectives

During the pandemic community-based rehabilitation was suspended for several months because of lockdown. Most rehabilitation services take place in leisure facilities, which have developed robust COVID-19 secure environments for exercise. This small-scale study examined the feasibility of restarting existing rehabilitation services as well as exploring the capacity (in terms of fatigue, breathlessness, etc.) for people with Long COVID-19 to travel to and take part in rehabilitation sessions at Healthworks leisure facilities in the city of Newcastle. The project was delivered in collaboration with Healthworks, a community health charity, and the Newcastle-upon-Tyne Hospitals NHS Foundation Trust, Royal Victoria Infirmary Long COVID-19 clinic who acted as the source of referrals to the community-based rehabilitation service. In addition, the project included patient and public involvement (PPI) to examine perceptions, needs and expectations of participants. Northumbria University financially supported the study via the Multidisciplinary Research Theme (MDRT) programme on Integrated Health and Social Care (IHSC).

The current pathway for people living with Long COVID-19 is referral to a specialist service. Following assessment and investigation, people with Long COVID-19 may then be referred for physiotherapy or discharged with an online package called 'Your COVID-19 Recovery'. This project tested the feasibility of providing community-based rehabilitation for people living with Long COVID-19.

Specifically, the project aimed to provide proof of concept that community-based COVID-19 rehabilitation was feasible, safe, beneficial, and acceptable for participants and staff, through addressing the following questions:

1. Were people living with Long COVID-19 confident to join group-based community rehabilitation services?
2. How well did people with Long COVID-19 and Healthworks staff accept the various components of the rehabilitation programme and measurement protocols?
3. Did people with Long COVID-19 feel that the rehabilitation programme was beneficial to them?
4. Were participants willing to repeatedly visit the community-based centre to undertake rehabilitation sessions and what was the level of peer support required to accomplish this and change their behaviour towards increased physical activity?
5. What were the logistical implications of the community-based programme?
6. What were the barriers and facilitators to the delivery of the community-based programme?
7. Was the programme effective in improving functional capacity and symptoms in people with Long Covid-19?

Following consultation with the NHS Health Research Authority this proof-of-concept study was not considered research but a service evaluation and hence it did not require REC approval. Northumbria University ethics approval was obtained. Several academics and Ph.D. fellows from Northumbria Health & Life Sciences Departments of Sport Exercise & Rehabilitation, Nursing & Midwifery, Social Work, Education & Community Wellbeing, and Psychology were involved in this project. External collaborators included the School of Psychology, Newcastle University, the Royal Victoria Infirmary Long COVID clinic and Healthworks.

Methods:

Study design

This project was a small-scale feasibility trial to evaluate participant recruitment, safety, acceptability, and adherence to a community-based rehabilitation programme for COVID-19 survivors. People living with long COVID-19 entered into group-based rehabilitation sessions where they received individual health and lifestyle advice (smoking cessation, physical activity promotion, alcohol consumption, nutrition) and took part in three 1-hour group-based exercises alongside educational sessions on managing exertional fatigue and breathlessness symptoms of long COVID-19.

The project was delivered through a partnership between Northumbria University, Healthworks Newcastle and Newcastle-upon-Tyne NHS Foundation Trust. This partnership brought together healthworks staff, providing extensive experience of community-based rehabilitation, Northumbria University academics with expertise in both quantitative and qualitative research methods and data analysis and the Newcastle-upon-Tyne NHS Foundation Trust, who provided the primary source of referrals for the project.

Participant referral

Participant referral was primarily sourced from Newcastle-upon-Tyne NHS Foundation Trust long COVID-19 clinic, which was delivered by a team of respiratory consultants, nurses, and physiotherapists (https://www.newcastle-hospitals.nhs.uk/news/long-covid-clinics-go-nationwide-following-successful-pilot-in-newcastle/). During scheduled appointments at the long COVID-19 clinic, eligible participants were provided with a participant information sheet (PIS) and gave a member of the clinic team their contact details which were passed onto a member of the research team. A minimum of 24 hours was provided before a member of the research team contacted the eligible participants, however, contact details of the research team were provided if eligible participants wished to contact the research team prior to that. In addition, social media and 'word of mouth' were used to promote the study, with any interested participants encouraged to contact the research team. Prior to participation to the study all eligible participants signed an informed consent form.

Face-to-face exercise sessions

Participants attended three, 1-hour face-to-face exercise sessions at the Healthworks community centre (https://www.healthworksnewcastle.org.uk/) across the 6-week programme. Each exercise session was delivered by a physical activity specialist, with specific knowledge of exercise prescription in both healthy individuals and those with long-term conditions. The exercise sessions consisted of a variety of aerobic and resistance-based activities using both specific gym equipment (cycle ergometers, treadmills, and resistance machines) and free weights, with the primary aim of improving cardiorespiratory fitness, muscular strength, and endurance. During each session, an exercise diary was used to record several variables of exercise (time, volume, and intensity) and perceived symptoms of dyspnea and leg discomfort using the Borg (1-10) scale. Heart rate and oxygen saturation were assessed during aerobic exercise. The exercise sessions commenced in July 2021 and were concluded in September 2021.

Health advice

A health improvement practitioner employed by Healthworks provided support to participants to help manage living with long COVID-19 and support their rehabilitation needs. This included using the occurrence of COVID-19 as an opportunity to tackle confounding lifestyle factors, such as:

1. Smoking cessation: the underlying cause in the vast majority of vascular diseases
2. Physical inactivity: A greater level of physical inactivity for people with long COVID-19 was generally linked with increased risk of mortality and significant problems such as cardiovascular disease and poor metabolic health.
3. Alcohol consumption: More than 14 units a week can be associated with increased risk of infection and complications.
4. Obesity: Increased risk of complications due to the associated risk of diabetes, obstructive sleep apnoea and atrial fibrillation.
5. Appetite and weight management issues associated with loss of smell and taste.

Outdoors physical activity promotion

Participants were asked to use their smartphones or a simple activity tracker alongside a physical activity diary to self-monitor and record steps/day and time spent during outdoor physical activity. Thereafter, on a weekly basis, a member of the research team contacted participants remotely to discuss their current physical activity levels and encourage outdoor physical activity through simple goal setting and action plan techniques.

Outcome measures

Safety:

Safety was assessed using data from Track and Trace. If a participant reported a positive PCR COVID-19 test, the participant had to inform Healthworks and abstain from the scheduled exercise session. This information provided details on whether a face-to-face programme would be safe in terms of exposure to COVID-19.

Recruitment, Retention & Adherence:

Data on the number of participants interested in the study, the number enrolled through informed consent and the number that dropped out throughout the study were recorded. In addition, records of attendance were collected at every exercise session to assess exercise adherence and physical activity diaries were used to assess outdoor physical activity adherence.

Acceptability, barriers, and facilitators of delivery:

Acceptability, barriers, and facilitators from the participant perspective were assessed through qualitative interviews lasting around 30-45 minutes. During these interviews, a member of the Northumbria research team explored the acceptability of the intervention, the needs and expectations of participants, the level of peer support and the study procedures.

Functional and psychological outcomes:

Several validated questionnaires were used to assess change of the following outcomes at baseline and following completion of the study.

- Physical and emotional outcomes – Functional Assessment of Chronic Illness Therapy (FACIT) and Chalder fatigue scale.
- Symptoms of breathlessness and health-related quality of life – COPD assessment test (CAT).
- Cognitive impairment – Montreal Cognitive Assessment tool (MoCA).
- Anxiety and depression – Hospital Anxiety and Depression scale (HADS).
- Taste and smell – Modified Smell/Taste questionnaire.
- Work and social life – Work and social adjustment scale (W&SA scale).
- Health status - EQ-5D-5L.
- Physical activity (steps/day)

Dietary habits:

Diet was assessed at baseline and following completion of the study using a 3-day food diary tailored for use across research studies at Northumbria University and the VAS appetite scale (1-100).

Process evaluation:

This post-intervention process evaluation explored the feasibility and acceptability of the intervention and any perceived barriers and facilitators of delivery. Interviews were conducted remotely with members of the project team. The aim was to understand what worked well and what were some of the areas for improvement. Participants included the Principal Investigators, the Research Assistant, the Chief Executive at Healthworks Newcastle and the physical activity specialists who delivered the intervention. The interviewer (an experienced qualitative researcher) recorded all interviews and took detailed fieldnotes. The data was coded, and content analysed for the key barriers and facilitators to intervention delivery.

Exercise training description:

The exercise provided during the community-based rehabilitation sessions consisted of a variety of aerobic and resistance-based activities using both specific gym equipment (cycle ergometers, treadmills & resistance machines) and free weights, with the aim of improve cardiorespiratory fitness, muscular strength, and endurance. In terms of aerobic exercise, participants typically undertook 10-15 minutes of continuous exercise or 5-15 minutes of interval exercise delivered on either a cycle ergometer or treadmill at similar loads/intensities throughout. Those conducting aerobic exercise on a treadmill typically began walking on average 2.5 km (week 1) and increased to 6.8 km (week 3) across the 3 sessions. Participants perceived ratings of dyspnea and leg discomfort averaged 3±1 and 2±1 respectively across the 3 sessions for aerobic exercises. For resistance exercises, participants typically undertook lower and upper body exercises including deadlifts, lateral raises, squats, press-ups and bicep curls at various repetitions/resistances. Taking lateral raises as an example, participants averaged 8-10 repetitions for 2-4 sets in week 1, followed by 10-12 repetitions for 2-4 sets in week 3. Participants perceived rating of dyspnea and leg discomfort for resistance-based exercise averaged 3±2 and 1±1 respectively across the 3 sessions.

Results

Recruitment, retention, and adherence

Figure 1 provides an overview of participant recruitment and retention across the study. Of the 25 participants who provided an initial interest in the study, 6 declined following a conversation with a member of the research team due to: not wishing to participate (n = 4) and not well enough to attend (n = 2). 19 participants were therefore screened for eligibility and 10 provided informed consent to take part in the study. Reasons for not providing informed consent included: contracting COVID-19 (n = 2) and not wishing to undertake exercise (n = 5). Following completion of the study, 7 participants completed the post assessment questionnaires and their data were analysed. Participants overall adherence to the face-to-face sessions were excellent, with 95% of exercise sessions completed at the allocated date and time. In addition, adherence to the home-based step count diary was also excellent, with 93% of days completed over the 6-week programme.

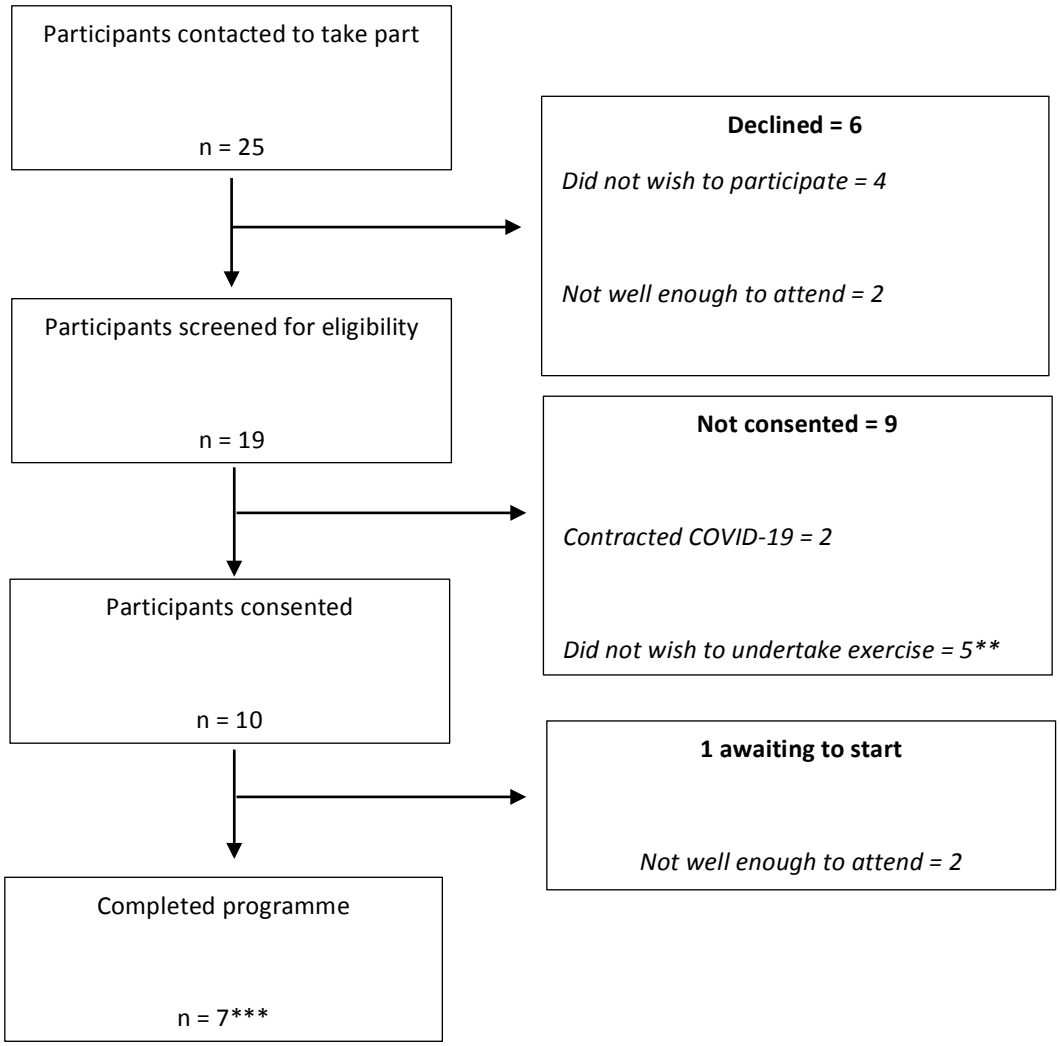

Figure 1: Participant flow through the study. n = number of participants. ** Individuals not certain on the overall benefits of exercise alongside long COVID-19. *** 1 completed participant contracted COVID-19 during final week of study and missed his last exercise session.

Baseline participant characteristics

Baseline demographic information and characteristics of participants consented to the study are summarised in table 1. Of the 7 participants who provided informed consent, 2 (29%) were female and 5 (71%) were male. The average time since initial COVID-19 infection was 11±4 months, which is in line with the recommendations for long COVID-19 diagnosis (symptoms >12 weeks). 2 of the 7 participants were hospitalised due to COVID-19 infection and 1 received continuous oxygen while in hospital. In terms of comorbidities, none were reported prior to COVID-19 infection, while 3 were reported post COVID-19 infection (right heart damage, heart palpitations and liver damage). The vast majority of participants reported symptoms of breathlessness (71%) and fatigue (100%), with over half reporting problems with short memory loss (57%).

Table 1: Participant demographics

Demographic variables	N = 7
Age	46±16
Gender (% female)	29
Height	174±19
Weight	83±22
BMI	28±6
Hospitalised	2/7
COVID-19 severity	No continuous oxygen (n = 6) Continuous oxygen (n = 1)
Months since initial infection (as of November 2021)	11±4
Comorbidities prior to diagnosis	None
Comorbidities post diagnosis	Right heart damage (n = 1) Heart palpitations (n = 1) Liver damage (n = 1)
Symptoms	Breathlessness (n = 5) Chest tightness (n = 3) Aching muscles (n = 3) Fatigue (n = 7) Impaired sleep quality (n = 2) Joint pain (n = 3) Limb weakness (n = 3) Pain (n = 1) Short memory loss (n = 4) Slowing down in thinking (n = 3) Cough/headache (n = 2) Loss of smell and/or taste (n = 1) Other

Safety: During the study only one participant contracted COVID-19 in between exercise sessions and therefore abstained from the final exercise session. Healthworks staff was made aware of that. Exertional breathlessness and leg discomfort during aerobic exercise (treadmill & cycling) were mild to moderate (2 to 4 on the Borg 1-10 scale).

Patient perceptions and acceptability:

A total of seven participants were contacted via an introductory text message to request their participation in a 30–45-minute semi-structured interview conducted via Zoom. Following a reminder text one week later and a final reminder three weeks later, three participants conducted the semi-structured interview with a member of the research team. The interviews consisted of several key themes including symptoms, motivation to participate, anxiety about participation, exercise choice, exercise progression, motivation to continue, session frequency, monitoring and confidence, programme exit and impact of data collection.

Beginning with participants motivation to participate in the program, various reasons were highlighted, with one participant hoping that participation would enable a better future prognosis compared with doing nothing at all and a second highlighting their desire to return to normality.

> ***"When they mentioned the study, I felt well you know I feel absolutely lousy and if this can get rid of this quicker and get me back on my feet the sooner than the better"***
>
> **Participant 03**

> ***"I used to go to the gym five times a week and I can barely manage half a session at the moment"***
>
> **Participant 01**

Despite the clear motivation to take part in the programme, participants reserved significant anxiety about participating in the exercise sessions, stating that they were unsure of their capacity for such exercise and because they did not want to overdo it and knock themselves back. It was clear that once exercise began, instructors asking about breathlessness, fatigue, and muscle pain significantly lowered anxiety.

Exercise choice and progression received a mixture of responses from the three interviewees. During the interviews, participants appeared relatively well which may go some way to explaining why the responses regarding exercise choices provided to participants were quite negative. For instance, one participant was asked to perform a press up but got down on the floor and was unable to do the exercise, she needed additional help to get back up. A second participant commented on the activity being too intense too early on in the programme. When asked about exercise progression, one participant reported being happy with the slower pace of sessions, while another commented on the lack of direction between sessions and the lack of progression beyond the last session.

> ***"you may laugh but I was embarrassed as he asked me to do a press up, I ended up flat on my face and we had to get three people to help get me back up"***
>
> **Participant 02**

"I was disappointed with the physical exercise I felt it wasn't pitched right it was too intense too early on and it wasn't long enough. I enjoyed what we did, and it was good to know what my limitations were but after the sessions I was completely washed out"

Participant 03

"he said that I don't want you to go too fast as you're going to exhaust yourself, you need to go at your own pace and your own level, that's the best was forward. He was lovely.

Participant 02

"after the session there was no homework, no sort of try these exercises at home"

Participant 03

Once in the programme, participants' motivation to continue remained high due to regular contact between participants and healthworks trainers/research team. This was closely linked to an increase in confidence due to regular monitoring during both the exercise sessions (oxygen saturation and heart rate) and at home (weekly phone calls).

"It was quite nice to know that there was somebody out the kind of looking out for you. I spoke to [name redacted] part of the research team and he used to check in one me and things and obviously the guys at Healthworks were brilliant"

Participant 01

"he was obviously keeping an eye on me and that made me confident to do more and I mean that that the guy was amazing keep an eye on me and other people at the same time looking out for us. I have an Apple watch so I can watch my heart rate and saturations and that also helped make me more confident"

Participant 01

Finally, one participant felt the exit from the programme was relatively 'abrupt' and that they were left wondering what to do next.

"Since it ended, I am just kind of left to myself and I can say I'm trying to go to the gym that I used to go to, but they're not geared up for dealing with long Covid either, so they don't know what they should be looking out for. So, it's just kind of down to myself, but I am pretty hesitant to do it in case I push myself too much and obviously have a crash afterwards. So longer than six weeks and some sort of guidance afterwards about what to do"

Participant 01

Barriers and facilitators of delivery

Interviews were conducted with four members of the study delivery team (Northumbria University and Healthworks) to evaluate the feasibility and acceptability of the intervention and understand any perceived barriers and facilitators to its delivery. Following analysis, four main categories emerged including *collaborative working, study protocol, intervention delivery/outcomes,* and *wider implementation.* An overview of the barriers and facilitators is provided in table 2.

Table 2 – Barriers and facilitators to the delivery of Long COVID-19 rehabilitation.

Collaborative working	
Barriers	**Facilitators**
• Delays in establishing a legal agreement between the University and Healthworks • Overloaded / under-resourcing of NHS services • Research involvement seen as an extra task	• Excellent collaborative working arrangement with Healthworks Newcastle • Charity's flexibility in accommodating participants' needs • Charity's existing expertise in delivering rehabilitation services • Charity's state-of-the-art rehabilitation facilities • NHS outsourcing Long COVID-19 rehabilitation to community services • Good project management (including ethics) and post-awards support
Study protocol	
Barriers	**Facilitators**
• Lack of time of healthcare practitioners to explain the study and recruit participants • Too many outcome measures	• Research assistant being on site/ recruiting patients into the study/service • Alternative recruitment channels, including via social media • Prioritisation of key measures and a priori power calculation • Robustness of developed measures • Including a control group to study natural recovery for the duration of the programme
Intervention delivery/ outcomes	
Barriers	**Facilitators**
• Only few intervention sessions with too long breaks between sessions • Few dropouts due to holidays and relocation of participants • Uncertainty about the scientific evidence around physical activity in people living with Long COVID-19	• Interest and need for more structured physical rehabilitation (both in staff and patients) • Compliance with the intervention • Safety and cost effectiveness of the intervention • Building of self-confidence in ability to exercise despite Long COVID-19 • Tailoring of the intervention to the participants' abilities and needs • Online delivery of the physical activity coaching/ education • Briefing staff about the benefits of exercising for Long COVID-19

Wider implementation	
Barriers	**Facilitators**
• Lack of knowledge and misinformation around the effectiveness of systematic rehabilitation in staff/ patients. This is reinforced by professionals (physios) in the media	• Potential reach and patient benefits of this community-based intervention • Potential for upscaling of the intervention • University's expertise and facilities to deliver the intervention using the sports centre

Functional and psychological outcomes

Physical activity (Steps/day)

The effect of the ACCEPT study on steps/day is detailed in table 3. Following completion of the study, a significant improvement in steps/day was demonstrated (by 1773±964, p = 0.002, table 3). Although there is yet to be a clinically meaningful margin for long COVID-19, improvements in steps/day following completion of the study could be deemed as clinically meaningful when compared to a clinically meaningful improvement in steps/day for patients with COPD (by 600 to 1100 steps/day).

Table 3: Physiological and psychological outcomes at baseline and following completion of the study.

	Baseline	Completion	Change	P value
Steps/day	4761±2268	6543±3231	1773±964	**0.002***
CAT	22±8	19±5	-3±4	0.13
EQ-5D-5L	0.70±0.17	0.69±0.21	-0.01	0.73
FACIT-F	85.6±30.3	88.8±27.3	3.2±6.4	0.59
CFS (bimodal)	8.6±4.0	7.1±3.6	-1.5±1.1	**0.04***
CFS (Likert)	22.3±6.6	19.0±5.9	-3.3±2.1	**0.02***
HADS – Total	13.0±7.1	12.9±7.4	-0.1±1.4	0.86
HADS - Anxiety	6.6±3.3	6.6±1.2	0.0±0.7	1.00
HADS - Depression	6.4±4.9	6.3±4.5	0.1±0.4	0.78
MoCA	23.1±5.5	25.6±4.1	2.5±1.2	**0.03***
WSAS	18.9±13.2	18.4±12.7	0.5±1.2	0.28

Asterisks denote statistical significance at p<0.05

Physical outcomes (Fatigue)

The overall effect of the ACCEPT study on physical outcomes is detailed in tables 3 and 4. In terms of the Chalder fatigue scale, following completion of the study, significant improvement in fatigue scores was demonstrated across both the bimodal (-1.5±1.1, p = 0.04, tables 3 & 4) and Likert (-3.3±2.1, p = 0.02, tables 3 & 4) scales. A positive, unsignificant change in the FACIT-Fatigue score following completion of the study was demonstrated (tables 3 & 4).

Table 4. Facit-Fatigue and Chadler fatigue scale results (n=7).

	N	z	r	p
FACIT-F Scale	7	-0.53	.19	.59
CFS Bimodal	7	-2.06	.77	**.04**
CFS Likert	7	-2.38	.89	**.02**
*Physical Sub	7	-1.90	.72	.06
**Mental Sub	7	-1.83	.69	.07

Cognitive impairment (MoCA)

Higher scores on the MoCA indicate greater levels of cognitive ability. Only two of the seven participants scored within the range of scores ($\geq$ 26) considered being normal levels of cognitive functioning at baseline. Ranges for scores within the pre-intervention condition consisted of a minimum total score of 13, and a maximum score of 29. Within the post-intervention condition, five participants scored within the ranges of normal levels of cognitive functioning (> 26). Ranges for scores within the post-condition consisted of a minimum total score of 17, and a maximum score of 29. Significant improvements in MoCA scores were demonstrated pre-post intervention (2.5±1.2, p = 0.03, table 3).

Work and social adjustment (WSAS)

Greater scores on the WSAS indicate poorer levels of adjustment to work and social demands. At baseline, only three of the seven participants scored (< 10) within the normal ranges of the WSAS. One participant reported a score indicative of functional impairment (between 10 – 20), whilst the remaining three participants demonstrated moderately severe levels of functional impairment (> 20). Participants' total scores at baseline ranged from a minimum of 6 to a maximum of 40.

Within the post-intervention condition, three participants scored within the normal range (< 10). One participant reported a score indicative of functional impairment (between 10 – 20), whilst the remaining three participants met the WSAS criteria for moderately severe functional impairment (< 20). Participants' total scores at baseline ranged from a minimum of 6 to a maximum of 38. No significant changes were reported for the WSAS pre-post intervention (table 3).

Health related quality of life

The effect of the ACCEPT study on health-related quality of life is detailed in table 3. Following completion of the study, a reduction in CAT scores (-3±4, p = 0.13, table 3) was clinically meaningful when compared to a clinically meaningful reduction in CAT scores for patients with COPD (-2).

Hospital Anxiety and Depression Scale

Higher scores on the Hospital Anxiety and Depression Scale (HADS) are indicative of greater Anxiety and Depression. Participants' HADS scores ranged from a minimum score of 0 to a maximum score of 23, for both the pre-intervention and post-intervention conditions.

In terms of the anxiety sub-scale, three participants scored above sub-clinical levels (total score ≥ 8) on the Anxiety sub-scale of the HADS questionnaire at baseline. Within the post-intervention condition, three participants also scored above sub-clinical level (total score ≥ 8) on the Anxiety sub-scale of the Hospital Anxiety and Depression questionnaire. Participants' HADS-A scores ranged from a minimum score of 0 to a maximum score of 10, for both the pre-intervention and post-intervention conditions. No significant changes were reported for the anxiety subscale pre-post intervention (table 3).

In terms of the depression sub-scale, three participants scored above sub-clinical levels (total score ≥ 8) on the depression sub-scale of the HADS questionnaire at baseline. Within the post-intervention condition, only two participants scored above sub-clinical level (total score ≥ 8) on the depression sub-scale of the HADS. Participants' HADS-D scores ranged from a minimum score of 0 to a maximum score of 15, within the pre-intervention condition. Range within the post-intervention condition consisted of a minimum participant score of 0, and a maximum score of 14. No significant changes were reported for the depression sub-scale pre-post intervention (table 3).

Health status (EQ-5D-5L)

Higher scores on the EQ-5D-5L are indicative of worse health status. Participants EQ-5D-5L scores at baseline and post-intervention were typically within 'level 1 – no problem', 'level 2 – slight problem', and 'level 3 – moderate problem' for all domains. In terms of the index score, no significant changes were reported pre-post intervention (table 3).

Dietary outcomes -*Food diaries*

Data analysis found adequate data collection by 4 participants creating a final sample size of 4 (n=1 female; n=3 male) for the food diaries. Observing the average daily intake of the participants, half had an increased post intervention daily average Kcal consumption whilst the other half had decreased. No significant changes were demonstrated pre-post intervention for Kcal intake.

A study by Whittle et al. (2020) found COVID-19 infection to promote a hypermetabolic state, positively longitudinal energy expenditures and that underfed patients were subject to an increased mortality rate; highlighting the need for individuals with active/long COVID 19 to increase their energy intake. Analysis of the nutrition data with regards to key macro and micronutrients, which are important for health, suggested that with the exception of protein, patients recovering from long Covid-19 require nutritional education/support to improve their dietary intake quality. This small pilot study has demonstrated that patients recovering from long Covid-19 are deficient of key macro and micronutrients, which are needed to support optimal health and thus recover from Covid-19. Future research should focus on working with and educating patients about easy, small changes, which they can make to their diet to ensure it is optimal for health.

Loss of taste and smell

Of the 7 participants recruited for the intervention, 2 reported olfactory and/or gustatory changes following infection.

The first of these participants had been experiencing distorted olfaction (parosmia) and a diminished sense of taste for 16 months prior to the intervention. They stated that the changes occurred over a period of months, and that while their appetite had remained the same and they had not changed what they ate or cooked they did now enjoy food less. They also stated that the changes to their taste and smell were something, which they were constantly aware of. They said that their mood had been affected by these changes to taste and smell, reporting feelings of 'frustration and anxiety', and that their relationship with food was affected ('leaves a bad taste in the mouth and constantly hard to smell' and 'unable to taste foods'), and that it also affected their day-to-day activities ('Can't go out with friends for food').

The second participant reported a distorted sense of smell (parosmia), which they state occurred suddenly following infection. They state that since the changes to their olfaction their appetite had been worse and they had enjoyed food less, but that the issue had not affected the way that they eat (types of food etc.). They stated that they were not constantly aware of the changes to their olfaction, but did select all of the areas of day-to-day life when asked about the impact of their olfactory dysfunction.

While there were only a small number of participants reporting olfactory changes it was clear from both participants that these changes had a significant impact upon their wellbeing and day-to-day function. The participants also highlight the variety in the experiences of olfactory change following infection, with one participant recovering their sense of smell and the other not.

Overall findings and future perspectives

The importance of this collaborative project between Northumbria University, Healthworks and NuTH is that it provides some preliminary evidence about the feasibility and safety of engaging people with long COVID-19 to a wellness programme. We have established the route for patient referral to a community-based exercise facility and appreciated the barriers and potential facilitators to make this collaboration more effective.

In terms of research importance, we may argue that thousands of people with long COVID-19 in the UK cannot be accommodated to hospital-based rehabilitation programmes, so community-based rehabilitation is the way forward. Through this small project we have seen that attendance to a community-base exercise facility is feasible and exercise sessions are safe with only mild exertional symptoms for the participants. Via questionnaires we have also seen that quality of life and cognitive function improve. Importantly, via activity diaries and questionnaires we have seen that participants become more physically active in daily life and that daily activities are performed with less fatigue. Importantly via priori sample size calculations for a number of examined outcome measures that were sensitive to significant change after the rehabilitation programme, we have made preliminary sample size estimations for a future randomised controlled trial.