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The British Thoracic Society survey of rehabilitation to support recovery of the Post Covid -19 population.

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Abstract

Objectives

Those discharged from hospital after treatment for Covid-19 are likely to have significant and ongoing symptoms, functional impairment and psychological disturbances. There is an immediate need to develop a safe and efficient discharge process and recovery programme. Pulmonary rehabilitation is well placed to deliver a rehabilitation programme for this group but will most likely need to be adapted for the post Covid-19 population. The purpose of this survey was to rapidly identify the components of a post-Covid-19 rehabilitation assessment and elements of a successful rehabilitation programme that would be required to deliver a comprehensive service for those post Covid-19 to inform service delivery.

Design

A survey comprising a series of closed questions and a free text comments box allowing for a qualitative analysis.

Setting

Online survey.

Participants

British Thoracic Society members and multi-professional clinicians, across specialities were invited to take part.

Results

1031 participants responded from a broad range of specialities over 6 days. There was overwhelming support for early post discharge from hospital phase of the recovery programme to advise patients about the management of fatigue (95% agreed/ strongly agreed), breathlessness (94%), and mood disturbances (including symptoms of anxiety and depression) 92%. At the 6-8-week time point an assessment was considered important, focusing on the assessment of a broad range of possible symptoms and the need to potentially return to work. Recommendations for the intervention described a holistic programme focusing on symptom management, return of function and return to employment. The free text comments added depth to the survey and the need 'not to reinvent the wheel' rather adapt well established (pulmonary rehabilitation) services to accommodate the needs of the post Covid-19 population.

Conclusion

The responses indicate the huge interest and the urgent need establish a programme to support and mitigate the long term impact of Covid-19.

Strengths and limitations

- Large and comprehensive survey conducted to guide the provision of post Covid-19 rehabilitation.
- The survey provides clear recommendations for the provision of advice and support immediately upon discharge, and recommendations for a programme of holistic rehabilitation 6-8 weeks post discharge based upon the existing pulmonary rehabilitation model.
- The survey engaged a wide range of specialities and experiences managing Covid-19
- The opinions of patients and carers be sought in an additional survey

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Competing interests

All authors have completed the Unified Competing Interests Form at http://www.icmje.org.coi_disclosure.pdf

Dr. Singh reports grants from Actegy, grants from Pfizer, outside the submitted work.

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Data sharing statement

No additional data are available.

Background

The global coronavirus pandemic has already resulted in tens of thousands of people being admitted to hospital for acute medical management in the past few months, a proportion of whom will have had a prolonged stay on Intensive Care Units (ICU). Those discharged from ICU are likely to exhibit significant on-going symptoms notably dyspnoea, fatigue and cough, functional impairment and psychological disturbances[1–3]. The larger cohort of people discharged after ward based care are likely to experience similar if less severe problems.

Although we have limited Covid-19 data so far, literature from the SARS outbreak would suggest that there is a considerable impact upon the individual with reduced functional performance and health status even at 6 months post discharge compared to normal values[4,5].

There is a pressing need to develop a safe and efficient discharge process to support patients at home remotely and secondly to set up a mechanism to review these individuals early in the post discharge phase to facilitate restoration of pre-morbid function and holistic well-being and, for many, a successful return to maximal function and work.

Pulmonary rehabilitation teams routinely assess and manage the rehabilitation needs of patients with chronic respiratory disease often with multiple co-morbidities, including cardiovascular, mental health and metabolic diseases[6,7]. There is a strong evidence base demonstrating that a centre-based supervised out-patient programme of education and physical activity, collectively termed pulmonary rehabilitation positively impacts breathlessness, anxiety, depression, health status and exercise capacity. Pulmonary rehabilitation is an interdisciplinary intervention that integrates a broad group of health care professionals including but not limited to physiotherapists, nurses, dietitians, pharmacists, psychologists, physicians, occupational therapists, exercise physiologists and graduates of the programme. Pulmonary rehabilitation is recommended in all national and international guidelines for chronic obstructive pulmonary disease (COPD) and other long term respiratory conditions [8–10] and the most recent Cochrane review[11] suggested that no further randomised controlled trials were needed to establish the benefit of pulmonary rehabilitation in COPD. The provision of pulmonary rehabilitation is demonstrably successful in clinical practice outside the context of research studies, UK data from over 7000 cases has been collected and reported as part of the National Asthma and COPD Audit Programme (Pulmonary Rehabilitation)[12]. Furthermore, participants frequently have multiple long-term conditions that do not compromise the outcome, the common comorbidities recorded in the chronic respiratory population mirror those that have been reported in the Covid-19 population of hypertension, diabetes and cardiovascular disease[13,14].

However, the rehabilitation needs of the post Covid-19 population are likely more diverse than those commonly observed in COPD and potentially with different objectives than those for chronic lung disease. Early data from Wuhan indicates that the mean age of people hospitalised with Covid-19 was 52·0 (45·0–58·0) years[13] compared to 69.0(9) years reported in for a conventional pulmonary rehabilitation programme[15], although data from the UK ISARIC registry of 16749 admissions indicates the median age is 72 (57-82) years[16] , more typical of the pulmonary rehabilitation population. However, given the widespread nature of the pandemic there will be a substantial number of younger patients, especially those admitted to ICU, and in some of the post Covid-19 patients their pre-morbid state is likely to be quite different, many may not have pre-existing lung disease, and likely different levels of employment, usual levels of activity and exercise behaviours. Furthermore, there is an indication the post Covid-19 population is likely to have significant psychological and cognitive impairment particularly if management involved a stay on ICU[17]. There is a small literature describing pulmonary rehabilitation interventions in the SARS population and ARDS with positive outcomes[18]. We postulated that whilst the core of pulmonary rehabilitation would in part meet the needs of the post Covid-19 patient, the programme would likely need to be adapted. The modifications would be at the point of assessment to broaden the scope to holistically assess the impact of Covid-19 and secondly to address the components of a comprehensive programme.

Therefore the purpose of this survey was to rapidly identify the additional components of a post-Covid-19 rehabilitation assessment, and elements of a successful rehabilitation programme that would be required to deliver a comprehensive service for those either discharged from hospital post Covid-19, or for those who we managed in the community but had marked ongoing symptoms that have prevented a full recovery.

Methods

We conducted a survey of multi-professional clinicians. The survey was designed by team a with expertise in pulmonary and cardiac rehabilitation and the wider management of respiratory disease. The survey, supported by the British Thoracic Society (BTS), was predominately composed of closed questions, with a free text box at the end of the survey for additional comments. The survey was built by the team at the BTS using ClassApps software. The survey was tested by local teams experienced in rehabilitation prior to the wider launch.

The initial stages of the survey asked for basic demographic information from the participants to include age, gender, ethnicity, professional background, location of work and exposure to patients with, or recovering from Covid-19 (the full survey is available in the on-line supplement).

The purpose was to gain wide clinical consensus opinion as to what an effective, holistic rehabilitation intervention might comprise for patients recovering from Covid-19. The survey aimed to secure guidance for rehabilitation support provided in two phases:

- The initial discharge period (which may be to home, a step-down unit or a rehabilitation facility).
- A formal rehabilitation programme that would be offered 6-8 weeks post rehabilitation. This time period is based upon evidence accumulated by an ad-hoc task force formed by the ATS/ERS with a supporting document[19].

For these sections of the survey there was a statement and participants were invited to respond with the following five categories: 'strongly disagree', 'disagree', 'neutral', 'agree' or 'strongly agree'. There was also the option to respond, 'unable to comment'.

Upon completion of the survey there was an additional free text box for further comments. No questions were mandatory.

Survey distribution

The survey was available to participants from 9th April 2020 to 15th April 2020. It was distributed to members of the BTS the societies' e-newsletter and additionally promoted via the BTS Twitter account. A reminder email was sent to BTS members 6 days later and retweeted by society members and the BTS encouraging individuals to participate and share the survey with colleagues. The survey was not restricted to UK based health care professionals, although country of practice was noted on the survey.

Participation in the survey was voluntary and anonymous. Participants confirmed their willingness to engage in this research by accessing and completing the online survey. As the survey was directed towards health care professionals there was no patient or public involvement.

Data analysis

Quantitative data were reported as counts and percentages for each category of the demographic and survey responses. At least 70% agreement on directionality (combining strongly agree and agree) was defined as the threshold for consensus.

Qualitative data were analysed using Thematic Analysis [20]. The text data was uploaded to NVivo 12 Pro and then coded and grouped into themes to portray patterns within the data. The established themes were reviewed by the first author and the finalised themes were defined.

Ethical approval was not required for this survey from either the UK Health Research Authority or leading Research and Development Centre. Completion of the survey was an indication of willingness to participate and implied consent. We set no threshold for response over such a short period of time but were anticipating around 300 responses across a range of health care professionals to allow the questionnaire to be considered robust and representative of those in the field.

Results

This report is based on data from 1031 respondents. A further 750 respondents only provided answers to the demographic questions on page 1 of the and therefore do not form part of this report. The majority of respondents were female (84%), the largest age group was 35-44 years (34%), followed by 45-54 years (27%) and 25-34 years (22%). A significant majority identified as white British (75%), with any other white background, white Irish and Indian representing 7%, 6% and 5% of the participants respectively. The largest group of respondents were from England (80%), with Scotland representing 6% of respondents, Wales 4%, Northern Ireland 3% and the remainder from the rest of Europe, Australasia and South America. Respiratory (32%) represented the largest known group by specialism, followed by Health Care of the Elderly (12%), Primary Care (7%) Acute Medicine (6%) and Sport & Exercise (5%) with smaller numbers from cardiology, general medicine, anaesthetics, psychiatry and psychology backgrounds. However, 34% recorded 'Other' backgrounds which included neurology (n=44), critical care (n=26) and musculo-skeletal (n=56)). Physiotherapists represented the largest group (71%), dietitians, nurses and consultant physicians represented 7%, 6% and 6% respectively, smaller numbers of occupational therapists, speech and language therapists, trainee physicians and health care assistants participated. The majority worked in either acute trusts (45%) or community hospitals/services (28%), with fewer responses from either primary care or private hospitals, 17% of 'others' were represented by the private (business) sector, universities, the community (excluding hospitals) and hospices. The final two profiling questions

allowed for more than one response, in total there were 1420 respondents to whether or not they had experience in manging patients with Covid-19. 361 respondents had no experience, the remainder had experience on acute wards (n=332), Intensive Care Units (n=257), community (n=209) and step-down units (n=154). With respect to rehabilitation, 442 respondents had no experience, 216 in pulmonary rehabilitation, 208 in Health Care of the Elderly, 52 in cardiac rehabilitation and 202 in other forms of rehabilitation. Of the 1030 respondents 167 (16%) answered 'no' to both questions,

Recommendations for the early phase of Covid-19 recovery

The first section of the survey addressed the immediate post discharge phase, that is, care or advice delivered in the home, in a step-down unit or in a rehabilitation hospital/ward that could be provided digitally or as a hard copy. Items that reached the threshold for recommendation for the early phase recovery programme are displayed in Table 1 (for complete data tables see online supplement). All proposed survey items were recommended for the early phase of Covid-19 recovery. There was overwhelming support for early post discharge from hospital phase of the recovery programme to advise patients about the management of fatigue (95% agreed or strongly agreed), breathlessness (94%), and mood disturbances (including symptoms of anxiety and depression) 92%. In recognition of the current UK community 'lockdown' there was clear agreement to provide support for coping with social isolation (91%). At this early stage in the recovery process there were less strong recommendations about cough management, delivery of an exercise programme or support for post-traumatic stress disorder but these comfortably exceeded the 70% threshold, at 81%, 80% and 78% respectively. Advice provided on a digital platform failed to reach the 70% threshold (59%), with 24.2% being neutral. This question provided the largest 'neutral response'.

Table 1: The essential components of an early phase recovery programme (first few weeks after discharge/episode)

Component	Agree	Strongly agree	N=
A home/step down unit aerobic exercise programme	38.1% (392)	41.89% (431)	1029
A home/step down unit resistance exercise programme	37.71% (388)	36.54% (376)	1029
An online/digital delivery is feasible for patients	37.67% (388)	21.07% (217)	1030
Advice on the management of cough	39.55% (407)	41.3% (425)	1029
Advice on the management of fatigue	26.43%	68.9%	1029

	(272)	(709)	
Advice on the management of breathlessness	25.85% (266)	68.12% (701)	1029
Advice on nutrition	38.29% (394)	48.69% (501)	1029
Psychological support for social isolation	33.43% (344)	58.02% (597)	1029
Support for mood disturbances (including anxiety and depression)	34.95% (360)	57.38% (591)	1030
Psychological support for Post Traumatic Stress Disorder (PTSD)	31.77% (326)	46.39% (476)	1026
Return to work advice	40.27% (414)	32.98% (339)	1028
Where to get financial support	38.66% (397)	33.79% (347)	1027
Symptom monitoring for worsening symptoms	33.56% (345)	56.03% (576)	1028
Dealing with grief and death of a family member	31.94% (328)	48.49% (498)	1027

Recommendations for assessment at 6-8 weeks post hospital discharge

The essential components that reached consensus of an assessment at 6-8 weeks post episode/hospital (or step down unit) discharge are displayed in Table 2. There was strong support for the assessment of mood (93% strongly agreed or agreed), quality of life (92%) and fatigue (92%). The assessment of cough just reached the 70% threshold with 71% recommending assessment. Advice with respect to returning to work (73%) and financial support (72%) were not rated as highly although also exceeded the 70% threshold. The items which did not reach consensus were the need for a face to face assessment, assessment of exercise capacity/muscle strength and the need for a measure of lung function with 68%, 66% and 69% of the survey participants respectively recommending these factors as an important part of the assessment.

Table 2: The essential components of an assessment at 6-8 weeks post hospital (step down unit) discharge

Component	Agree	Strongly agree	N=
An initial face to face (centre-based) assessment	33.82% (346)	33.72% (345)	1023
Conduct of an exercise test (6MWT/ISWT) at the	39.3%	26.49%	1023

time of the assessment	(402)	(271)	
Assessment of muscle strength (quadriceps)	42.33% (433)	26.3% (269)	1023
Assessment of quality of life	36.27% (371)	56.01% (573)	1023
Assessment of cough	41.06% (420)	30.3% (310)	1023
Assessment of fatigue	41.63% (425)	50.34% (514)	1021
Assessment of dyspnoea	40.18% (411)	47.51% (486)	1023
Assessment of mood (e.g. anxiety and depression)	37.05% (379)	56.11% (574)	1023
Screening for Post-Traumatic Stress Disorder (PTSD)	38.22% (391)	43.99% (450)	1023
Medication review	40.18% (411)	44.77% (458)	1023
Assessment of nutritional status	45.94% (470)	40.57% (415)	1023
Assessment of comorbidities	43.21% (442)	40.18% (411)	1023
Measurement of lung function (spirometry)	36.85% (377)	30.11% (308)	1023
Assessment of oxygen requirements	38.71% (396)	40.57% (415)	1023
Further intervention is only needed if there is evidence of ongoing physical or psychological deficit	37.54% (384)	36.17% (370)	1023

Recommendations for the components of a rehabilitation recovery programme for Covid-19

The essential components which reached consensus for the later phase of recovery (6-8 weeks post discharge/episode and following the assessment outline above) are displayed in Table 3. The most frequently recommended items included advice on returning to usual exercise habits (93% either strongly agreeing or agreeing), 91% recommending advice on community exercise schemes, and given the 'lockdown' at the time of writing advice on community exercise schemes (once social isolation policy is relaxed) and advice for engaging in outdoors activities (once social isolation policy is relaxed) were highly rated (91 and 93% respectively) by respondents. Similarly exercise advice for home based aerobic and resistance programmes were highly rated (90% and 88% respectively). Symptom management was rated with advice on the management of fatigue and support for mood disturbances (including anxiety and depression) being equally strong recommended at 89%. Advice

on the management of breathlessness was marginally less at 86%. Advice on the management of cough did not reach the 70% threshold at 6-8 weeks post discharge, with the largest number of respondents reporting to be 'neutral' for this question compared to any other question in this particular section (21%). The impact upon employment was also rated highly, advice on returning to usual employment (87%), where to get financial support advice (75%) and advice on returning to alternative employment (74%). Support for some unique aspects of Covid -19 and the current lockdown were also rated highly, psychological support for social isolation 84%, dealing with grief and death of a family member 80% and psychological support for Post-Traumatic Stress Disorder (PTSD) 80%. Assessment of lung function at 6 months post discharge was endorsed by 75% of respondents.

Table 3: The essential components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge

Component	Agree	Strongly agree	N=
A home-based progressive aerobic exercise programme	33.76% (345)	55.87% (571)	1022
A home-based progressive resistance exercise programme	35.32% (361)	52.35% (535)	1022
Advice on the management of cough	40.61% (415)	26.22% (268)	1022
Advice on the management of fatigue	43.15% (441)	45.4% (464)	1022
Advice on the management of breathlessness	42.47% (434)	43.05% (440)	1022
Psychological support for social isolation	42.56% (435)	41.1% (420)	1022
Support for mood disturbances (including anxiety and depression)	40.41% (413)	48.83% (499)	1022
Assessment of nutrition	43.74% (447)	33.66% (344)	1022
Psychological support for Post-Traumatic Stress Disorder (PTSD)	38.75% (396)	41.59% (425)	1022
Return to work advice	40.61% (415)	43.44% (444)	1022
Where to get financial support	40.7% (416)	34.64% (354)	1022
Dealing with grief and death of a family member	40.22% (411)	39.53% (404)	1022
Advice on returning to usual exercise habits	32% (327)	61.35% (627)	1022
Advice on returning to usual employment	37.08% (379)	49.71% (508)	1022
Advice on returning to alternative employment	37.57%	36.11%	1022

	(384)	(369)	
Once social isolation policy is relaxed, advice for engaging in outdoors activities	38.45% (393)	51.17% (523)	1022
Once social isolation policy is relaxed, advice on community exercise schemes	34.54% (353)	56.56% (578)	1022
Assessment of lung function at 6 months	32.78% (335)	42.47% (434)	1022

Recommendations from the free text comments

A total of 341 free text comments were recorded and analysed. These informed seven themes and 16 sub-themes. See Table 4 for illustrative quotes (further details in online supplement).

A large proportion of the results complimented the quantitative findings; however, additional service and treatment priorities were proposed. Firstly, respondents recognised that 'A collaborative effort for rehabilitation development' would be essential with input from experts in pulmonary/cardiac rehabilitation, nutrition, psychology, neurology, physiotherapy, respiratory medicine, occupational therapy and speech and language therapy, alongside recently published research from across the globe. Respondents felt there was a need to produce clear guidance for Covid-19 management, including this rehabilitation model, and there should be a campaign to promote Covid-19 rehabilitation to raise its profile amongst patients, carers and referrers and embed it within the Covid-19 recovery pathway.

Secondly, respondents recognised the uniqueness of this pandemic and therefore highlighted the importance of continued learning from Covid-19 for service development. It was recognised this would be an iterative process as services adapt to meet the new demands and service evaluations and research develop an evidence-based model.

Thirdly, alongside the early phase of recovery, suggestions for managing the acute phase were presented. Respondents highlighted the importance of assessing a patient's physical and psychological wellbeing to inform personalised care plans. They also wanted to see a robust Covid-19 discharge bundle of self-management materials for both patients and caregivers.

The fourth theme comprised comments relating to the appropriate methods of rehabilitation delivery. Respondents felt this was an opportunity to adapt and improve current pulmonary rehabilitation models to meet the new demands and accommodate social distancing measures. For example, respondents suggested using pre and post outcome measures that could be assessed virtually (flexibility in assessment), using tele-rehabilitation with virtual group-based rehabilitation to

maintain peer support. A personalised rehabilitation programme involving the assessment of patients' care needs to inform a tailored rehabilitation plan from a menu of rehabilitation modules was proposed. There was debate about the timing of rehabilitation with some respondents leaning towards inpatient rehabilitation to minimise functional loss and others towards outpatient rehabilitation to allow time for immediate physical and psychological recovery. Access to rehabilitation was also acknowledged, with respondents highlighting the need for a clear referral pathway that healthcare professionals and patients can refer and re-refer to as necessary.

As a fifth theme, respondents proposed the necessary components for Covid-19 rehabilitation. There was acknowledgement of the effectiveness of current rehabilitation and holistic care pathways and therefore a desire not to reinvent the wheel, rather build on guidance from established rehabilitation models. Notably pulmonary rehabilitation, but other suggested models of care to consider and complement might include cardiac rehabilitation, neurorehabilitation, cognitive behavioural therapy, palliative rehabilitation, speech and language therapy, music therapy, yoga/tai chi, acupuncture, pastoral support and hydrotherapy. The majority of individual components recommended for a Covid-19 rehabilitation programme mirrored the quantitative findings, however, the following topics were also presented as care priorities: sputum clearance, frailty, pain, behaviour change, the impact of comorbidities, energy conservation, falls, inhaler technique, skin integrity, swallowing and voice care, cognitive functioning, inspiratory muscle training, caregiver support, signposting and peer support through group activities.

The sixth theme identified respondents wanting to see a team of specialist Covid-19 rehabilitation staff to deliver this new model. This is to include a multidisciplinary team who have specialist skills for this patient group. Additionally, respondents felt it was important to keep our staff physically safe, for example, by ensuring an appropriate supply of personal protective equipment (PPE) and the mental well-being of staff by monitoring and providing appropriate support when indicated to maintain the psychological health of the workforce.

Finally, respondents articulated the need for reassurance of financial support to ensure the robust development and delivery of this new rehabilitation model. They felt this support needed to be secured nationally to ensure equality and continuity of the service.

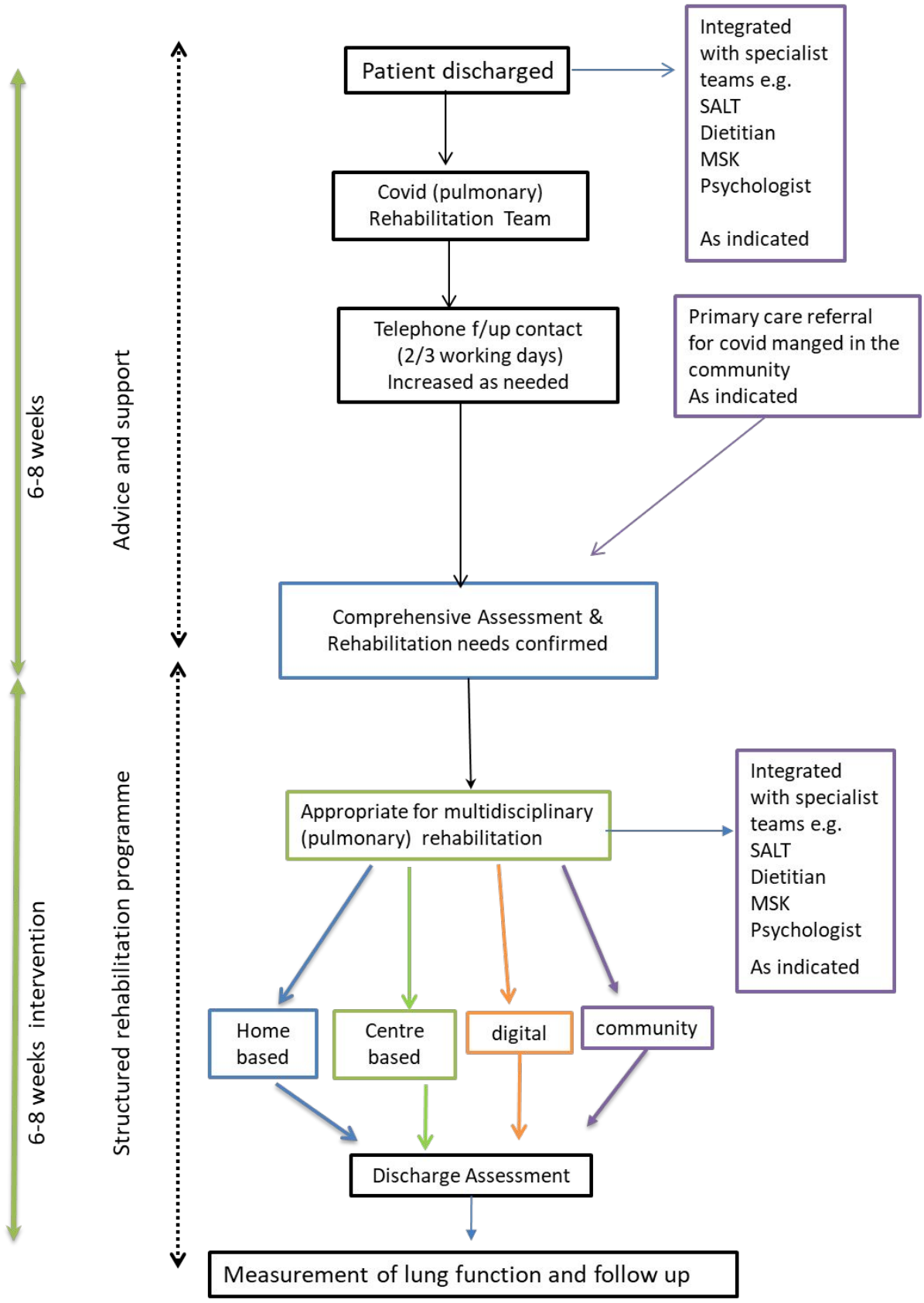
Table 4: Generated themes and sub-themes from the survey's free text comments

Theme	Sub-theme(s)
A collaborative effort for rehabilitation development: to develop this model a collaborative effort is needed from experts within the field and around the world. We can learn from international findings, current models of rehabilitation and the specialists that deliver them (e.g. pulmonary/cardiac/neurological rehabilitation teams, dieticians, psychologists, respiratory consultants, respiratory and muscular skeletal physiotherapists, nurses, occupational therapists, speech and language therapists). *"I feel an effective service can only be designed if all specialists within the multi-disciplinary team are part of the development stage: physio, occupational therapist, dietitian, nurse, speech and language therapist, psychologist and any other relevant member…"*	**Clear guidance for COVID-19 management:** there is an identified need for clear guidance and protocols for COVID-19 management, including COVID-19 rehabilitation.
	A campaign to promote COVID-19 rehabilitation: it is important to raise awareness of the COVID-19 rehabilitation service across population (service providers, referrers, patients/carers). There are suggestions to advertise it as a health promotion programme to normalise it as part of recovery on TV, radio etc.
Continued learning from COVID-19 for service development: it will be important to collate data for the development of the COVID-19 rehabilitation service, its evaluation and research into overall COVID-19 management. This theme acknowledges the iterative process of refining the rehabilitation service as new information comes to light and how this will inform future pandemics. *"I think we need to understand the demographics of covid survivors, as service planning for post-covid rehab without understanding transport availability, digital literacy, ongoing psychosocial / PTSD related issues, usual working status amongst other things could result in significant oversights of what these patients are able to, and want to, engage with."*	
COVID-19 patient management: overall patient management in COVID-19 recovery; including recommendations for inpatient and outpatient care. *"The 'Aftershock' isn't necessarily immediate. You can experience the euphoria of having cheated death, which may go on for some weeks/months. However, when reality hits, it can hit hard, literally overnight. Some warning that it could happen and somewhere to turn to is very important..."*	**Managing the acute phase:** recommendations for inpatient care; including assessment of physical and psychological wellbeing to inform personalised follow up care plans, and upon discharge, the provision of a discharge bundle of assessments and advice/documentation about self-management and support for carers/family.
	Early phase of recovery: recommendations for continued outpatient follow up; including physical/psychological assessment, individualised advice on symptom management and/or referral to specialist services for additional support (e.g. rehabilitation, Improving Access to Psychological Therapies (IAPT), peer support etc.).
Methods of rehabilitation delivery: this theme encapsulates the recommendations for how rehabilitation should be delivered and when. It is felt this is an opportunity to develop upon telerehabilitation and early rehabilitation services, including adaptations and flexibility when measuring pre and post rehabilitation outcomes. *"…programmes could be run online BUT need to ensure there is a supervised element and that access to, willingness to use and actual use are measured."*	**Flexibility in assessment:** recognising the inability to perform face to face consultations so adaptations to assessments are needed. Many psychometric measures can be delivered via telephone/video calls/online and alternative measures of exercise capacity can be done at home (e.g. grip strength, timed up and go, sit to stand etc.)
	Early/delayed rehabilitation there is debate about whether rehabilitation should be delivered early/later during a patient's recovery. Some respondents felt inpatient rehabilitation was appropriate, whereas others felt this would be too early for a patient's lungs and/or psychological status to have prepared for rehabilitation.
	Group-based rehabilitation: safety issues inhibit group-based rehabilitation as an option currently, however there is the option for virtual group sessions, or the delivery of these once social distancing measures have relaxed. These are important for social support, especially when people are feeling isolated and alone in their recovery.
	Referral and re-referral: the ability for anyone to refer to rehabilitation (e.g. self-referral and re-referral as per patient request). This needs to be a simple process which is widely known.
	Telerehabilitation: this is a popular and viable option for home-rehabilitation. This circumstance offers an opportunity to grow home-based rehabilitation services.

<table>
<tr><td></td><td>Personalised rehabilitation: the need for patient-centred rehabilitation and not a one size fits all approach. There may be an opportunity to develop a multi-module rehabilitation service where modules can be selected if they are important to the patient's needs.</td></tr>
<tr><td rowspan="2">Components for COVID-19 rehabilitation: the components highlighted as important to a COVID-19 rehabilitation model.
“[I] feel strongly pts will struggle with post COVID standard exercise prog. For example look at problems recruiting to post COPD exacerbation PR. [I] feel should be replaced by physical activity prog plus something like yoga / tai chi or similar. If we disproportionately focus on the exercise - like we do in standard PR - only most motivated pts will complete and they will probably be the ones who would have gone away and exercised anyway.”</td><td>Take guidance from established rehabilitation models: we should look to use/adapt/learn from current models of rehabilitation and/or holistic care services (e.g. pulmonary/cardiac/neurological/palliative/post-intensive care rehabilitation, psychological support (e.g. IAPT, Cognitive Behavioural Therapy (CBT)), occupational therapy, music therapy, yoga/tai chi, speech & language therapy, community gyms, pastoral support, acupuncture, hydrotherapy).</td></tr>
<tr><td>Education, exercise and social support: the proposed components for the new rehabilitation model include:
1. Education for self-management: cough, sputum clearance, breathlessness, fatigue, frailty, pain, psych wellbeing, behaviour change, impact of comorbidities, energy conservation, falls, improving function for daily activities, nutrition, inhaler technique, signposting, skin integrity, swallowing and voice care
2. Exercises (physical/psychological): - cognitive function, exercise programme, inspiratory muscle training, neurorehabilitation
3. Social support: - caregiver support, guidance in line with government recommendations, group activities to facilitate peer engagement</td></tr>
<tr><td rowspan="2">A team of specialist COVID-19 rehabilitation staff: the need for a multidisciplinary team to deliver rehabilitation. They need to have been trained appropriately/have specialist skills for this patient population.
“[We will need a] trained and expert team in rehabilitation medicine...”</td><td>Keep our staff physically safe: the need to maintain the physical health of staff who deliver rehabilitation (e.g. COVID-19 testing for staff and patients, appropriate supply of PPE).</td></tr>
<tr><td>Keep our staff psychologically safe: the monitoring of staff psychological wellbeing and the provision of psychological support to support their mental health.</td></tr>
<tr><td colspan="2">The reassurance of financial support: recognition of the financial input and service support needed to develop, deliver and sustain this programme. It will need considerable financial engagement to ensure it can be rolled out nationally/internationally.
“The reality of available funding and staffing post covid19 pandemic should be taken into account when creating rehabilitation programs for patients. Most services were stretched prior to the outbreak and will struggle afterwards to deliver comprehensive services for patients who are being discharged.”</td></tr>
</table>

Discussion

These data are the first from a comprehensive survey describing views from a large and diverse range of health-care professionals about the rehabilitation needs of the post Covid-19 population. Given the scale of response in such a short time period there is clearly a pressing need to develop a coherent recovery programme for people who are discharged from hospital after being infected with Covid-19. There was wide engagement with the health care community to support the development of the most appropriate package of rehabilitation, having secured the opinion of over 1,000 respondents from a wide variety of professional backgrounds and specialities. The survey identified the important components of the immediate post discharge phase, an assessment for a holistic rehabilitation intervention and the components of this intervention (Figure 1). The comments box allowed us to enrich the survey data and support the development of an appropriate recovery pathway for the post Covid-19 patient.


6-8 weeks
6-8 weeks intervention
Advice and support
Structured rehabilitation programme
Patient discharged
Integrated with specialist teams e.g. SALT Dietitian MSK Psychologist
As indicated
Covid (pulmonary) Rehabilitation Team
Telephone f/up contact (2/3 working days) Increased as needed
Primary care referral for covid manged in the community
As indicated
Comprehensive Assessment & Rehabilitation needs confirmed
Appropriate for multidisciplinary (pulmonary) rehabilitation
Integrated with specialist teams e.g. SALT Dietitian MSK Psychologist
As indicated
Home based
Centre based
digital
community
Discharge Assessment
Measurement of lung function and follow up

The predominant symptoms of Covid-19 are associated with the respiratory system (cough, breathlessness and fatigue) and the pulmonary rehabilitation model appears well placed to deliver the rehabilitation packages (with over 500 centres delivering pulmonary rehabilitation in the UK). Programmes currently deliver a personalised package of exercise and education, commonly extending over 6-8 weeks as a centre based, supervised package of care. Pulmonary rehabilitation is an interdisciplinary intervention that integrates a broad group of health care professionals including but not limited to physiotherapists, nurses, dietitians, pharmacists, psychologists, physicians, occupational therapists, exercise physiologists and graduates of the programme. As reported by respondents there is little appetite to 'reinvent the wheel' and develop a discreet single indication rehabilitation programme, rather there was a clear preference to adapt established pulmonary rehabilitation services to extend the scope to meet the needs of the post Covid-19 population. It was clear from the comments received that this needs to be collaborative and iterative as services become more experienced to meet the demands of this 'new' group. Many components recommended are already core components of a pulmonary rehabilitation pathway, assessment and programme, however the survey gave clear guidance of the additional components required to maximise impact, these included advice and support at the time of discharge. This is an important aspect of the cardiac rehabilitation pathway after discharge from cardiac revascularisation or myocardial infarction with routine telephone follow up [21]. The advice in the early stages focuses on symptom management and returning to normal (with a focus on gentle exercise and employment/financial issues). The assessment of the post Covid-19 patient at 6-8 weeks requires a much broader approach than commonly adopted by pulmonary programmes, specifically screening for PTSD and fatigue as a discreet symptom. PTSD is reported as a core outcome measure in the consensus statement for the follow up of ICU survivors [22]. This report indicated that consensus was achieved for measures of mood, quality of life and PTSD, whilst exercise capacity and cognition almost reached consensus. It is beyond the scope of this survey to indicate the most appropriate outcome measures for the rehabilitation of the post Covid-19 population but there would seem a great deal of logic in combining the core measures of pulmonary rehabilitation with the outcomes recommended in the post ICU population. Interestingly the conduct of a face to face assessment, and performance of an exercise measure strength were recommended by 68%, and 66% respectively. These measures feature in all national and international guidance for PR and may reflect the current circumstances where face to face assessments are challenging. This is perhaps echoed in the free text comments with respect to service users and providers safety concerns. Additional comments from the survey identified the importance of measuring cognition, and importantly the need for integration with social care and Speech and Language Therapy. The timing

and the modes of delivery was a discreet theme, and issues such as the feasibility of a face to face assessment and the need to be flexible in the current environment, with digital/telehealth solutions being highlighted as options. A sub-theme arose identifying the need for clear guidance. To date there is little guidance on the delivery of rehabilitation for this population. Previous international literature has described pulmonary rehabilitation services supporting recovery in other respiratory epidemics (SARS)[4] but the survey rightly reflects the need to collaborate with a much wider multi-disciplinary team to offer the best service to patients post Covid-19.

This work highlights the real need for rehabilitating the post Covid-19 population and is strengthened by the large number of respondents. A limitation is that it did not consider the views of patients and the public; this is currently being undertaken by the British Lung Foundation[23]. These two surveys taken together should support guidance on the provision of rehabilitation services for the post Covid-19 patient.

It would seem that there is a real opportunity to develop a structured multidisciplinary rehabilitation programme that addresses the complex needs of the post Covid-19 population, alongside conventional pulmonary rehabilitation population. This would include those who had a period on ICU. The provision of post ICU rehabilitation although recommended[24] is poorly provided[25]. A legacy of this pandemic is the potential to raise the provision of post ICU care by integrating with established pulmonary rehabilitation services. However, it is important that capacity development is supported, as to not compromise the service for those who routinely access these programmes.

However, the more immediate challenge is to deliver a recovery pathway for those individuals who are being discharged now and for all those who have been discharged over the last few weeks with a diagnosis of Covid-19. We should use this survey data to inform service delivery and work collaboratively across specialties and professions to deliver a comprehensive recovery package for the Covid-19 population. Whilst of course retaining the high quality of service delivered to the usual case load of individuals with chronic respiratory disease.

Conclusion

These data on over 1,000 respondents reflects the interest in the field of rehabilitation and the urgent need to adapt existing services to meet the complex set of needs that Covid-19 patients. Overall there was high level of agreement for the components of an early intervention, the elements of assessment and the components of the subsequent rehabilitation programme. This pandemic presents a real opportunity for truly collaborative working across disciplines and specialities and should be an immediate priority to mitigate the long term impact of Covid-19.

Authors contribution

SS, CEB GJ and JRH contributed to the conception and design of the study. LP, AB and SS analysed the data. SS and AB interpreted the data. SS and AB drafted the manuscript and all authors critically revised for significant intellectual content and insight. All authors had full access to all of the data and can take responsibility for the integrity and accuracy of data analysis. In addition, all authors gave final approval of the manuscript version for publication. SS and AB are responsible for the overall content as guarantors.

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References

1 Huang C, Wang Y, Li X, *et al.* Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;**395**:497–506. doi:10.1016/S0140-6736(20)30183-5

2 Wang D, Hu B, Hu C, *et al.* Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA - J Am Med Assoc* 2020;**323**:1061–9. doi:10.1001/jama.2020.1585

3 Wang L, He W, Yu X, *et al.* Coronavirus disease 2019 in elderly patients: Characteristics and prognostic factors based on 4-week follow-up. *J Infect* Published Online First: 2020. doi:10.1016/j.jinf.2020.03.019

4 Hui DS, Joynt GM, Wong KT, *et al.* Impact of severe acute respiratory syndrome (SARS) on pulmonary function, functional capacity and quality of life in a cohort of survivors. *Thorax* 2005;**60**:401–9. doi:10.1136/thx.2004.030205

5 Luyt CE, Combes A, Becquemin MH, *et al.* Long-term outcomes of pandemic 2009 influenza A(H1N1)-associated severe ARDS. *Chest* 2012;**142**:583–92. doi:10.1378/chest.11-2196

6 Crisafulli E, Gorgone P, Vagaggini B, *et al.* Efficacy of standard rehabilitation in COPD outpatients with comorbidities. *Eur Respir J* 2010;**36**:1042–8. doi:10.1183/09031936.00203809

7 Vanfleteren LEGW, Spruit MA, Groenen M, *et al.* Clusters of Comorbidities Based on Validated Objective Measurements and Systemic Inflammation in Patients with Chronic Obstructive Pulmonary Disease. *Am J Respir Crit Care Med* 2013;**187**:728–35. doi:10.1164/rccm.201209-1665OC

8 Spruit MA, Singh SJ, Garvey C, *et al.* An official American thoracic society/European respiratory society statement: Key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med* 2013;**188**. doi:10.1164/rccm.201309-1634ST

9 National Institute for Health and Care Excellence. Idiopathic pulmonary fibrosis in adults: diagnosis and management. *NICE Guidel* 2013;:1–22. doi:10.1007/s00408-018-0123-9

10 Bolton CE, Bevan-Smith EF, Blakey JD, *et al.* British Thoracic Society guideline on pulmonary rehabilitation in adults. Thorax. 2013;**68**. doi:10.1136/thoraxjnl-2013-203808

11 Mccarthy B, Casey D, Devane D, *et al.* Pulmonary rehabilitation for chronic obstructive pulmonary disease. Cochrane Database Syst. Rev. 2015;**23**. doi:10.1002/14651858.CD003793.pub3

12 Steiner M, McMillan V, Lowe D, Saleem Khan M, Holzhauer-Barrie J, Mortier K, Riordan J, CM R. National COPD Audit Programme Pulmonary rehabilitation: An exercise in improvement. 2018. doi:www.rcplondon.ac.uk/nacap

13 Zhou F, Yu T, Du R, *et al.* Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020;**395**:1054–62. doi:10.1016/S0140-6736(20)30566-3

14 Guan W, Liang W, He J, *et al.* Cardiovascular comorbidity and its impact on patients with Covid-19. *Eur Respir J* 2020;:2001227. doi:10.1183/13993003.01227-2020

15 Steiner M, Holzhauer-Barrie J, Lowe D, Searle L, Skipper E, Welham S RC. National COPD Audit Programme: Pulmonary Rehabilitation: Time to breathe better. 2015.

16 Docherty AB, Harrison EM, Green CA, *et al.* Features of 16,749 hospitalised UK patients with COVID-19 using the ISARIC WHO Clinical Characterisation Protocol. *medRxiv* 2020;:2020.04.23.20076042. doi:10.1101/2020.04.23.20076042

17 Azoulay E, Vincent JL, Angus DC, *et al.* Recovery after critical illness: Putting the puzzle together-a consensus of 29. Crit. Care. 2017;**21**. doi:10.1186/s13054-017-1887-7

18 Hsieh MJ, Lee WC, Cho HY, *et al.* Recovery of pulmonary functions, exercise capacity, and quality of life after pulmonary rehabilitation in survivors of ARDS due to severe influenza A (H1N1) pneumonitis. *Influenza Other Respi Viruses* 2018;**12**:643–8. doi:10.1111/irv.12566

19 In the line of duty | European Respiratory Society. https://www.ersnet.org/covid-19-blog (accessed 4 May 2020).

20 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101. doi:10.1191/1478088706qp063oa

21 Dalal HM, Doherty P, Taylor RS. Cardiac rehabilitation. *BMJ* 2015;**351**:h5000. doi:10.1136/BMJ.H5000

22 Needham DM, Sepulveda KA, Dinglas VD, *et al.* Core outcome measures for clinical research in acute respiratory failure survivors an international modified delphi consensus study. *Am J Respir Crit Care Med* 2017;**196**:1122–30. doi:10.1164/rccm.201702-0372OC

23 BLF. Post-COVID Survey (28/04/2020). https://auk2016.typeform.com/to/LlhQXR (accessed 7 May 2020).

24 National Institute for Heath and Care Excellence, NICE. Rehabilitation after critical illness in adults. *Natl Inst Heal Care Excell* 2009;**CG83**:1–27. doi:http://dx.doi.org/10.1001/jama.2015.9496

25 Connolly B, Douiri A, Steier J, *et al.* A UK survey of rehabilitation following critical illness: implementation of NICE Clinical Guidance 83 (CG83) following hospital discharge. *BMJ Open* 2014;**4**:4963. doi:10.1136/bmjopen-2014-004963

Table 1: The essential components of an early phase recovery programme (first few weeks after discharge/episode)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Unable to comment	N=
A home/step down unit aerobic exercise programme (agree/strongly agree 80%)	1.07% (11)	4.28% (44)	9.52% (98)	38.1% (392)	41.89% (431)	5.15% (53)	1029
A home/step down unit resistance exercise programme (agree/strongly agree 74%)	1.46% (15)	4.76% 49)	14.29% (147)	37.71% (388)	36.54% (376)	5.25% (54)	1029
An online/digital delivery is feasible for patients (agree/strongly agree 59%)	1.55% (16)	10.58% (109)	24.17% (249)	37.67% (388)	21.07% (217)	4.95% (51)	1030
Advice on the management of cough (agree/strongly agree 81%)	0.49% (5)	1.65% (17)	10.69% (110)	39.55% (407)	41.3% (425)	6.32% (65)	1029
Advice on the management of fatigue (agree/strongly agree 95%)	0.39% (4)	0.29% (3)	1.36% (14)	26.43% (272)	68.9% (709)	2.62% (27)	1029
Advice on the management of breathlessness (agree/strongly agree 94%)	0.39% (4)	0.1% (1)	1.46% (15)	25.85% (266)	68.12% (701)	4.08% (42)	1029
Advice on nutrition (agree/strongly agree 87%)	0.49% (5)	0.19% (2)	8.84% (91)	38.29% (394)	48.69% (501)	3.5% (36)	1029
Psychological support for social isolation (agree/strongly agree 91%)	0.39% (4)	0.68% (7)	4.76% (49)	33.43% (344)	58.02% (597)	2.72% (28)	1029
Support for mood disturbances (including anxiety and depression) (agree/strongly agree 92%)	0.49% (5)	0.78% (8)	3.2% (33)	34.95% (360)	57.38% (591)	3.2% (33)	1030
Psychological support for Post Traumatic Stress Disorder (PTSD) (agree/strongly agree 78%)	0.49% (5)	1.85% (19)	13.16% (135)	31.77% (326)	46.39% (476)	6.34% (65)	1026
Return to work advice (agree/strongly agree 73%)	0.88% (9)	4.67% (48)	17.61% (181)	40.27% (414)	32.98% (339)	3.6% (37)	1028
Where to get financial support (agree/strongly agree 72%)	0.88% (9)	3.21% (33)	19.08% (196)	38.66% (397)	33.79% (347)	4.38% (45)	1027
Symptom monitoring for worsening symptoms (agree/strongly agree 90%)	0.49% (5)	0.78% (8)	5.54% (57)	33.56% (345)	56.03% (576)	3.6% (37)	1028

Dealing with grief and death of a family member (agree/strongly agree 80%)	0.88% (9)	1.17% (12)	11.88% (122)	31.94% (328)	48.49% (498)	5.65% (58)	1027

Table 2: The essential components of an assessment at 6-8 weeks post hospital (step down unit) discharge

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Unable to comment	N=
An initial face to face (centre-based) assessment (agree/strongly agree 68%)	1.27% (13)	7.43% (76)	20.23% (207)	33.82% (346)	33.72% (345)	3.52% (36)	1023
Conduct of an exercise test (6MWT/ISWT) at the time of the assessment (agree/strongly agree 66%)	1.47% (15)	6.55% (67)	19.55% (200)	39.3% (402)	26.49% (271)	6.65% (68)	1023
Assessment of muscle strength (quadriceps) (agree/strongly agree 69%)	0.98% (10)	6.26% (64)	19.26% (197)	42.33% (433)	26.3% (269)	4.89% (50)	1023
Assessment of quality of life (agree/strongly agree 92%)	0.88% (9)	0.88% (9)	3.52% (36)	36.27% (371)	56.01% (573)	2.44% (25)	1023
Assessment of cough (agree/strongly agree 71%)	0.68% (7)	4.2% (43)	17.89% (183)	41.06% (420)	30.3% (310)	5.87% (60)	1023
Assessment of fatigue (agree/strongly agree 92%)	0.59% (6)	0.59% (6)	4.11% (42)	41.63% (425)	50.34% (514)	2.74% (28)	1021
Assessment of dyspnoea (agree/strongly agree (88%)	0.49% (5)	0.88% (9)	5.87% (60)	40.18% (411)	47.51% (486)	5.08% (52)	1023
Assessment of mood (e.g. anxiety and depression) (agree/strongly agree (93%)	0.49% (5)	0.78% (8)	2.93% (30)	37.05% (379)	56.11% (574)	2.64% (27)	1023
Screening for Post Traumatic Stress Disorder (agree/strongly agree 82%)	0.59% (6)	1.96% (20)	9.87% (101)	38.22% (391)	43.99% (450)	5.38% (55)	1023
Medication review (agree/strongly agree 85%)	0.68% (7)	1.17% (12)	9.19% (94)	40.18% (411)	44.77% (458)	4.01% (41)	1023
Assessment of nutritional status (agree/strongly agree 87%)	0.59% (6)	0.88% (9)	8.21% (84)	45.94% (470)	40.57% (415)	3.81% (39)	1023
Assessment of comorbidities (agree/strongly agree 83%)	0.59% (6)	1.66% (17)	10.46% (107)	43.21% (442)	40.18% (411)	3.91% (40)	1023
Measurement of lung function (spirometry) (agree/strongly agree 67%)	1.66% (17)	4.69% (48)	18.57% (190)	36.85% (377)	30.11% (308)	8.11% (83)	1023
Assessment of oxygen requirements (agree/strongly agree 79%)	0.68% (7)	1.86% (19)	10.36% (106)	38.71% (396)	40.57% (415)	7.82% (80)	1023
Further intervention is only needed if there is evidence of ongoing physical or psychological deficit (agree/strongly agree 74%)	2.44% (25)	8.99% (92)	10.85% (111)	37.54% (384)	36.17% (370)	4.01% (41)	1023

Table 3: The essential components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge							
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	**Unable to comment**	**N=**
A home-based progressive aerobic exercise programme (agree/strongly agree 90%)	0.88% (9)	0.39% (4)	4.4% (45)	33.76% (345)	55.87% (571)	4.7% (48)	1022
A home-based progressive resistance exercise programme (agree/strongly agree 88%)	0.68% (7)	0.59% (6)	6.16% (63)	35.32% (361)	52.35% (535)	4.89% (50)	1022
Advice on the management of cough (agree/strongly agree 67%)	0.98% (10)	4.79% (49)	20.94% (214)	40.61% (415)	26.22% (268)	6.46% (66)	1022
Advice on the management of fatigue (agree/strongly agree 89%)	0.49% (5)	1.17% (12)	6.85% (70)	43.15% (441)	45.4% (464)	2.94% (30)	1022
Advice on the management of breathlessness (agree/strongly agree 86%)	0.59% (6)	1.57% (16)	8.02% (82)	42.47% (434)	43.05% (440)	4.31% (44)	1022
Psychological support for social isolation (agree/strongly agree 84%)	0.88% (9)	1.57% (16)	10.47% (107)	42.56% (435)	41.1% (420)	3.42% (35)	1022
Support for mood disturbances (including anxiety and depression) (agree/strongly agree 89%)	0.59% (6)	0.49% (5)	6.75% (69)	40.41% (413)	48.83% (499)	2.94% (30)	1022
Assessment of nutrition (agree/strongly agree 77%)	0.78% (8)	1.66% (17)	15.66% (160)	43.74% (447)	33.66% (344)	4.5% (46)	1022
Psychological support for Post Traumatic Stress Disorder (agree/strongly agree 80%)	0.78% (8)	1.37% (14)	11.94% (122)	38.75% (396)	41.59% (425)	5.58% (57)	1022
Return to work advice (agree/strongly agree 84%)	1.08% (11)	1.66% (17)	9.59% (98)	40.61% (415)	43.44% (444)	3.62% (37)	1022
Where to get financial support (agree/strongly agree 75%)	1.08% (11)	3.03% (31)	15.46% (158)	40.7% (416)	34.64% (354)	5.09% (52)	1022
Dealing with grief and death of a family member (agree/strongly agree 80%)	0.88% (9)	1.17% (12)	13.8% (141)	40.22% (411)	39.53% (404)	4.4% (45)	1022
Advice on returning to usual exercise habits (agree/strongly agree 93%)	0.68% (7)	0.39% (4)	2.64% (27)	32% (327)	61.35% (627)	2.94% (30)	1022
Advice on returning to usual employment (agree/strongly agree 87%)	0.78% (8)	0.88% (9)	6.95% (71)	37.08% (379)	49.71% (508)	4.6% (47)	1022
Advice on returning to alternative employment (agree/strongly agree 74%)	1.08% (11)	2.74% (28)	15.26% (156)	37.57% (384)	36.11% (369)	7.24% (74)	1022
Once social isolation policy is relaxed, advice for engaging in outdoors activities (agree/strongly agree 90%)	0.78% (8)	0.68% (7)	6.16% (63)	38.45% (393)	51.17% (523)	2.74% (28)	1022
Once social isolation policy is relaxed, advice on community exercise schemes (agree/strongly agree 91%)	0.59% (6)	0.68% (7)	4.99% (51)	34.54% (353)	56.56% (578)	2.64% (27)	1022

Assessment of lung function at 6 months (agree/strongly agree 75%)	1.08% (11)	1.76% (18)	12.43% (127)	32.78% (335)	42.47% (434)	9.49% (97)	1022

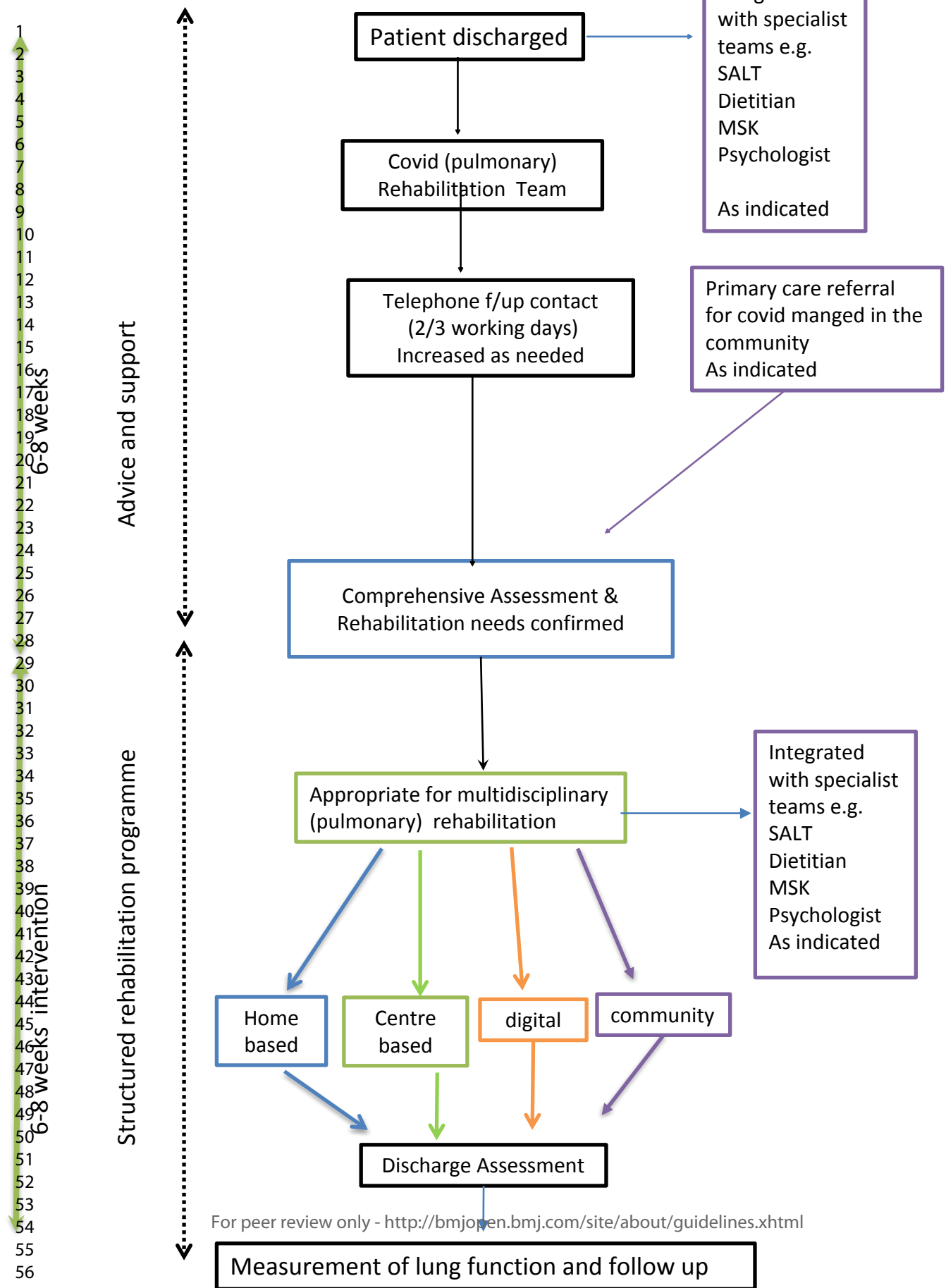
Table 4: Generated themes and sub-themes from the survey's free text comments

Theme	Sub-theme(s)
A collaborative effort for rehabilitation development To develop this model of rehab a collaborative effort is needed from experts within the field and around the world. We can learn from international findings, current models of rehab and the specialists that deliver them. The following staff were identified as important for the development of this new model of rehabilitation: pulmonary/cardiac/neurological rehabilitation teams, dieticians, psychologists, respiratory consultants, respiratory and muscular skeletal physiotherapists, nurses, occupational therapists, speech and language therapists. *"I feel an effective service can only be designed if all specialists within the MDT are part of the development stage: physio, OT, dietitian, nurse, SLT, psychologist and any other relevant member, by contacting their professional associations directly."*	**Clear guidance for COVID-19 management** There is an identified need for clear guidance and protocols for COVID-19 management, including COVID-19 rehabilitation. *"I would love to see a nationally agreed follow-up programme rather than being trust specific as this would lead to huge variation."*
	A campaign to promote COVID-19 rehabilitation It is important to raise awareness of the COVID-19 rehabilitation service across population (service providers, referrers, patients/carers). There are suggestions to advertise it as a health promotion programme to normalise it as part of recovery on TV, radio etc. *"And/or big public health campaign to ensure people are aware about rehabilitation."*
Continued learning from COVID-19 for service development It will be important to collate data for the development of the COVID-19 rehabilitation service, its evaluation and research into overall COVID-19 management. This theme acknowledges the iterative process of refining the rehabilitation service as new information comes to light and how this will inform future pandemics. *"I think we need to understand the demographics of covid survivors, as service planning for post-covid rehab without understanding transport availability, digital literacy, ongoing psychosocial / PTSD related issues, usual working status amongst other things could result in significant oversights of what these patients are able to, and want to, engage with."*	
COVID-19 patient management Overall patient management in COVID-19 recovery; including recommendations for inpatient and outpatient care.	**Managing the acute phase** Recommendations for inpatient care; including assessment of physical and psychological wellbeing to inform personalised follow up care plans, and upon discharge, the provision of a discharge bundle of assessments and advice/documentation about self-management and support for carers/family. *"I think thorough assessment will highlight those patients requiring specific intervention and early treatment will minimise long term problems."* *"I feel patients would benefit from clear discharge booklet that explains what COVID 19 is and what to expect symptom wise for patients and families. When to contact doctor and some management advise like breathing exercises and strengthening exercises."*
	Early phase of recovery Recommendations for continued outpatient follow up; including physical/psychological assessment, individualised advice on symptom management and/or referral to specialist services for additional support (e.g. rehabilitation, IAPT, peer support etc.) *"Nutrition intervention important esp if underlying conditions prior to covid19/elderly/frail."*

	"The 'Aftershock' isn't necessarily immediate. You can experience the euphoria of having cheated death, which may go on for some weeks/months. However, when reality hits, it can hit hard, literally overnight. Some warning that it could happen and somewhere to turn to is very important, be it professional or peer support. Long term support, the recognition that PTSD or at least anxiety/depression is a very likely outcome, is I think essential."
Methods of rehabilitation delivery This theme encompasses the recommendations for how rehabilitation should be delivered and when. It is felt this is an opportunity to develop upon telerehabilitation and early rehab/prehab services, including adaptations and flexibility when measuring pre and post rehabilitation outcomes.	**Flexibility in assessment** Recognising the inability to perform face to face consultations so adaptations to assessments are needed. Many psychometric measures can be delivered via telephone/video calls/online and alternative measures of exercise capacity can be done at home (e.g. grip strength, timed up and go, sit to stand etc.) *"Currently planning to use grip strength, 30s sit to stand, and probably repeated timed up and go (x5 or x10) as measures of function and outcome, as doing any sort of corridor walk test (6WT, ISWT or ESWT) not going to be practical, limited equipment to do cycle ergometry, and patient group too poor re: balance to do step tests."*
	Early/delayed rehabilitation There is debate about whether rehabilitation should be delivered early/later during a patient's recovery. Some respondents felt inpatient rehabilitation was appropriate, whereas others felt this would be too early for a patient's lungs and/or psychological status to have prepared for rehabilitation. *"…acute rehabilitation phase prior to people leaving hospital. Intensive inpatient rehabilitation supports discharge, and improved outcomes of people requiring subacute rehabilitation and community rehabilitation."* *"Thus far it seems that people need time to recover from the acute effects before starting more of a resp rehab programme."*
	Group-based rehabilitation Safety issues inhibit group-based rehabilitation as an option currently, however there is the option for virtual group sessions, or the delivery of these once social distancing measures have relaxed. These are important for social support, especially when people are feeling isolated and alone in their recovery. *"I consider face to face and group support essential not only for fitness but to manage the psychological impact of this illness."*
	Referral and re-referral The ability for anyone to refer to rehabilitation (e.g. self-referral and re-referral as per patient request). This needs to be a simple process which is widely known. *"Ensure pathway for referral is documented is essential as some of these clients will go home and be ok initially but 6 plus months down the track will not be back at baseline and require pulmonary rehab."*
	Telerehabilitation This is a popular and viable option for home-rehabilitation. This circumstance offers an opportunity to grow home-based rehabilitation services.

	"…programmes could be run online BUT need to ensure there is a supervised element and that access to, willingness to use and actual use are measured."
	Personalised rehabilitation The need for patient-centred rehabilitation and not a one size fits all approach. There may be an opportunity to develop a multi-module rehabilitation service where modules can be selected if they are important to the patient's needs. *"I feel that post COVID-19 support needs to be person-centred and tailored to the individual. All the components listed are important but some may be more relevant for some people than others. In order not to overwhelm survivors, undertake unnecessary assessment/interventions and make best use of resources, a specific and MDT recovery plan made in partnership with the person is key."*
Components for COVID-19 rehabilitation The components highlighted as important to a COVID-19 rehabilitation model.	**Take guidance from established rehabilitation models** We should look to use/adapt/learn from current models of rehabilitation and/or holistic care services. Suggestions include pulmonary/cardiac/neurological/palliative/post-intensive care rehabilitation, psychological support (e.g. IAPT, CBT), occupational therapy, music therapy, yoga/tai chi, speech & language therapy, community gyms, pastoral support, acupuncture, hydrotherapy. *"I feel that we have enough resources to sign post and or refer on as necessary, ie Cardiac and pulmonary mental health, SOHAS etc."* *"Yes - feel strongly pts will struggle with post COVID standard exercise prog. For example look at problems recruiting to post AECOPD PR. Feel should be replaced by physical activity prog plus something like yoga / tai chi or similar. If we disproportionately focus on the exercise - like we do in standard PR - only most motivated pts will complete and they will probably be the ones who would have gone away and exercised anyway."*
	Education, exercise and social support Proposed components for the new rehabilitation model, separated by education, exercise and social support: 1. Education for self-management with topics to include: cough, sputum clearance, breathlessness, fatigue, frailty, pain, psych wellbeing, behaviour change, impact of comorbidities, energy conservation, falls, improving function for daily activities, nutrition, inhaler technique, signposting, skin integrity, swallowing and voice care 2. Exercises (physical/psychological): - cognitive function, exercise programme, inspiratory muscle training, neurorehabilitation 3. Social support: - caregiver support, guidance in line with government recommendations, group activities to facilitate peer engagement
A team of specialist COVID-19 rehabilitation staff The need for an multidisciplinary team to deliver rehabilitation. They need to have been trained appropriately/have specialist skills for this patient population.	**Keep our staff physically safe** The need to maintain the physical health of staff who deliver rehabilitation (e.g. COVID-19 testing for staff and patients, appropriate supply of PPE).

We will need a *"trained and expert team in rehabilitation medicine..."*	*"Please make sure staff who work in any settings have appropriate PPE for doing any face to face consultations with patients."*
	Keep our staff psychologically safe The monitoring of staff psychological wellbeing and the provision of psychological support to support their mental health. *"We should also, and I feel this very strongly indeed, should be assessed ourselves for signs of any signs of distress or psychological trauma, and rapidly be offered help and support to allow us, the members of the society, to survive this experience in ways which allow us to heal as individuals, and grow as clinicians."*
The reassurance of financial support Recognition of the financial input and service support needed to develop, deliver and sustain this programme. It will need considerable financial engagement to ensure it can be rolled out nationally/internationally. *"The reality of available funding and staffing post covid19 pandemic should be taken into account when creating rehabilitation programs for patients. Most services were stretched prior to the outbreak and will struggle afterwards to deliver comprehensive services for patients who are being discharged."*	



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The British Thoracic Society survey of rehabilitation to support recovery of the post COVID-19 population

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The British Thoracic Society survey of rehabilitation to support recovery of the post COVID-19 population.

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Abstract (300 words)

Objectives

Those discharged from hospital after treatment for Coronavirus Disease 19 (COVID-19) are likely to have significant and ongoing symptoms, functional impairment and psychological disturbances. There is an immediate need to develop a safe and efficient discharge process and recovery programme. Established rehabilitation programmes are well placed to deliver a programme for this group but will most likely need to be adapted for the post COVID-19 population. The purpose of this survey was to rapidly identify the components of a post COVID-19 rehabilitation assessment and elements of a successful rehabilitation programme that would be required to deliver a comprehensive service for those post COVID-19 to inform service delivery.

Design

A survey comprising of a series of closed questions and a free text comments box allowing for a qualitative analysis.

Setting

Online survey.

Participants

Multi-professional clinicians, across specialities were invited to take part.

Results

1031 participants responded from a broad range of specialities. There was overwhelming support for an early post hospital discharge recovery programme to advise patients about the management of fatigue (95% agreed/ strongly agreed), breathlessness (94%), and mood disturbances (including symptoms of anxiety and depression) 92%. At the 6-8-week time point an assessment was considered important, focusing on a broad range of possible symptoms and supporting a return to work. Recommendations for the intervention described a holistic programme focusing on symptom management, return of function and return to employment. The free text comments added depth to the survey and the need 'not to reinvent the wheel' rather adapt well established rehabilitation services to individually tailor needs based care with continued learning for service development.

Conclusion

The responses indicate a huge interest and the urgent need to establish a programme to support and mitigate the long-term impact of COVID-19, by optimising and individualising existing rehabilitation programmes.

Strengths and limitations

- Large and comprehensive survey conducted to guide the provision of post COVID-19 assessment and rehabilitation.
- The survey provides clear recommendations for the provision of advice and support immediately upon discharge.
- The survey provides recommendations for a programme of holistic rehabilitation 6-8 weeks post discharge based upon the existing rehabilitation models.
- 71% of respondents were physiotherapists and 84% of respondents were female, limiting the generalisability of results to all relevant specialties.
- 25% respondents had no experience of managing patients with COVID-19 and 31% had no experience of rehabilitation.

Background

Since December 2019, the global Coronavirus Disease 19 (COVID-19) pandemic has already resulted in tens of thousands of people being admitted to hospital for acute medical management, a proportion of whom will have had a prolonged stay on Intensive Care Units (ICU). Those discharged from ICU are likely to exhibit significant on-going symptoms notably dyspnoea, fatigue and cough, functional impairment and psychological disturbances[1–3]. The larger cohort of people discharged after ward based care are likely to experience similar if less severe problems.

Although we have limited COVID-19 data so far, literature from the Severe Acute Respiratory Syndrome (SARS) outbreak would suggest that there is a considerable impact upon the individual with reduced functional performance and health status even at 6 months post discharge compared to normal values[4,5].

There is a pressing need to develop a safe and efficient discharge process to support patients in the early phase of recovery and to set up a mechanism to review these individuals early in the post discharge phase to facilitate care planning, onward referral, restoration of pre-morbid function, holistic well-being and participation in family, community and work life. Furthermore any pathway should be accessible to those who remained in the community to manage their COVID-19 infection but have had a slow and incomplete recovery.

There are existing rehabilitation pathways that assess and manage the rehabilitation needs of patients with long term conditions notably cardiac and pulmonary rehabilitation pathways. These services accommodate patients with multiple co-morbidities, including chronic respiratory disease, cardiovascular, mental health and metabolic diseases[6,7]. There is a strong evidence base demonstrating that a centre-based supervised out-patient programme of education and physical activity, impacts upon symptom burden e.g. breathlessness, anxiety, depression, health status and exercise capacity. As an example, pulmonary rehabilitation is an interdisciplinary intervention that integrates a broad group of health care professionals including but not limited to physiotherapists, nurses, dietitians, pharmacists, psychologists, physicians, occupational therapists, exercise physiologists and graduates of the programme. The provision of pulmonary rehabilitation is demonstrably successful in clinical practice outside the context of research studies.UK data from over 7000 cases has been collected and reported as part of the National Asthma and COPD Audit Programme (Pulmonary Rehabilitation)[8]. Furthermore, patients frequently have multiple long-term conditions that do not compromise the outcome, the common comorbidities recorded in the chronic respiratory population mirror those that have been reported in the COVID-19 population of hypertension, diabetes and cardiovascular disease[9,10].Additionally, a recent review proposed that

a referral to a pulmonary rehabilitation programme for the post COVID-19 individual who remains symptomatic, is appropriate[11].

However, the rehabilitation needs of the post COVID-19 population are likely more diverse than those commonly observed in pulmonary and cardiac rehabilitation programmes. Early data from Wuhan in China indicates that the mean age of people hospitalised with COVID-19 was 52(45–58) years[9] compared to 69(9) years reported for a conventional pulmonary rehabilitation programme[12]. Although data from the United Kingdom International Severe Acute Respiratory and Emerging Infection Consortium (UK ISARIC) registry of 16,749 COVID-19 admissions indicates the median age is 72(57-82) years[13], more typical of the pulmonary rehabilitation population. However, given the widespread nature of the pandemic there will be a substantial number of younger patients, included in those admitted to ICU, and in some of the post COVID-19 patients their pre-morbid state is likely to be quite different. Many may not have pre-existing lung disease, and likely different levels of employment, usual levels of activity and exercise behaviours. Furthermore, there is an indication the post COVID-19 population is likely to have significant psychological and cognitive impairment particularly if management involved a stay on ICU[14]. There is some evidence indicating that pulmonary rehabilitation interventions in the SARS population and Acute Respiratory Distress Syndrome (ARDS) are effective[15]. We postulated that whilst the core of pulmonary rehabilitation would in part meet the needs of the post COVID-19 patient, the programme would likely need to be adapted. The modifications would primarily be at the point of assessment to broaden the scope to holistically assess the impact of COVID-19 and secondly to address the components of a comprehensive programme which considers the psychological and mental health needs of patients in recovery.

Therefore the purpose of this survey was to rapidly identify the additional components of a post-COVID-19 rehabilitation assessment, and elements of a successful rehabilitation programme that would be required to deliver a comprehensive service for those either discharged from hospital post COVID-19, or for those managed in the community with marked ongoing symptoms that prevent a full recovery.

Methods

We conducted a survey of multi-professional clinicians. The survey was designed in collaboration with the British Thoracic Society (BTS) and a team with expertise in pulmonary and cardiac rehabilitation and the wider management of respiratory disease. The survey was predominately composed of closed questions, with a free text box at the end of the survey for additional

comments. The survey was built by the team at the BTS using ClassApps software. The survey was tested by local teams experienced in rehabilitation prior to the wider launch.

The initial stages of the survey asked for basic demographic information from the participants to include age, gender, ethnicity, professional background, location of work and exposure to patients with, or recovering from COVID-19 (the full survey is available in Supplementary File 1).

The purpose was to gain wide clinical consensus as to what an effective, holistic rehabilitation intervention might comprise for patients recovering from COVID-19. The survey aimed to secure guidance for rehabilitation support provided in two phases:

- The initial discharge period (which may be to home, a step-down unit or a rehabilitation facility).
- A formal rehabilitation programme that would be offered 6-8 weeks post rehabilitation. This time period is based upon evidence accumulated by an ad-hoc task force formed by the American Thoracic Society (ATS)/European Respiratory Society (ERS) with a supporting document[16].

For these sections of the survey there was a statement and participants were invited to respond with the following five categories: 'strongly disagree', 'disagree', 'neutral', 'agree' or 'strongly agree'. There was also the option to respond, 'unable to comment'.

Upon completion of the survey there was an additional free text box for further comments. No questions were mandatory.

Patient and public involvement

No patient involvement.

Survey distribution

The survey was available to participants from 9th April 2020 to 15th April 2020. 7 days access covered a bank holiday, scheduled workdays and a weekend which maximised opportunities to complete the survey. It was distributed to members of the BTS via the societies' e-newsletter and healthcare professionals via the BTS Twitter account. A reminder email was sent to BTS members 6 days later, a reminder to participate was retweeted by society members and the BTS encouraging both BTS members and healthcare professionals to participate and share the survey with colleagues. The

survey was not restricted to UK based healthcare professionals, although country of practice was noted on the survey.

Participation in the survey was voluntary and anonymous. Participants confirmed their willingness to engage in this research by accessing and completing the online survey. As the survey was directed towards healthcare professionals there was no patient or public involvement.

Data analysis

Quantitative data were reported as counts and percentages for each category of the demographic and survey responses. At least 70% agreement on directionality (combining strongly agree and agree) was defined as the threshold for consensus.

Qualitative data were analysed using Thematic Analysis [17]. The text data was uploaded to NVivo 12 Pro and then coded and grouped into themes to portray patterns within the data. The established themes were reviewed by the first author and the finalised themes were defined.

Ethical approval was not required for this survey from either the UK Health Research Authority or leading Research and Development Centre. Completion of the survey was an indication of willingness to participate and implied consent. We set no threshold for response over such a short period of time but were anticipating around 300 responses across a range of healthcare professionals to allow the questionnaire to be considered robust and representative of those in the field.

Results

This report is based on data from 1031 respondents. A further 750 respondents only provided answers to the demographic questions on page 1 and therefore do not form part of this report, however, their demographics are consistent with the results presented below. The majority of respondents were female (84%), the largest age group was 35-44 years (34%), followed by 45-54 years (27%) and 25-34 years (22%). A significant majority identified as white British (75%), with any other white background, white Irish and Indian representing 7%, 6% and 5% of the participants respectively. The largest group of respondents were from England (80%), with Scotland representing 6% of respondents, Wales 4%, Northern Ireland 3% and the remainder from the rest of Europe, Australasia and South America. Respiratory (32%) represented the largest known group by specialism, followed by Health Care of the Elderly (12%), Primary Care (7%) Acute Medicine (6%) and

Sport & Exercise (5%) with smaller numbers from cardiology, general medicine, anaesthetics, psychiatry and psychology backgrounds. However, 34% recorded 'Other' backgrounds which included neurology (n=44), critical care (n=26) and musculoskeletal (n=56)). Physiotherapists represented the largest group (71%), dietitians, nurses and consultant physicians represented 7%, 6% and 6% respectively, smaller numbers of occupational therapists, speech and language therapists, trainee physicians and healthcare assistants participated. The majority worked in either secondary care hospital (45%) or community hospitals/services (28%), with fewer responses from either primary care or private hospitals, 17% of 'others' were represented by the private (industry) sector, universities, the community (excluding hospitals) and hospices. The final two profiling questions allowed for more than one response, in total there were 1420 responses as to whether or not they had experience in managing patients with COVID-19. 361 (25%) respondents had no experience, the remainder had experience on acute wards (n=332; 23%), Intensive Care Units (n=257; 18%), community (n=209; 15%) and step-down units (n=154; 11%). With respect to rehabilitation, 442 (31%) respondents had no experience, 216 (15%) had experience in pulmonary rehabilitation, 208 (15%) had experience in Health Care of the Elderly, 52 (4%) in cardiac rehabilitation and 202 (14%) in other forms of rehabilitation. Of the 1030 respondents, 167 (16%) had no experience of managing patients with COVID-19 or rehabilitation.

Recommendations for the early phase of COVID-19 recovery

The first section of the survey addressed the immediate post discharge phase. That is, care or advice delivered in the home, in a step-down unit or in a rehabilitation hospital/ward. Items that reached the threshold for recommendation for the early phase recovery programme are displayed in Figure 1. All but one proposed survey items (online/digital delivery) were recommended for the early phase of COVID-19 recovery. There was overwhelming support for early post discharge from hospital phase of the recovery programme to advise patients about the management of fatigue (95% agreed or strongly agreed), breathlessness (94%), and mood disturbances (including symptoms of anxiety and depression) 92%. In recognition of the current UK community 'lockdown' there was clear agreement to provide support for coping with social isolation (91%). At this early stage in the recovery process there were less strong recommendations about cough management, delivery of an exercise programme or support for post-traumatic stress disorder (PTSD) but these comfortably exceeded the 70% threshold, at 81%, 80% and 78% respectively. Advice provided on a digital platform failed to reach the 70% threshold (59%), with 24.2% being neutral. This question provided the largest 'neutral response'.

(Insert Figure 1)

Recommendations for assessment at 6-8 weeks post hospital discharge

The essential components that reached consensus of an assessment at 6-8 weeks post episode/hospital (or step down unit) discharge are displayed in Figure 2. There was strong support for the assessment of mood (93% strongly agreed or agreed), quality of life (92%) and fatigue (92%). The assessment of cough just reached the 70% threshold with 71% recommending assessment. Advice with respect to returning to work (73%) and financial support (72%) were not rated as highly although also exceeded the 70% threshold. The items which did not reach consensus were the need for a face to face assessment, assessment of exercise capacity/muscle strength and the need for a measure of lung function with 68%, 66% and 69% of the survey participants respectively recommending these factors as an important part of the assessment.

(Insert Figure 2)

Recommendations for the components of a rehabilitation recovery programme for COVID-19

The essential components which reached consensus for the later phase of recovery (6-8 weeks post discharge/episode and following the assessment outline above) are displayed in Figure 3. The most frequently recommended items included advice on returning to usual exercise habits (93% either strongly agreeing or agreeing), 91% recommending advice on community exercise schemes, and given the 'lockdown' at the time of writing advice on community exercise schemes (once social isolation policy is relaxed) and advice for engaging in outdoors activities (once social isolation policy is relaxed) were highly rated (91% and 93% respectively) by respondents. Similarly exercise advice for home based aerobic and resistance programmes were highly rated (90% and 88% respectively). Symptom management was rated with advice on the management of fatigue and support for mood disturbances (including anxiety and depression) being equally strong recommended at 89%. Advice on the management of breathlessness was marginally less at 86%. Advice on the management of cough did not reach the 70% threshold at 6-8 weeks post discharge, with the largest number of respondents reporting to be 'neutral' for this question compared to any other question in this particular section (21%). The impact upon employment was also rated highly, advice on returning to usual employment (87%), where to get financial support advice (75%) and advice on returning to alternative employment (74%). Support for some unique aspects of COVID -19 and the current lockdown were also rated highly, psychological support for social isolation 84%, dealing with grief and death of a family member 80% and psychological support for PTSD 80%. Assessment of lung function at 6 months post discharge was endorsed by 75% of respondents.

(Insert Figure 3)

Recommendations from the free text comments

A total of 341 free text comments were recorded and analysed. These informed seven themes and 16 sub-themes. See Table 1 for illustrative quotes (expanded tables in Supplementary File 2).

A large proportion of the results complimented the quantitative findings; however, additional service and treatment priorities were proposed. Firstly, respondents recognised that 'A collaborative effort for rehabilitation development' would be essential with input from experts in pulmonary/cardiac rehabilitation, nutrition, psychology, neurology, physiotherapy, respiratory medicine, occupational therapy and speech and language therapy (SALT), alongside recently published research from across the globe. Respondents felt there was a need to produce clear guidance for COVID-19 management, including this rehabilitation model, and there should be an educational campaign to promote COVID-19 rehabilitation, raise its profile amongst patients, carers and referrers and embed it within the COVID-19 recovery pathway.

Secondly, respondents recognised the uniqueness of this pandemic and therefore highlighted the importance of continued learning from COVID-19 for service development. It was recognised this would be an iterative process as services adapt to meet the new demands and service evaluations and research develop an evidence-based model.

Thirdly, alongside the early phase of recovery, suggestions for managing the acute phase were presented. Respondents highlighted the importance of assessing a patient's physical and psychological wellbeing to inform personalised care plans. They also wanted to see a robust COVID-19 discharge bundle of self-management materials for both patients and caregivers.

The fourth theme comprised comments relating to the appropriate methods of rehabilitation delivery. Respondents felt this was an opportunity to adapt and improve current pulmonary rehabilitation models to meet the new demands and accommodate social distancing measures. For example, respondents suggested using pre and post outcome measures that could be assessed virtually (flexibility in assessment), using tele-rehabilitation with virtual group-based rehabilitation to maintain peer support. A personalised rehabilitation programme involving the assessment of patients' care needs to inform a tailored rehabilitation plan from a menu of rehabilitation modules was proposed. There was debate about the timing of rehabilitation with some respondents leaning towards inpatient rehabilitation to minimise functional loss and others towards outpatient rehabilitation to allow time for immediate physical and psychological recovery. Access to rehabilitation was also acknowledged, with respondents highlighting the need for a clear referral pathway that healthcare professionals and patients can refer and re-refer to as necessary.

As a fifth theme, respondents proposed the necessary components for COVID-19 rehabilitation. There was acknowledgement of the effectiveness of current rehabilitation and holistic care pathways and therefore a desire not to reinvent the wheel, rather build on guidance from established rehabilitation models. Notably pulmonary rehabilitation, but other suggested models of care to consider and complement might include cardiac rehabilitation, neurorehabilitation, cognitive behavioural therapy, palliative rehabilitation, SALT, music therapy, yoga/tai chi, acupuncture, pastoral support and hydrotherapy. The majority of individual components recommended for a COVID-19 rehabilitation programme mirrored the quantitative findings, however, the following topics were also presented as care priorities: sputum clearance, frailty, pain, behaviour change, the impact of comorbidities, energy conservation, falls, inhaler technique, skin integrity, swallowing and voice care, cognitive functioning, inspiratory muscle training, caregiver support, signposting and peer support through group activities.

The sixth theme identified respondents wanting to see a team of specialist COVID-19 rehabilitation staff to deliver this new model. This is to include an interdisciplinary team who have specialist skills for this patient group. Additionally, respondents felt it was important to keep our staff physically safe, for example, by ensuring an appropriate supply of personal protective equipment (PPE) and the mental well-being of staff by monitoring and providing appropriate support when indicated to maintain the psychological health of the workforce.

Finally, respondents articulated the need for reassurance of financial support to ensure the robust development and delivery of this new rehabilitation model. They felt this support needed to be secured nationally to ensure equality and continuity of the service.

Table 1: Generated themes and sub-themes from the survey's free text comments

Theme	Sub-theme(s)
A collaborative effort for rehabilitation development: to develop this model a collaborative effort is needed from experts within the field and around the world. We can learn from international findings, current models of rehabilitation and the specialists that deliver them (e.g. pulmonary/cardiac/neurological rehabilitation teams, dieticians, psychologists, respiratory consultants, respiratory and muscular skeletal physiotherapists, nurses, occupational therapists, speech and language therapists). *"I feel an effective service can only be designed if all specialists within the multi-disciplinary team are part of the development stage: physio, occupational therapist, dietitian, nurse, speech and language therapist, psychologist and any other relevant member…"*	**Clear guidance for COVID-19 management:** there is an identified need for clear guidance and protocols for COVID-19 management, including COVID-19 rehabilitation.
	A campaign to promote COVID-19 rehabilitation: it is important to raise awareness of the COVID-19 rehabilitation service across populations (service providers, referrers, patients/carers). There are suggestions to advertise it as a health promotion programme to normalise it as part of recovery on TV, radio etc.
Continued learning from COVID-19 for service development: it will be important to collate data for the development of the COVID-19 rehabilitation service, its evaluation and research into overall COVID-19 management. This theme acknowledges the iterative process of refining the rehabilitation service as new information comes to light and how this will inform future pandemics. *"I think we need to understand the demographics of COVID survivors, as service planning for post-COVID rehab without understanding transport availability, digital literacy, ongoing psychosocial / PTSD related issues, usual working status amongst other things could result in significant oversights of what these patients are able to, and want to, engage with."*	
COVID-19 patient management: overall patient management in COVID-19 recovery; including recommendations for inpatient and outpatient care. *"The 'Aftershock' isn't necessarily immediate. You can experience the euphoria of having cheated death, which may go on for some weeks/months. However, when reality hits, it can hit hard, literally overnight. Some warning that it could happen and somewhere to turn to is very important..."*	**Managing the acute phase:** recommendations for inpatient care; including assessment of physical and psychological wellbeing to inform personalised follow up care plans, and upon discharge, the provision of a discharge bundle of assessments and advice/documentation about self-management and support for carers/family.
	Early phase of recovery: recommendations for continued outpatient follow up; including physical/psychological assessment, individualised advice on symptom management and/or referral to specialist services for additional support (e.g. rehabilitation, Improving Access to Psychological Therapies (IAPT), peer support etc.).
Methods of rehabilitation delivery: this theme encapsulates the recommendations for how rehabilitation should be delivered and when. It is felt this is an opportunity to develop upon telerehabilitation and early rehabilitation services, including adaptations and flexibility when measuring pre and post rehabilitation outcomes. *"…programmes could be run online BUT need to ensure there is a supervised element and that access to, willingness to use and actual use are measured."*	**Flexibility in assessment:** recognising the inability to perform face to face consultations so adaptations to assessments are needed. Many psychometric measures can be delivered via telephone/video calls/online and alternative measures of exercise capacity can be done at home (e.g. grip strength, timed up and go, sit to stand etc.)
	Early/delayed rehabilitation there is debate about whether rehabilitation should be delivered early/later during a patient's recovery. Some respondents felt inpatient rehabilitation was appropriate, whereas others felt this would be too early for a patient's lungs and/or psychological status to have prepared for rehabilitation.
	Group-based rehabilitation: safety issues inhibit group-based rehabilitation as an option currently, however there is the option for virtual group sessions, or the delivery of these once social distancing measures have relaxed. These are important for social support, especially when people are feeling isolated and alone in their recovery.
	Referral and re-referral: the ability for anyone to refer to rehabilitation (e.g. self-referral and re-referral as per patient request). This needs to be a simple process which is widely known.
	Telerehabilitation: this is a popular and viable option for home-rehabilitation. This circumstance offers an opportunity to grow home-based rehabilitation services.

	Personalised rehabilitation: the need for patient-centred rehabilitation and not a one size fits all approach. There may be an opportunity to develop a multi-module rehabilitation service where modules can be selected if they are important to the patient's needs.
Components for COVID-19 rehabilitation: the components highlighted as important to a COVID-19 rehabilitation model. *"[I] feel strongly pts will struggle with post COVID standard exercise prog. For example look at problems recruiting to post COPD exacerbation PR. [I] feel should be replaced by physical activity prog plus something like yoga / tai chi or similar. If we disproportionately focus on the exercise - like we do in standard PR - only most motivated pts will complete and they will probably be the ones who would have gone away and exercised anyway."*	**Take guidance from established rehabilitation models:** we should look to use/adapt/learn from current models of rehabilitation and/or holistic care services (e.g. pulmonary/cardiac/neurological/palliative/post-intensive care rehabilitation, psychological support (e.g. IAPT, Cognitive Behavioural Therapy (CBT)), occupational therapy, music therapy, yoga/tai chi, SALT, community gyms, pastoral support, acupuncture, hydrotherapy).
	Education, exercise and social support: the proposed components for the new rehabilitation model include: 1. Education for self-management: cough, sputum clearance, breathlessness, fatigue, frailty, pain, psych wellbeing, behaviour change, impact of comorbidities, energy conservation, falls, improving function for daily activities, nutrition, inhaler technique, signposting, skin integrity, swallowing and voice care 2. Exercises (physical/psychological): - cognitive function, exercise programme, inspiratory muscle training, neurorehabilitation 3. Social support: - caregiver support, guidance in line with government recommendations, group activities to facilitate peer engagement
A team of specialist COVID-19 rehabilitation staff: the need for an interdisciplinary team to deliver rehabilitation. They need to have been trained appropriately/have specialist skills for this patient population. *"[We will need a] trained and expert team in rehabilitation medicine..."*	**Keep our staff physically safe:** the need to maintain the physical health of staff who deliver rehabilitation (e.g. COVID-19 testing for staff and patients, appropriate supply of PPE).
	Keep our staff psychologically safe: the monitoring of staff psychological wellbeing and the provision of psychological support to support their mental health.
The reassurance of financial support: recognition of the financial input and service support needed to develop, deliver and sustain this programme. It will need considerable financial engagement to ensure it can be rolled out nationally/internationally. *"The reality of available funding and staffing post COVID-19 pandemic should be taken into account when creating rehabilitation programs for patients. Most services were stretched prior to the outbreak and will struggle afterwards to deliver comprehensive services for patients who are being discharged."*	

Discussion

These data are the first from a comprehensive survey describing views from a large and diverse range of healthcare professionals about the rehabilitation needs of the post COVID-19 population. Given the scale of response in such a short time period there is clearly a pressing need to develop a coherent recovery programme for people who are discharged from hospital after being infected with COVID-19. There was wide engagement with the healthcare community to support the development of the most appropriate package of rehabilitation, having secured the opinion of over 1,000 respondents from a wide variety of professional backgrounds and specialities. The survey identified the important components of the immediate post discharge phase, an assessment for a holistic rehabilitation intervention and the components of this intervention. The comments box allowed us to enrich the survey data and support us in developing an appropriate recovery pathway for the post COVID-19 patient (Figure 4).

(Insert Figure 4)

Pulmonary rehabilitation programmes currently deliver a personalised package of exercise and education, integrating a broad group of healthcare professionals including but not limited to physiotherapists, nurses, dietitians, pharmacists, psychologists, physicians, occupational therapists, exercise physiologists and graduates of the programme. As reported by respondents, there is little appetite to 'reinvent the wheel' and develop a discreet single indication rehabilitation programme, rather there was a clear preference to adapt existing and established rehabilitation services to extend the scope to meet the needs of the post COVID-19 population. It was clear from the comments received that this needs to be collaborative and iterative as services become more experienced to meet the demands of this 'novel' group, recognising the complex symptom burden of many recovering from COVID-19.

Many components recommended are already core components of a pulmonary rehabilitation pathway, assessment and programme, however the survey gave clear guidance of the additional components required to maximise impact, these included advice and support at the time of discharge. This is an important aspect of the cardiac rehabilitation pathway after discharge from cardiac revascularisation or myocardial infarction with routine telephone follow up [18]. The advice in the early stages focuses on symptom management and returning to normal (with a focus on gentle exercise and employment/financial issues).

The assessment of the post COVID-19 patient at 6-8 weeks requires a much broader approach than commonly adopted by pulmonary programmes, specifically screening for PTSD and fatigue as a discreet symptom. PTSD is reported as a core outcome measure in the consensus statement for the follow up of ICU survivors [19]. This report indicated that consensus was achieved for measures of mood, quality of life and PTSD, whilst exercise capacity and cognition almost reached consensus. It is beyond the scope of this survey to indicate the most appropriate outcome measures for the rehabilitation of the post COVID-19 population but there would seem a great deal of logic in combining the core measures of pulmonary rehabilitation with the outcomes recommended in the post ICU population. Interestingly the conduct of a face to face assessment, was recommended by 68%, circumstances where face to face assessments are challenging and require adherence to strict infection control processes. This is reflected in the free text comments with respect to service users and providers safety concerns. Additional comments from the survey identified the importance of measuring cognition, and importantly the need for integration with social care and SALT. The timing and the modes of delivery was a discreet theme, and issues such as the feasibility of a face to face assessment and the need to be flexible in the current environment, with digital/telehealth solutions being highlighted as options. A sub-theme arose identifying the need for clear guidance. Previous international literature has described pulmonary rehabilitation services supporting recovery in other

respiratory epidemics (SARS)[4] but the survey rightly reflects the need to collaborate with a much wider interdisciplinary team to offer the best service to patients post COVID-19. There is now emerging evidence from national and international societies stating a pulmonary rehabilitation framework will need to be adapted to suit the recovery needs of the COVID-19 individual ([20,21]

This work highlights the real need for rehabilitating the post COVID-19 population and is strengthened by the large number of respondents, however, we acknowledge a large proportion of these were physiotherapists and female which limits our scope for generalising the results to all relevant specialities. Furthermore, 25% of respondents had no experience of managing COVID-19 patients and 31% had no experience of rehabilitation. Additionally, we did not consider the views of patients, carers or the public; this is currently being undertaken by the British Lung Foundation[22]. These two surveys taken together should support guidance on the provision of rehabilitation services for the post COVID-19 patient.

It would seem that there is a real opportunity to develop a structured interdisciplinary rehabilitation programme that addresses the complex needs of the post COVID-19 population, including those who had a period on ICU through to those managed in the community. The provision of post ICU rehabilitation although recommended[23] is poorly provided[24]. A potential and desirable legacy of this pandemic is to raise the provision of post ICU care. However, it is important that capacity development is supported, as to not compromise the service for those who routinely access these established rehabilitation programmes.

However, the more immediate challenge is to deliver a recovery pathway for those individuals who are being discharged now and for all those who have been discharged over the last few weeks with a diagnosis of COVID-19. We should use this survey data to inform service delivery and work collaboratively across specialties and professions to deliver a comprehensive recovery package for the COVID-19 population. Whilst of course retaining the high quality of service delivered to the usual case load of individuals with chronic respiratory disease.

Conclusion

This data on over 1,000 respondents reflects the interest in the field of rehabilitation and the urgent need to adapt existing services to meet the complex set of needs that COVID-19 patients. Overall there was high level of agreement for the components of an early intervention, the elements of assessment and the components of the subsequent rehabilitation programme. This pandemic presents a real opportunity for truly collaborative working across disciplines and specialities and should be an immediate priority to mitigate the long-term impact of COVID-19.

Figure 1: The essential components of an early phase recovery programme (first few weeks after discharge/episode)

Figure 2: The essential components of an assessment at 6-8weeks post hospital (step down unit) discharge

Figure 3: The essential components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge

Figure 4: Recovery pathway for patients recovering from COVID-19

Authors contribution

SS, NJG, CB GJ and JRH contributed to the conception and design of the study. LP, AB and SS analysed the data. SS and AB interpreted the data. SS and AB drafted the manuscript and all authors critically revised for significant intellectual content and insight. All authors had full access to all of the data and can take responsibility for the integrity and accuracy of data analysis. In addition, all authors gave final approval of the manuscript version for publication. SS and AB are responsible for the overall content as guarantors.

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Competing interests

All authors have completed the Unified Competing Interests Form at http://www.icmje.org.coi_disclosure.pdf

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Data sharing statement

No additional data are available.

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References

1 Huang C, Wang Y, Li X, *et al.* Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;**395**:497–506. doi:10.1016/S0140-6736(20)30183-5

2 Wang D, Hu B, Hu C, *et al.* Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA - J Am Med Assoc* 2020;**323**:1061–9. doi:10.1001/jama.2020.1585

3 Wang L, He W, Yu X, *et al.* Coronavirus disease 2019 in elderly patients: Characteristics and prognostic factors based on 4-week follow-up. *J Infect* Published Online First: 2020. doi:10.1016/j.jinf.2020.03.019

4 Hui DS, Joynt GM, Wong KT, *et al.* Impact of severe acute respiratory syndrome (SARS) on pulmonary function, functional capacity and quality of life in a cohort of survivors. *Thorax* 2005;**60**:401–9. doi:10.1136/thx.2004.030205

5 Luyt CE, Combes A, Becquemin MH, *et al.* Long-term outcomes of pandemic 2009 influenza A(H1N1)-associated severe ARDS. *Chest* 2012;**142**:583–92. doi:10.1378/chest.11-2196

6 Crisafulli E, Gorgone P, Vagaggini B, *et al.* Efficacy of standard rehabilitation in COPD outpatients with comorbidities. *Eur Respir J* 2010;**36**:1042–8. doi:10.1183/09031936.00203809

7 Vanfleteren LEGW, Spruit MA, Groenen M, *et al.* Clusters of Comorbidities Based on Validated Objective Measurements and Systemic Inflammation in Patients with Chronic Obstructive Pulmonary Disease. *Am J Respir Crit Care Med* 2013;**187**:728–35. doi:10.1164/rccm.201209-1665OC

8 Steiner M, McMillan V, Lowe D, Saleem Khan M, Holzhauer-Barrie J, Mortier K, Riordan J, CM R. National COPD Audit Programme Pulmonary rehabilitation: An exercise in improvement. 2018. doi:www.rcplondon.ac.uk/nacap

9 Zhou F, Yu T, Du R, *et al.* Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020;**395**:1054–62. doi:10.1016/S0140-6736(20)30566-3

10 Guan W, Liang W, He J, *et al.* Cardiovascular comorbidity and its impact on patients with Covid-19. *Eur Respir J* 2020;:2001227. doi:10.1183/13993003.01227-2020

11 Greenhalgh T, Knight M, A'Court C, *et al.* Management of post-acute covid-19 in primary care. *BMJ* 2020;**370**:m3026. doi:10.1136/bmj.m3026

12 Steiner M, Holzhauer-Barrie J, Lowe D, Searle L, Skipper E, Welham S RC. National COPD Audit Programme: Pulmonary Rehabilitation: Time to breathe better. 2015.

13 Docherty AB, Harrison EM, Green CA, *et al.* Features of 16,749 hospitalised UK patients with COVID-19 using the ISARIC WHO Clinical Characterisation Protocol. *medRxiv* 2020;:2020.04.23.20076042. doi:10.1101/2020.04.23.20076042

14 Azoulay E, Vincent JL, Angus DC, *et al.* Recovery after critical illness: Putting the puzzle together-a consensus of 29. Crit. Care. 2017;**21**. doi:10.1186/s13054-017-1887-7

15 Hsieh MJ, Lee WC, Cho HY, *et al.* Recovery of pulmonary functions, exercise capacity, and quality of life after pulmonary rehabilitation in survivors of ARDS due to severe influenza A (H1N1) pneumonitis. *Influenza Other Respi Viruses* 2018;**12**:643–8. doi:10.1111/irv.12566

16 ERS. In the line of duty | European Respiratory Society. https://www.ersnet.org/covid-19-blog (accessed 4 May 2020).

17 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101. doi:10.1191/1478088706qp063oa

18 Dalal HM, Doherty P, Taylor RS. Cardiac rehabilitation. *BMJ* 2015;**351**:h5000. doi:10.1136/BMJ.H5000

19 Needham DM, Sepulveda KA, Dinglas VD, *et al.* Core outcome measures for clinical research in acute respiratory failure survivors an international modified delphi consensus study. *Am J Respir Crit Care Med* 2017;**196**:1122–30. doi:10.1164/rccm.201702-0372OC

20 Singh, SJ; Bolton, C; Nolan, C; Harvey-Dunstand, T; Connolly B; Man, W; Walker P. Delivering rehabilitation to patients surviving COVID-19 using an adapted pulmonary rehabilitation approach – BTS guidance. 2020. https://www.brit-thoracic.org.uk/document-library/quality-improvement/covid-19/pulmonary-rehabilitation-for-covid-19-patients/

21 Spruit MA, Holland AE, Singh SJ, *et al.* COVID-19: Interim Guidance on Rehabilitation in the Hospital and Post-Hospital Phase from a European Respiratory Society and American Thoracic Society-coordinated International Task Force. *Eur Respir J* 2020;:2002197. doi:10.1183/13993003.02197-2020

22 Post-COVID Survey (28/04/2020). https://auk2016.typeform.com/to/LlhQXR (accessed 7 May 2020).

23 National Institute for Heath and Care Excellence, NICE. Rehabilitation after critical illness in adults. *Natl Inst Heal Care Excell* 2009;**CG83**:1–27. doi:http://dx.doi.org/10.1001/jama.2015.9496

24 Connolly B, Douiri A, Steier J, *et al.* A UK survey of rehabilitation following critical illness: implementation of NICE Clinical Guidance 83 (CG83) following hospital discharge. *BMJ Open* 2014;**4**:4963. doi:10.1136/bmjopen-2014-004963

Figure 1: The essential components of an early phase recovery programme (first few weeks after discharge/episode)

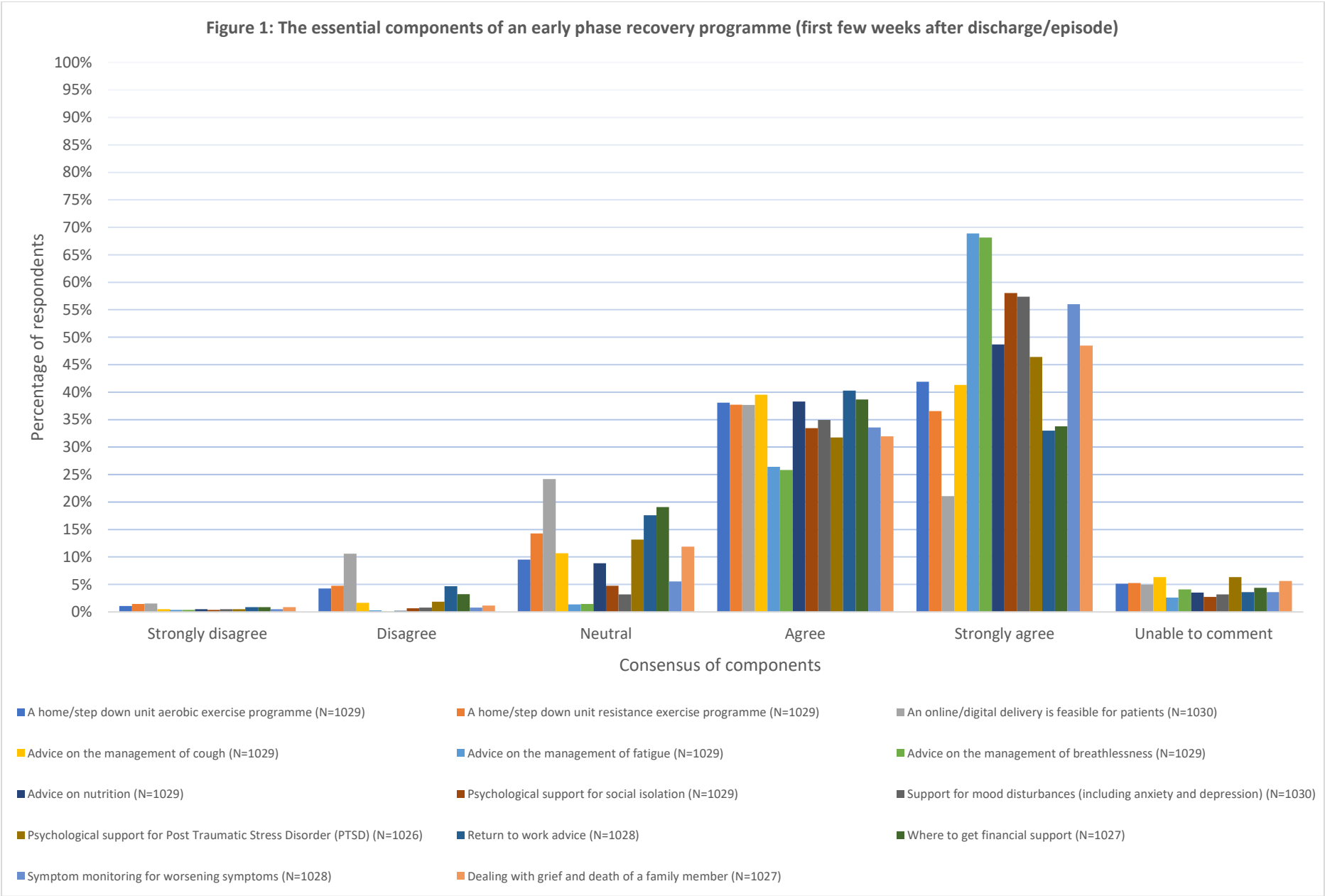


Figure 2: The essential components of an assessment at 6-8weeks post hospital (step down unit) discharge

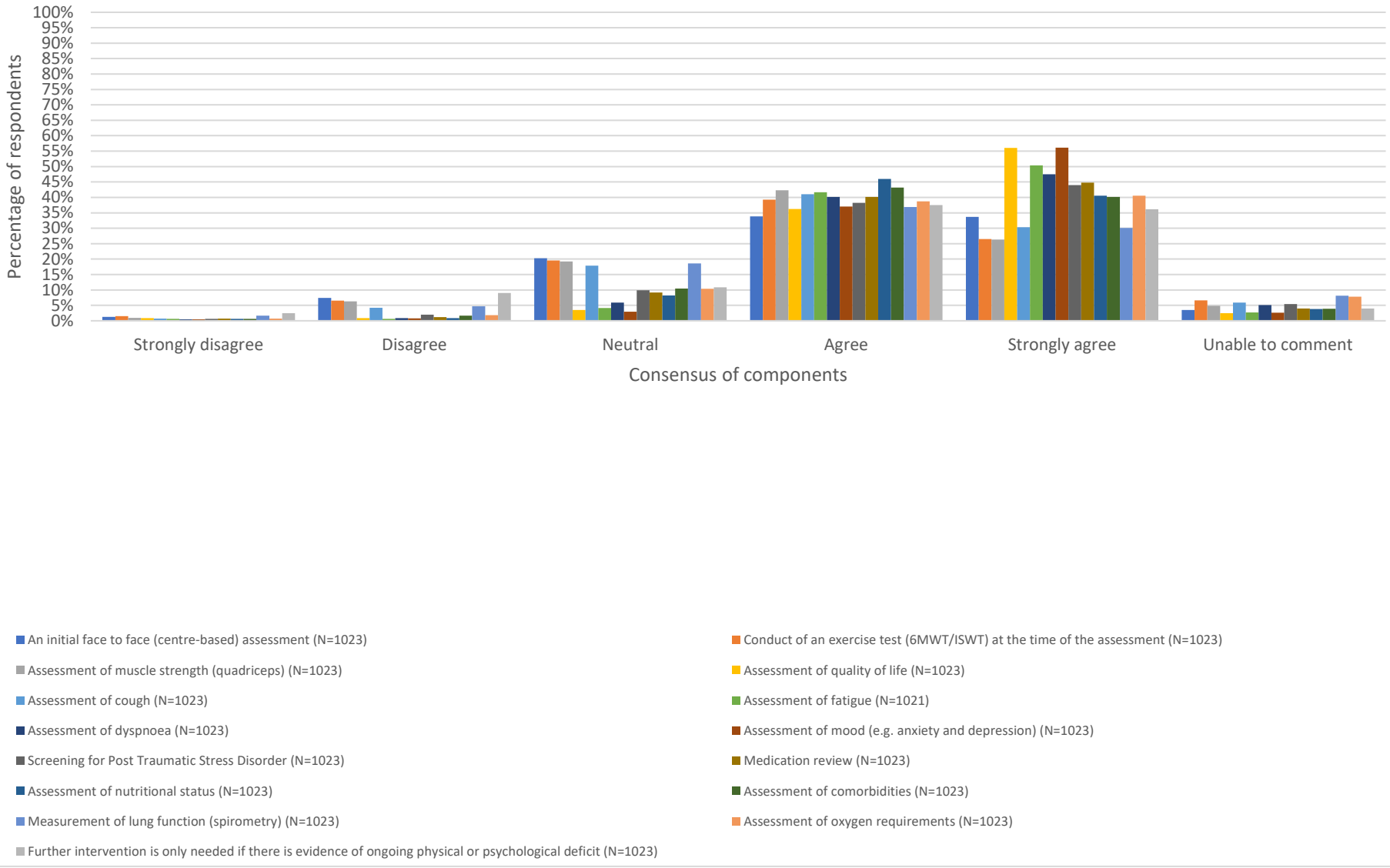
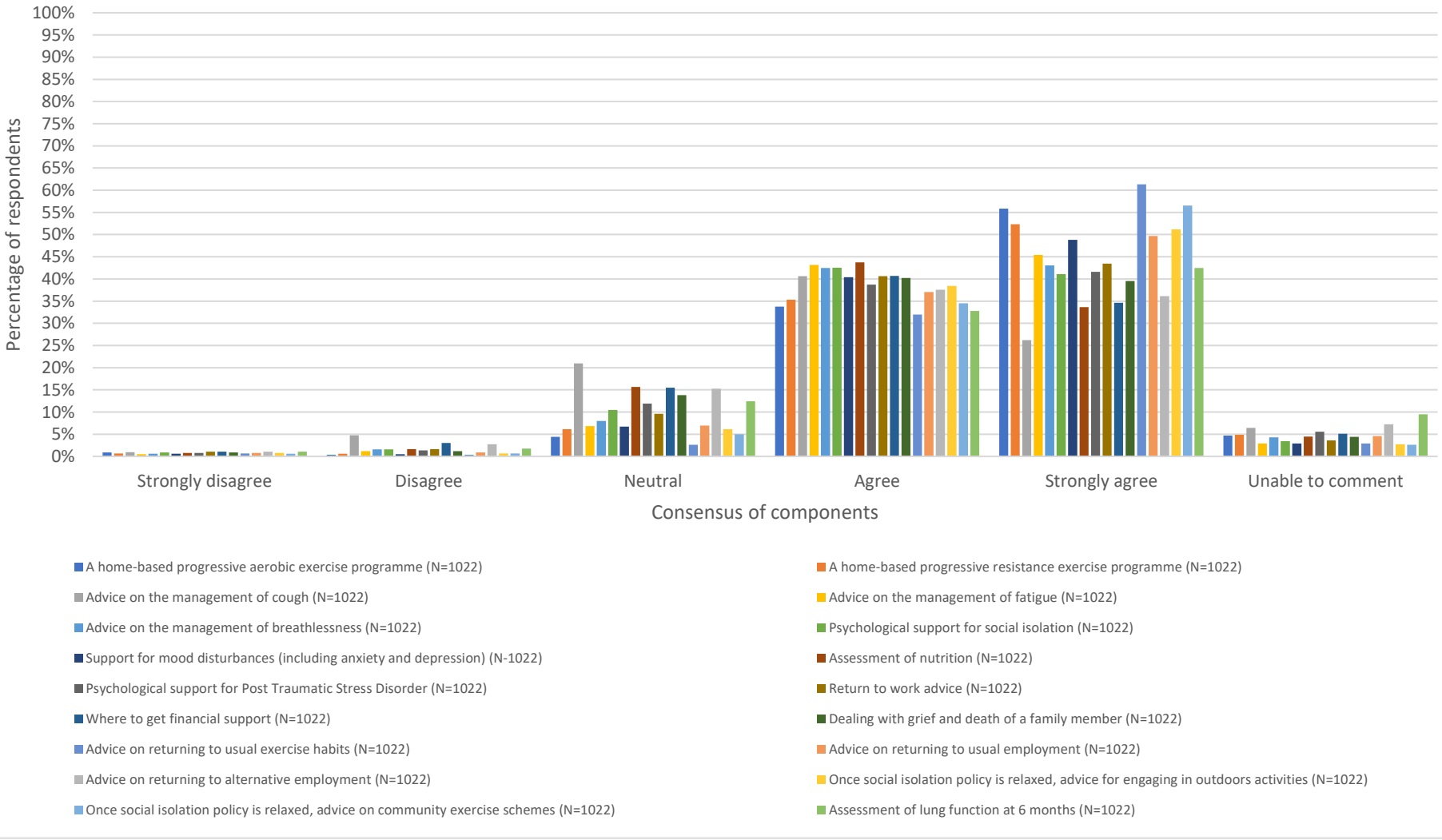


Figure 3: The essntial components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge



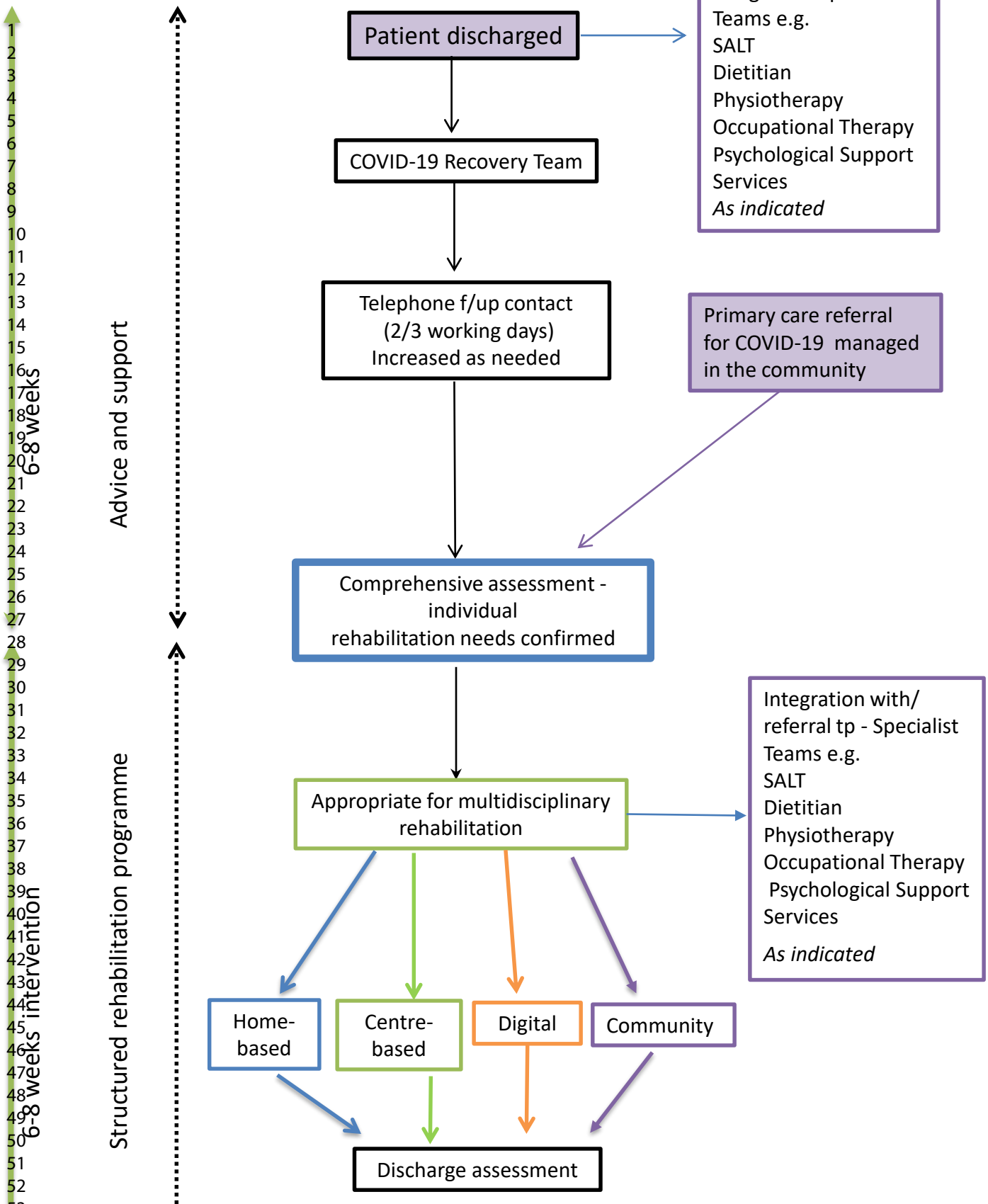


Figure 4: Recovery pathway for patients recovering from COVID-19

Support of people recovering from Covid-19

We are developing guidance on the care of all people recovering from COVID-19, following either a hospital discharge or a managed episode in the community.

We would appreciate your opinion on various components of a support package focusing on recovery; the package at this stage would have a focus on the delivery of a holistic rehabilitation-based intervention. All data collected will be anonymised.

We are also hoping to secure views from those who have first-hand experience of treating COVID-19.

We hope the questionnaire should take less than five minutes of your time, and will help inform what might be the best approach to support people recovering from COVID-19.

We have identified a range of components that may be included in a recovery programme. We would like you to indicate whether you think these are essential components of the package.

Please complete this by Wednesday 15 April.

Could you please tell us a little bit about you? This informs the data collected and will not be used to identify individual responses in any way.

1. **What is your gender?**
   - Male
   - Female
   - Prefer not to say

2. **What age are you?**
   - 18-24
   - 25-34
   - 35-44
   - 45-54
   - 55-64
   - 65+
   - Prefer not to say

3. **What is your ethnicity?**
   - White British
   - White Irish
   - Gypsy/Irish Traveller
   - Any other White Background

- White and Black Caribbean
- White and Black African
- White and Asian
- Any other mixed/ multiple ethnic background
- Indian
- Bangladeshi
- Pakistani
- Chinese
- Any other Asian background
- African
- Caribbean
- Any other black background
- Arab
- Any other ethnic group
- Not stated
- Prefer not to say

4. To what speciality do you belong?

- Anaesthetics
- General Medicine
- Acute Medicine
- Respiratory
- Cardiac
- Healthcare of the Elderly
- Primary Care
- Sports and Exercise
- Psychology
- Psychiatry
- Other, please specify

5. What is your professional status?

- Consultant physician
- Trainee physician
- Nurse
- Physiotherapist

- Physician associate
- Speech and language therapist
- Occupational therapist
- Healthcare assistant
- Primary care physician
- Dietician
- Other, please specify

6. Where are you based/in what environment do you work?

- Acute hospital
- Community hospital/service
- Private hospital
- Primary care
- Other, please specify

7. In what country/continent do you work?

- England
- Scotland
- Wales
- Northern Ireland
- Rest of Europe
- North America
- South America
- Australasia
- Asia
- Africa
- Prefer not to say

8. **Have you been involved in the care of people with COVID-19?**

Please select all that apply

- Yes – ITU
- Yes – Acute Medical Ward
- Yes – step down unit
- Yes – Community
- No

- Other, please specify

9. Are you routinely employed as part of a rehabilitation programme?

- Please select all that apply
- Yes – pulmonary rehabilitation
- Yes – cardiac rehabilitation
- Yes – healthcare of the eldery
- No

Other – please specify

For the following questions, respondents were asked to give one of the following answers Strongly disagree, Disagree, Neutral, Agree, Strongly Agree, Unable to comment

10. The essential components of an early phase recovery programme (first few weeks after discharge/episode) recovery programme are:

- A home/step down unit aerobic exercise programme
- A home/step down unit resistance exercise programme
- An online/digital delivery is feasible for patients
- Advice on the management of cough
- Advice on the management of fatigue
- Advice on the management of breathlessness
- Advice on nutrition
- Psychological support for social isolation
- Support for mood disturbances (including anxiety and depression)
- Psychological support for Post Traumatic Stress Disorder (PTSD)
- Return to work advice
- Where to get financial support
- Symptom monitoring for worsening symptoms
- Dealing with grief and death of a family member

11. The essential components of an assessment at 6-8 weeks post hospital (step down unit) discharge are:

- An initial face to face (centre-based) assessment
- Conduct of an exercise test (6MWT/ISWT) at the time of the assessment
- Assessment of muscle strength (quadriceps)

- Assessment of quality of life
- Assessment of cough
- Assessment of fatigue
- Assessment of dyspnoea
- Assessment of mood (e.g. anxiety and depression)
- Screening for Post Traumatic Stress Disorder
- Medication review
- Assessment of nutritional status
- Assessment of comorbidities
- Measurement of lung function (spirometry)
- Assessment of oxygen requirements
- Further intervention is only needed if there is evidence of ongoing physical or psychological deficit

12. The essential components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge are:

- A home-based progressive aerobic exercise programme
- A home-based progressive resistance exercise programme
- Advice on the management of cough
- Advice on the management of fatigue
- Advice on the management of breathlessness
- Psychological support for social isolation
- Support for mood disturbances (including anxiety and depression)
- Assessment of nutrition
- Psychological support for Post Traumatic Stress Disorder
- Return to work advice
- Where to get financial support
- Dealing with grief and death of a family member
- Advice on returning to usual exercise habits
- Advice on returning to usual employment
- Advice on returning to alternative employment
- Once social isolation policy is relaxed, advice for engaging in outdoors activities
- Once social isolation policy is relaxed, advice on community exercise schemes
- Assessment of lung function at 6 months

13. Please provide your email address

This will only be used to contact you for clarification regarding your answers

14. Do you have any further comments or suggestions?

Supplementary Table: Generated themes and sub-themes from the survey's free text comments (expanded table)	
Theme	**Sub-theme(s)**
A collaborative effort for rehabilitation development To develop this model of rehab a collaborative effort is needed from experts within the field and around the world. We can learn from international findings, current models of rehab and the specialists that deliver them. The following staff were identified as important for the development of this new model of rehabilitation: pulmonary/cardiac/neurological rehabilitation teams, dieticians, psychologists, respiratory consultants, respiratory and muscular skeletal physiotherapists, nurses, occupational therapists, speech and language therapists. *"I feel an effective service can only be designed if all specialists within the MDT are part of the development stage: physio, OT, dietitian, nurse, SLT, psychologist and any other relevant member, by contacting their professional associations directly."*	**Clear guidance for COVID-19 management** There is an identified need for clear guidance and protocols for COVID-19 management, including COVID-19 rehabilitation. *"I would love to see a nationally agreed follow-up programme rather than being trust specific as this would lead to huge variation."*
	A campaign to promote COVID-19 rehabilitation It is important to raise awareness of the COVID-19 rehabilitation service across population (service providers, referrers, patients/carers). There are suggestions to advertise it as a health promotion programme to normalise it as part of recovery on TV, radio etc. *"And/or big public health campaign to ensure people are aware about rehabilitation."*
Continued learning from COVID-19 for service development It will be important to collate data for the development of the COVID-19 rehabilitation service, its evaluation and research into overall COVID-19 management. This theme acknowledges the iterative process of refining the rehabilitation service as new information comes to light and how this will inform future pandemics. *"I think we need to understand the demographics of covid survivors, as service planning for post-covid rehab without understanding transport availability, digital literacy, ongoing psychosocial / PTSD related issues, usual working status amongst other things could result in significant oversights of what these patients are able to, and want to, engage with."*	
COVID-19 patient management Overall patient management in COVID-19 recovery; including recommendations for inpatient and outpatient care.	**Managing the acute phase** Recommendations for inpatient care; including assessment of physical and psychological wellbeing to inform personalised follow up care plans, and upon discharge, the provision of a discharge bundle of assessments and advice/documentation about self-management and support for carers/family. *"I think thorough assessment will highlight those patients requiring specific intervention and early treatment will minimise long term problems."* *"I feel patients would benefit from clear discharge booklet that explains what COVID 19 is and what to expect symptom wise for patients and families. When to contact doctor and some management advise like breathing exercises and strengthening exercises."*
	Early phase of recovery Recommendations for continued outpatient follow up; including physical/psychological assessment, individualised advice on symptom management and/or referral to specialist services for additional support (e.g. rehabilitation, IAPT, peer support etc.) *"Nutrition intervention important esp if underlying conditions prior to covid19/elderly/frail."*

	"The 'Aftershock' isn't necessarily immediate. You can experience the euphoria of having cheated death, which may go on for some weeks/months. However, when reality hits, it can hit hard, literally overnight. Some warning that it could happen and somewhere to turn to is very important, be it professional or peer support. Long term support, the recognition that PTSD or at least anxiety/depression is a very likely outcome, is I think essential."
Methods of rehabilitation delivery This theme encompasses the recommendations for how rehabilitation should be delivered and when. It is felt this is an opportunity to develop upon telerehabilitation and early rehab/prehab services, including adaptations and flexibility when measuring pre and post rehabilitation outcomes.	**Flexibility in assessment** Recognising the inability to perform face to face consultations so adaptations to assessments are needed. Many psychometric measures can be delivered via telephone/video calls/online and alternative measures of exercise capacity can be done at home (e.g. grip strength, timed up and go, sit to stand etc.) *"Currently planning to use grip strength, 30s sit to stand, and probably repeated timed up and go (x5 or x10) as measures of function and outcome, as doing any sort of corridor walk test (6WT, ISWT or ESWT) not going to be practical, limited equipment to do cycle ergometry, and patient group too poor re: balance to do step tests."*
	Early/delayed rehabilitation There is debate about whether rehabilitation should be delivered early/later during a patient's recovery. Some respondents felt inpatient rehabilitation was appropriate, whereas others felt this would be too early for a patient's lungs and/or psychological status to have prepared for rehabilitation. *"…acute rehabilitation phase prior to people leaving hospital. Intensive inpatient rehabilitation supports discharge, and improved outcomes of people requiring subacute rehabilitation and community rehabilitation."* *"Thus far it seems that people need time to recover from the acute effects before starting more of a resp rehab programme."*
	Group-based rehabilitation Safety issues inhibit group-based rehabilitation as an option currently, however there is the option for virtual group sessions, or the delivery of these once social distancing measures have relaxed. These are important for social support, especially when people are feeling isolated and alone in their recovery. *"I consider face to face and group support essential not only for fitness but to manage the psychological impact of this illness."*
	Referral and re-referral The ability for anyone to refer to rehabilitation (e.g. self-referral and re-referral as per patient request). This needs to be a simple process which is widely known. *"Ensure pathway for referral is documented is essential as some of these clients will go home and be ok initially but 6 plus months down the track will not be back at baseline and require pulmonary rehab."*
	Telerehabilitation This is a popular and viable option for home-rehabilitation. This circumstance offers an opportunity to grow home-based rehabilitation services.

	"…programmes could be run online BUT need to ensure there is a supervised element and that access to, willingness to use and actual use are measured."
	Personalised rehabilitation The need for patient-centred rehabilitation and not a one size fits all approach. There may be an opportunity to develop a multi-module rehabilitation service where modules can be selected if they are important to the patient's needs. *"I feel that post COVID-19 support needs to be person-centred and tailored to the individual. All the components listed are important but some may be more relevant for some people than others. In order not to overwhelm survivors, undertake unnecessary assessment/interventions and make best use of resources, a specific and MDT recovery plan made in partnership with the person is key."*
Components for COVID-19 rehabilitation The components highlighted as important to a COVID-19 rehabilitation model.	**Take guidance from established rehabilitation models** We should look to use/adapt/learn from current models of rehabilitation and/or holistic care services. Suggestions include pulmonary/cardiac/neurological/palliative/post-intensive care rehabilitation, psychological support (e.g. IAPT, CBT), occupational therapy, music therapy, yoga/tai chi, speech & language therapy, community gyms, pastoral support, acupuncture, hydrotherapy. *"I feel that we have enough resources to sign post and or refer on as necessary, ie Cardiac and pulmonary mental health, SOHAS etc."* *"Yes - feel strongly pts will struggle with post COVID standard exercise prog. For example look at problems recruiting to post AECOPD PR. Feel should be replaced by physical activity prog plus something like yoga / tai chi or similar. If we disproportionately focus on the exercise - like we do in standard PR - only most motivated pts will complete and they will probably be the ones who would have gone away and exercised anyway."*
	Education, exercise and social support Proposed components for the new rehabilitation model, separated by education, exercise and social support: 1. Education for self-management with topics to include: cough, sputum clearance, breathlessness, fatigue, frailty, pain, psych wellbeing, behaviour change, impact of comorbidities, energy conservation, falls, improving function for daily activities, nutrition, inhaler technique, signposting, skin integrity, swallowing and voice care 2. Exercises (physical/psychological): - cognitive function, exercise programme, inspiratory muscle training, neurorehabilitation 3. Social support: - caregiver support, guidance in line with government recommendations, group activities to facilitate peer engagement
A team of specialist COVID-19 rehabilitation staff The need for an interdisciplinary team to deliver rehabilitation. They need to have been trained appropriately/have specialist skills for this patient population.	**Keep our staff physically safe** The need to maintain the physical health of staff who deliver rehabilitation (e.g. COVID-19 testing for staff and patients, appropriate supply of PPE).

We will need a *"trained and expert team in rehabilitation medicine..."*	*"Please make sure staff who work in any settings have appropriate PPE for doing any face to face consultations with patients."*
	Keep our staff psychologically safe The monitoring of staff psychological wellbeing and the provision of psychological support to support their mental health. *"We should also, and I feel this very strongly indeed, should be assessed ourselves for signs of any signs of distress or psychological trauma, and rapidly be offered help and support to allow us, the members of the society, to survive this experience in ways which allow us to heal as individuals, and grow as clinicians."*
The reassurance of financial support Recognition of the financial input and service support needed to develop, deliver and sustain this programme. It will need considerable financial engagement to ensure it can be rolled out nationally/internationally. *"The reality of available funding and staffing post covid19 pandemic should be taken into account when creating rehabilitation programs for patients. Most services were stretched prior to the outbreak and will struggle afterwards to deliver comprehensive services for patients who are being discharged."*	

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The British Thoracic Society survey of rehabilitation to support recovery of the post COVID-19 population

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The British Thoracic Society survey of rehabilitation to support recovery of the post COVID-19 population.

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Abstract (296 words)

Objectives

A proportion of those recovering from Coronavirus Disease 19 (COVID-19) are likely to have significant and ongoing symptoms, functional impairment and psychological disturbances. There is an immediate need to develop a safe and efficient discharge process and recovery programme. Established rehabilitation programmes are well placed to deliver a programme for this group but will most likely need to be adapted for the post COVID-19 population. The purpose of this survey was to rapidly identify the components of a post COVID-19 rehabilitation assessment and elements of a successful rehabilitation programme that would be required to deliver a comprehensive service for those post COVID-19 to inform service delivery.

Design

A survey comprising of a series of closed questions and a free text comments box allowing for a qualitative analysis.

Setting

Online survey.

Participants

Multi-professional clinicians, across specialities were invited to take part.

Results

1031 participants responded from a broad range of specialities. There was overwhelming support for an early post hospital discharge recovery programme to advise patients about the management of fatigue (95% agreed/ strongly agreed), breathlessness (94%), and mood disturbances (including symptoms of anxiety and depression) 92%. At the 6-8-week time point an assessment was considered important, focusing on a broad range of possible symptoms and supporting a return to work. Recommendations for the intervention described a holistic programme focusing on symptom management, return of function and return to employment. The free text comments added depth to the survey and the need 'not to reinvent the wheel' rather adapt well established rehabilitation services to individually tailor needs based care with continued learning for service development.

Conclusion

The responses indicate a huge interest and the urgent need to establish a programme to support and mitigate the long-term impact of COVID-19, by optimising and individualising existing rehabilitation programmes.

Strengths and limitations

- Large and comprehensive survey conducted to guide the provision of post COVID-19 assessment and rehabilitation.
- The survey provides clear recommendations for the provision of advice and support immediately upon discharge.
- The survey provides recommendations for a programme of holistic rehabilitation 6-8 weeks post discharge based upon the existing rehabilitation models.
- 71% of respondents were physiotherapists and 84% of respondents were female, limiting the generalisability of results to all relevant specialties.
- 25% respondents had no experience of managing patients with COVID-19 and 31% had no experience of rehabilitation.

Background

Since December 2019, the global Coronavirus Disease 19 (COVID-19) pandemic has already resulted in tens of thousands of people being admitted to hospital for acute medical management, a proportion of whom will have had a prolonged stay on Intensive Care Units (ICU). Those discharged from ICU are likely to exhibit significant on-going symptoms notably dyspnoea, fatigue and cough, functional impairment and psychological disturbances[1–3]. The larger cohort of people discharged after ward based care, or managed in the community, are also likely to experience similar problems.

Although we have limited COVID-19 data so far, literature from the Severe Acute Respiratory Syndrome (SARS) outbreak would suggest that there is a considerable impact upon the individual with reduced functional performance and health status even at 6 months post discharge compared to normal values[4,5].

There is a pressing need to develop a safe and efficient discharge process to support patients in the early phase of recovery and to set up a mechanism to review these individuals early in the post discharge phase to facilitate care planning, onward referral, restoration of pre-morbid function, holistic well-being and participation in family, community and work life. Furthermore any pathway should be accessible to those who remained in the community to manage their COVID-19 infection but have had a slow and incomplete recovery.

There are existing rehabilitation pathways that assess and manage the rehabilitation needs of patients with long term conditions notably cardiac and pulmonary rehabilitation pathways. These services accommodate patients with multiple co-morbidities, including chronic respiratory disease, cardiovascular, mental health and metabolic diseases[6,7]. There is a strong evidence base demonstrating that a centre-based supervised out-patient programme of education and physical activity, impacts upon symptom burden e.g. breathlessness, anxiety, depression, health status and exercise capacity. As an example, pulmonary rehabilitation is an interdisciplinary intervention that integrates a broad group of health care professionals including but not limited to physiotherapists, nurses, dietitians, pharmacists, psychologists, physicians, occupational therapists, exercise physiologists and graduates of the programme. The provision of pulmonary rehabilitation is demonstrably successful in clinical practice outside the context of research studies.UK data from over 7000 cases has been collected and reported as part of the National Asthma and COPD Audit Programme (Pulmonary Rehabilitation)[8]. Furthermore, patients frequently have multiple long-term conditions that do not compromise the outcome, the common comorbidities recorded in the chronic respiratory population mirror those that have been reported in the COVID-19 population of hypertension, diabetes and cardiovascular disease[9,10].Additionally, a recent review proposed that

a referral to a pulmonary rehabilitation programme for the post COVID-19 individual who remains symptomatic, is appropriate[11].

However, the rehabilitation needs of the post COVID-19 population are likely more diverse than those commonly observed in pulmonary and cardiac rehabilitation programmes. Early data from Wuhan in China indicates that the mean age of people hospitalised with COVID-19 was 52(45–58) years[9] compared to 69(60-78) years reported for a conventional pulmonary rehabilitation programme[12]. Although data from the United Kingdom International Severe Acute Respiratory and Emerging Infection Consortium (UK ISARIC) registry of 16,749 COVID-19 admissions indicates the median age is 72(57-82) years[13], more typical of the pulmonary rehabilitation population. However, given the widespread nature of the pandemic there will be a substantial number of younger patients, included in those admitted to ICU, and in some of the post COVID-19 patients their pre-morbid state is likely to be quite different. Many may not have pre-existing lung disease, and likely different levels of employment, usual levels of activity and exercise behaviours. Furthermore, there is an indication the post COVID-19 population is likely to have significant psychological and cognitive impairment particularly if management involved a stay on ICU[14]. There is some evidence indicating that pulmonary rehabilitation interventions in the SARS population and Acute Respiratory Distress Syndrome (ARDS) are effective[15]. We postulated that whilst the core of pulmonary rehabilitation would in part meet the needs of the post COVID-19 patient, the programme would likely need to be adapted. The modifications would primarily be at the point of assessment to broaden the scope to holistically assess the impact of COVID-19 and secondly to address the components of a comprehensive programme which considers the psychological and mental health needs of patients in recovery.

Therefore the purpose of this survey was to rapidly identify the additional components of a post-COVID-19 rehabilitation assessment, and elements of a successful rehabilitation programme that would be required to deliver a comprehensive service for those either discharged from hospital post COVID-19, or for those managed in the community with marked ongoing symptoms that prevent a full recovery.

Methods

We conducted a survey of multi-professional clinicians. The survey was designed in collaboration with the British Thoracic Society (BTS) and a team with expertise in pulmonary and cardiac rehabilitation and the wider management of respiratory disease. The survey was predominately composed of closed questions, with a free text box at the end of the survey for additional

comments. The survey was built by the team at the BTS using ClassApps software. The survey was tested by local teams experienced in rehabilitation prior to the wider launch.

The initial stages of the survey asked for basic demographic information from the participants to include age, gender, ethnicity, professional background, location of work and exposure to patients with, or recovering from COVID-19 (the full survey is available in Supplementary File 1).

The purpose was to gain wide clinical consensus as to what an effective, holistic rehabilitation intervention might comprise for patients recovering from COVID-19. The survey aimed to secure guidance for rehabilitation support provided in two phases:

- The initial discharge period (which may be to home, a step-down unit or a rehabilitation facility).
- A formal rehabilitation programme that would be offered 6-8 weeks post rehabilitation. This time period is based upon evidence accumulated by an ad-hoc task force formed by the American Thoracic Society (ATS)/European Respiratory Society (ERS) with a supporting document[16].

For these sections of the survey there was a statement and participants were invited to respond with the following five categories: 'strongly disagree', 'disagree', 'neutral', 'agree' or 'strongly agree'. There was also the option to respond, 'unable to comment'.

Upon completion of the survey there was an additional free text box for further comments. No questions were mandatory.

Patient and public involvement

No patient involvement.

Survey distribution

The survey was available to participants from 9th April 2020 to 15th April 2020. 7 days access covered a bank holiday, scheduled workdays and a weekend which maximised opportunities to complete the survey. It was distributed to members of the BTS via the societies' e-newsletter and healthcare professionals via the BTS Twitter account. A reminder email was sent to BTS members 6 days later, a reminder to participate was retweeted by society members and the BTS encouraging both BTS members and healthcare professionals to participate and share the survey with colleagues. The

survey was not restricted to UK based healthcare professionals, although country of practice was noted on the survey.

Participation in the survey was voluntary and anonymous. Participants confirmed their willingness to engage in this research by accessing and completing the online survey. As the survey was directed towards healthcare professionals there was no patient or public involvement.

Data analysis

Quantitative data were reported as counts and percentages for each category of the demographic and survey responses. At least 70% agreement on directionality (combining strongly agree and agree) was defined as the threshold for consensus.

Qualitative data were analysed using Thematic Analysis [17]. The text data was uploaded to NVivo 12 Pro and then coded and grouped into themes to portray patterns within the data. The established themes were reviewed by the first author and the finalised themes were defined.

Ethical approval was not required for this survey from either the UK Health Research Authority or leading Research and Development Centre. Completion of the survey was an indication of willingness to participate and implied consent. We set no threshold for response over such a short period of time but were anticipating around 300 responses across a range of healthcare professionals to allow the questionnaire to be considered robust and representative of those in the field.

Results

This report is based on data from 1031 respondents. A further 750 respondents only provided answers to the demographic questions on page 1 and therefore do not form part of this report, however, their demographics are consistent with the results presented below. The majority of respondents were female (84%), the largest age group was 35-44 years (34%), followed by 45-54 years (27%) and 25-34 years (22%). A significant majority identified as white British (75%), with any other white background, white Irish and Indian representing 7%, 6% and 5% of the participants respectively. The largest group of respondents were from England (80%), with Scotland representing 6% of respondents, Wales 4%, Northern Ireland 3% and the remainder from the rest of Europe, Australasia and South America. Respiratory (32%) represented the largest known group by specialism, followed by Health Care of the Elderly (12%), Primary Care (7%) Acute Medicine (6%) and

Sport & Exercise (5%) with smaller numbers from cardiology, general medicine, anaesthetics, psychiatry and psychology backgrounds. However, 34% recorded 'Other' backgrounds which included neurology (n=44), critical care (n=26) and musculoskeletal (n=56)). Physiotherapists represented the largest group (71%), dietitians, nurses and consultant physicians represented 7%, 6% and 6% respectively, smaller numbers of occupational therapists, speech and language therapists, trainee physicians and healthcare assistants participated. The majority worked in either secondary care hospital (45%) or community hospitals/services (28%), with fewer responses from either primary care or private hospitals, 17% of 'others' were represented by the private (industry) sector, universities, the community (excluding hospitals) and hospices. The final two profiling questions allowed for more than one response, in total there were 1420 responses as to whether or not they had experience in managing patients with COVID-19. 361 (25%) respondents had no experience, the remainder had experience on acute wards (n=332; 23%), Intensive Care Units (n=257; 18%), community (n=209; 15%) and step-down units (n=154; 11%). With respect to rehabilitation, 442 (31%) respondents had no experience, 216 (15%) had experience in pulmonary rehabilitation, 208 (15%) had experience in Health Care of the Elderly, 52 (4%) in cardiac rehabilitation and 202 (14%) in other forms of rehabilitation. Of the 1030 respondents, 167 (16%) had no experience of managing patients with COVID-19 or rehabilitation.

Recommendations for the early phase of COVID-19 recovery

The first section of the survey addressed the immediate post discharge phase. That is, care or advice delivered in the home, in a step-down unit or in a rehabilitation hospital/ward. Items that reached the threshold for recommendation for the early phase recovery programme are displayed in Figure 1. All but one proposed survey items (online/digital delivery) were recommended for the early phase of COVID-19 recovery. There was overwhelming support for early post discharge from hospital phase of the recovery programme to advise patients about the management of fatigue (95% agreed or strongly agreed), breathlessness (94%), and mood disturbances (including symptoms of anxiety and depression) 92%. In recognition of the current UK community 'lockdown' there was clear agreement to provide support for coping with social isolation (91%). At this early stage in the recovery process there were less strong recommendations about cough management, delivery of an exercise programme or support for post-traumatic stress disorder (PTSD) but these comfortably exceeded the 70% threshold, at 81%, 80% and 78% respectively. Advice provided on a digital platform failed to reach the 70% threshold (59%), with 24.2% being neutral. This question provided the largest 'neutral response'.

(Insert Figure 1)

Recommendations for assessment at 6-8 weeks post hospital discharge

The essential components that reached consensus of an assessment at 6-8 weeks post episode/hospital (or step down unit) discharge are displayed in Figure 2. There was strong support for the assessment of mood (93% strongly agreed or agreed), quality of life (92%) and fatigue (92%). The assessment of cough just reached the 70% threshold with 71% recommending assessment. Advice with respect to returning to work (73%) and financial support (72%) were not rated as highly although also exceeded the 70% threshold. The items which did not reach consensus were the need for a face to face assessment, assessment of exercise capacity/muscle strength and the need for a measure of lung function with 68%, 66% and 69% of the survey participants respectively recommending these factors as an important part of the assessment.

(Insert Figure 2)

Recommendations for the components of a rehabilitation recovery programme for COVID-19

The essential components which reached consensus for the later phase of recovery (6-8 weeks post discharge/episode and following the assessment outline above) are displayed in Figure 3. The most frequently recommended items included advice on returning to usual exercise habits (93% either strongly agreeing or agreeing), 91% recommending advice on community exercise schemes, and given the 'lockdown' at the time of writing advice on community exercise schemes (once social isolation policy is relaxed) and advice for engaging in outdoors activities (once social isolation policy is relaxed) were highly rated (91% and 93% respectively) by respondents. Similarly exercise advice for home based aerobic and resistance programmes were highly rated (90% and 88% respectively). Symptom management was rated with advice on the management of fatigue and support for mood disturbances (including anxiety and depression) being equally strong recommended at 89%. Advice on the management of breathlessness was marginally less at 86%. Advice on the management of cough did not reach the 70% threshold at 6-8 weeks post discharge, with the largest number of respondents reporting to be 'neutral' for this question compared to any other question in this particular section (21%). The impact upon employment was also rated highly, advice on returning to usual employment (87%), where to get financial support advice (75%) and advice on returning to alternative employment (74%). Support for some unique aspects of COVID -19 and the current lockdown were also rated highly, psychological support for social isolation 84%, dealing with grief and death of a family member 80% and psychological support for PTSD 80%. Assessment of lung function at 6 months post discharge was endorsed by 75% of respondents.

(Insert Figure 3)

Recommendations from the free text comments

A total of 341 free text comments were recorded and analysed. These informed seven themes and 16 sub-themes. See Table 1 for illustrative quotes (expanded tables in Supplementary File 2).

A large proportion of the results complimented the quantitative findings; however, additional service and treatment priorities were proposed. Firstly, respondents recognised that 'A collaborative effort for rehabilitation development' would be essential with input from experts in pulmonary/cardiac rehabilitation, nutrition, psychology, neurology, physiotherapy, respiratory medicine, occupational therapy and speech and language therapy (SALT), alongside recently published research from across the globe. Respondents felt there was a need to produce clear guidance for COVID-19 management, including this rehabilitation model, and there should be an educational campaign to promote COVID-19 rehabilitation, raise its profile amongst patients, carers and referrers and embed it within the COVID-19 recovery pathway.

Secondly, respondents recognised the uniqueness of this pandemic and therefore highlighted the importance of continued learning from COVID-19 for service development. It was recognised this would be an iterative process as services adapt to meet the new demands and service evaluations and research develop an evidence-based model.

Thirdly, alongside the early phase of recovery, suggestions for managing the acute phase were presented. Respondents highlighted the importance of assessing a patient's physical and psychological wellbeing to inform personalised care plans. They also wanted to see a robust COVID-19 discharge bundle of self-management materials for both patients and caregivers.

The fourth theme comprised comments relating to the appropriate methods of rehabilitation delivery. Respondents felt this was an opportunity to adapt and improve current pulmonary rehabilitation models to meet the new demands and accommodate social distancing measures. For example, respondents suggested using pre and post outcome measures that could be assessed virtually (flexibility in assessment), using tele-rehabilitation with virtual group-based rehabilitation to maintain peer support. A personalised rehabilitation programme involving the assessment of patients' care needs to inform a tailored rehabilitation plan from a menu of rehabilitation modules was proposed. There was debate about the timing of rehabilitation with some respondents leaning towards inpatient rehabilitation to minimise functional loss and others towards outpatient rehabilitation to allow time for immediate physical and psychological recovery. Access to rehabilitation was also acknowledged, with respondents highlighting the need for a clear referral pathway that healthcare professionals and patients can refer and re-refer to as necessary.

As a fifth theme, respondents proposed the necessary components for COVID-19 rehabilitation. There was acknowledgement of the effectiveness of current rehabilitation and holistic care pathways and therefore a desire not to reinvent the wheel, rather build on guidance from established rehabilitation models. Notably pulmonary rehabilitation, but other suggested models of care to consider and complement might include cardiac rehabilitation, neurorehabilitation, cognitive behavioural therapy, palliative rehabilitation, SALT, music therapy, yoga/tai chi, acupuncture, pastoral support and hydrotherapy. The majority of individual components recommended for a COVID-19 rehabilitation programme mirrored the quantitative findings, however, the following topics were also presented as care priorities: sputum clearance, frailty, pain, behaviour change, the impact of comorbidities, energy conservation, falls, inhaler technique, skin integrity, swallowing and voice care, cognitive functioning, inspiratory muscle training, caregiver support, signposting and peer support through group activities.

The sixth theme identified respondents wanting to see a team of specialist COVID-19 rehabilitation staff to deliver this new model. This is to include an interdisciplinary team who have specialist skills for this patient group. Additionally, respondents felt it was important to keep our staff physically safe, for example, by ensuring an appropriate supply of personal protective equipment (PPE) and the mental well-being of staff by monitoring and providing appropriate support when indicated to maintain the psychological health of the workforce.

Finally, respondents articulated the need for reassurance of financial support to ensure the robust development and delivery of this new rehabilitation model. They felt this support needed to be secured nationally to ensure equality and continuity of the service.

Table 1: Generated themes and sub-themes from the survey's free text comments

Theme	Sub-theme(s)
A collaborative effort for rehabilitation development: to develop this model a collaborative effort is needed from experts within the field and around the world. We can learn from international findings, current models of rehabilitation and the specialists that deliver them (e.g. pulmonary/cardiac/neurological rehabilitation teams, dieticians, psychologists, respiratory consultants, respiratory and muscular skeletal physiotherapists, nurses, occupational therapists, speech and language therapists). *"I feel an effective service can only be designed if all specialists within the multi-disciplinary team are part of the development stage: physio, occupational therapist, dietitian, nurse, speech and language therapist, psychologist and any other relevant member…"*	**Clear guidance for COVID-19 management:** there is an identified need for clear guidance and protocols for COVID-19 management, including COVID-19 rehabilitation.
	A campaign to promote COVID-19 rehabilitation: it is important to raise awareness of the COVID-19 rehabilitation service across populations (service providers, referrers, patients/carers). There are suggestions to advertise it as a health promotion programme to normalise it as part of recovery on TV, radio etc.
Continued learning from COVID-19 for service development: it will be important to collate data for the development of the COVID-19 rehabilitation service, its evaluation and research into overall COVID-19 management. This theme acknowledges the iterative process of refining the rehabilitation service as new information comes to light and how this will inform future pandemics. *"I think we need to understand the demographics of COVID survivors, as service planning for post-COVID rehab without understanding transport availability, digital literacy, ongoing psychosocial / PTSD related issues, usual working status amongst other things could result in significant oversights of what these patients are able to, and want to, engage with."*	
COVID-19 patient management: overall patient management in COVID-19 recovery; including recommendations for inpatient and outpatient care. *"The 'Aftershock' isn't necessarily immediate. You can experience the euphoria of having cheated death, which may go on for some weeks/months. However, when reality hits, it can hit hard, literally overnight. Some warning that it could happen and somewhere to turn to is very important..."*	**Managing the acute phase:** recommendations for inpatient care; including assessment of physical and psychological wellbeing to inform personalised follow up care plans, and upon discharge, the provision of a discharge bundle of assessments and advice/documentation about self-management and support for carers/family.
	Early phase of recovery: recommendations for continued outpatient follow up; including physical/psychological assessment, individualised advice on symptom management and/or referral to specialist services for additional support (e.g. rehabilitation, Improving Access to Psychological Therapies (IAPT), peer support etc.).
Methods of rehabilitation delivery: this theme encapsulates the recommendations for how rehabilitation should be delivered and when. It is felt this is an opportunity to develop upon telerehabilitation and early rehabilitation services, including adaptations and flexibility when measuring pre and post rehabilitation outcomes. *"…programmes could be run online BUT need to ensure there is a supervised element and that access to, willingness to use and actual use are measured."*	**Flexibility in assessment:** recognising the inability to perform face to face consultations so adaptations to assessments are needed. Many psychometric measures can be delivered via telephone/video calls/online and alternative measures of exercise capacity can be done at home (e.g. grip strength, timed up and go, sit to stand etc.)
	Early/delayed rehabilitation there is debate about whether rehabilitation should be delivered early/later during a patient's recovery. Some respondents felt inpatient rehabilitation was appropriate, whereas others felt this would be too early for a patient's lungs and/or psychological status to have prepared for rehabilitation.
	Group-based rehabilitation: safety issues inhibit group-based rehabilitation as an option currently, however there is the option for virtual group sessions, or the delivery of these once social distancing measures have relaxed. These are important for social support, especially when people are feeling isolated and alone in their recovery.
	Referral and re-referral: the ability for anyone to refer to rehabilitation (e.g. self-referral and re-referral as per patient request). This needs to be a simple process which is widely known.
	Telerehabilitation: this is a popular and viable option for home-rehabilitation. This circumstance offers an opportunity to grow home-based rehabilitation services.

	Personalised rehabilitation: the need for patient-centred rehabilitation and not a one size fits all approach. There may be an opportunity to develop a multi-module rehabilitation service where modules can be selected if they are important to the patient's needs.
Components for COVID-19 rehabilitation: the components highlighted as important to a COVID-19 rehabilitation model. *"[I] feel strongly pts will struggle with post COVID standard exercise prog. For example look at problems recruiting to post COPD exacerbation PR. [I] feel should be replaced by physical activity prog plus something like yoga / tai chi or similar. If we disproportionately focus on the exercise - like we do in standard PR - only most motivated pts will complete and they will probably be the ones who would have gone away and exercised anyway."*	**Take guidance from established rehabilitation models:** we should look to use/adapt/learn from current models of rehabilitation and/or holistic care services (e.g. pulmonary/cardiac/neurological/palliative/post-intensive care rehabilitation, psychological support (e.g. IAPT, Cognitive Behavioural Therapy (CBT)), occupational therapy, music therapy, yoga/tai chi, SALT, community gyms, pastoral support, acupuncture, hydrotherapy).
	Education, exercise and social support: the proposed components for the new rehabilitation model include: 1. Education for self-management: cough, sputum clearance, breathlessness, fatigue, frailty, pain, psych wellbeing, behaviour change, impact of comorbidities, energy conservation, falls, improving function for daily activities, nutrition, inhaler technique, signposting, skin integrity, swallowing and voice care 2. Exercises (physical/psychological): - cognitive function, exercise programme, inspiratory muscle training, neurorehabilitation 3. Social support: - caregiver support, guidance in line with government recommendations, group activities to facilitate peer engagement
A team of specialist COVID-19 rehabilitation staff: the need for an interdisciplinary team to deliver rehabilitation. They need to have been trained appropriately/have specialist skills for this patient population. *"[We will need a] trained and expert team in rehabilitation medicine..."*	**Keep our staff physically safe:** the need to maintain the physical health of staff who deliver rehabilitation (e.g. COVID-19 testing for staff and patients, appropriate supply of PPE).
	Keep our staff psychologically safe: the monitoring of staff psychological wellbeing and the provision of psychological support to support their mental health.
The reassurance of financial support: recognition of the financial input and service support needed to develop, deliver and sustain this programme. It will need considerable financial engagement to ensure it can be rolled out nationally/internationally. *"The reality of available funding and staffing post COVID-19 pandemic should be taken into account when creating rehabilitation programs for patients. Most services were stretched prior to the outbreak and will struggle afterwards to deliver comprehensive services for patients who are being discharged."*	

Discussion

These data are the first from a comprehensive survey describing views from a large and diverse range of healthcare professionals about the rehabilitation needs of the post COVID-19 population. Given the scale of response in such a short time period there is clearly a pressing need to develop a coherent recovery programme for people who are discharged from hospital after being infected with COVID-19. There was wide engagement with the healthcare community to support the development of the most appropriate package of rehabilitation, having secured the opinion of over 1,000 respondents from a wide variety of professional backgrounds and specialities. The survey identified the important components of the immediate post discharge phase, an assessment for a holistic rehabilitation intervention and the components of this intervention. The comments box allowed us to enrich the survey data and support us in developing an appropriate recovery pathway for the post COVID-19 patient (Figure 4) integrating with the wider multidisciplinary team.

(Insert Figure 4)

Pulmonary rehabilitation programmes currently deliver a personalised package of exercise and education, integrating a broad group of healthcare professionals including but not limited to physiotherapists, nurses, dietitians, pharmacists, psychologists, physicians, occupational therapists, exercise physiologists and graduates of the programme. As reported by respondents, there is little appetite to 'reinvent the wheel' and develop a discreet single indication rehabilitation programme, rather there was a clear preference to adapt existing and established rehabilitation services to extend the scope to meet the needs of the post COVID-19 population. It was clear from the comments received that this needs to be collaborative and iterative as services become more experienced to meet the demands of this 'novel' group, recognising the complex symptom burden of many recovering from COVID-19.

Many constituents recommended are already core components of a pulmonary rehabilitation pathway, assessment and programme, however the survey gave clear guidance of the additional components required to maximise impact, these included advice and support at the time of discharge. This is an important aspect of the cardiac rehabilitation pathway after discharge from cardiac revascularisation or myocardial infarction with routine telephone follow up [18]. The advice in the early stages focuses on symptom management and returning to normal (with a focus on gentle exercise and employment/financial issues).

The assessment of the post COVID-19 patient at 6-8 weeks requires a much broader approach than commonly adopted by pulmonary programmes, specifically screening for PTSD and fatigue as a discreet symptom. PTSD is reported as a core outcome measure in the consensus statement for the follow up of ICU survivors [19]. This report indicated that consensus was achieved for measures of mood, quality of life and PTSD, whilst exercise capacity and cognition almost reached consensus. It is beyond the scope of this survey to indicate the most appropriate outcome measures for the rehabilitation of the post COVID-19 population but there would seem a great deal of logic in combining the core measures of pulmonary rehabilitation with the outcomes recommended in the post ICU population. Interestingly the conduct of a face to face assessment, was recommended by 68%, circumstances where face to face assessments are challenging and require adherence to strict infection control processes. This is reflected in the free text comments with respect to service users and providers safety concerns. Additional comments from the survey identified the importance of measuring cognition, and importantly the need for integration with social care and SALT. The timing and the modes of delivery was a discreet theme, and issues such as the feasibility of a face to face assessment and the need to be flexible in the current environment, with digital/telehealth solutions being highlighted as options. Moving forwards, digital solutions may be important to increase capacity and give patients choice [20]. A sub-theme arose identifying the need for clear guidance.

Previous international literature has described pulmonary rehabilitation services supporting recovery in other respiratory epidemics (SARS)[4] but the survey rightly reflects the need to collaborate with a much wider interdisciplinary team to offer the best service to patients post COVID-19. There is now emerging evidence from national and international societies stating a pulmonary rehabilitation framework will need to be adapted to suit the recovery needs of the COVID-19 individual ([21,22]

This work highlights the real need for rehabilitating the post COVID-19 population and is strengthened by the large number of respondents, however, we acknowledge a large proportion of these were physiotherapists and female which limits our scope for generalising the results to all relevant specialities. Furthermore, 25% of respondents had no experience of managing COVID-19 patients and 31% had no experience of rehabilitation. Additionally, we did not consider the views of patients, carers or the public; this is currently being undertaken by the British Lung Foundation[23]. These two surveys taken together should support guidance on the provision of rehabilitation services for the post COVID-19 patient.

It would seem that there is a real opportunity to develop a structured interdisciplinary rehabilitation programme that addresses the complex needs of the post COVID-19 population, including those who had a period on ICU through to those managed in the community. The provision of post ICU rehabilitation although recommended[24] is poorly provided[25]. A potential and desirable legacy of this pandemic is to raise the provision of post ICU care. However, it is important that capacity development is supported, as to not compromise the service for those who routinely access these established rehabilitation programmes.

However, the more immediate challenge is to deliver a recovery pathway for those individuals who are being discharged now and for all those who have been discharged over the last few weeks with a diagnosis of COVID-19. We should use this survey data to inform service delivery and work collaboratively across specialties and professions to deliver a comprehensive recovery package for the COVID-19 population. Whilst of course retaining the high quality of service delivered to the usual case load of individuals with chronic respiratory disease.

Conclusion

This data on over 1,000 respondents reflects the interest in the field of rehabilitation and the urgent need to adapt existing services to meet the complex set of needs that COVID-19 patients. Overall there was high level of agreement for the components of an early intervention, the elements of assessment and the components of the subsequent rehabilitation programme. This pandemic

presents a real opportunity for truly collaborative working across disciplines and specialities and should be an immediate priority to mitigate the long-term impact of COVID-19.

Figure 1: The essential components of an early phase recovery programme (first few weeks after discharge/episode)

Figure 2: The essential components of an assessment at 6-8weeks post hospital (step down unit) discharge

Figure 3: The essential components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge

Figure 4: Recovery pathway for patients recovering from COVID-19

Authors contribution

SS, NJG, CB GJ and JRH contributed to the conception and design of the study. LP, AB and SS analysed the data. SS and AB interpreted the data. SS and AB drafted the manuscript and all authors critically revised for significant intellectual content and insight. All authors had full access to all of the data and can take responsibility for the integrity and accuracy of data analysis. In addition, all authors gave final approval of the manuscript version for publication. SS and AB are responsible for the overall content as guarantors.

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Competing interests

All authors have completed the Unified Competing Interests Form at http://www.icmje.org.coi_disclosure.pdf

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References

1 Huang C, Wang Y, Li X, *et al.* Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;**395**:497–506. doi:10.1016/S0140-6736(20)30183-5

2 Wang D, Hu B, Hu C, *et al.* Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA - J Am Med Assoc* 2020;**323**:1061–9. doi:10.1001/jama.2020.1585

3 Wang L, He W, Yu X, *et al.* Coronavirus disease 2019 in elderly patients: Characteristics and prognostic factors based on 4-week follow-up. *J Infect* Published Online First: 2020. doi:10.1016/j.jinf.2020.03.019

4 Hui DS, Joynt GM, Wong KT, *et al.* Impact of severe acute respiratory syndrome (SARS) on pulmonary function, functional capacity and quality of life in a cohort of survivors. *Thorax* 2005;**60**:401–9. doi:10.1136/thx.2004.030205

5 Luyt CE, Combes A, Becquemin MH, *et al.* Long-term outcomes of pandemic 2009 influenza A(H1N1)-associated severe ARDS. *Chest* 2012;**142**:583–92. doi:10.1378/chest.11-2196

6 Crisafulli E, Gorgone P, Vagaggini B, *et al.* Efficacy of standard rehabilitation in COPD outpatients with comorbidities. *Eur Respir J* 2010;**36**:1042–8. doi:10.1183/09031936.00203809

7 Vanfleteren LEGW, Spruit MA, Groenen M, *et al.* Clusters of Comorbidities Based on Validated Objective Measurements and Systemic Inflammation in Patients with Chronic Obstructive Pulmonary Disease. *Am J Respir Crit Care Med* 2013;**187**:728–35. doi:10.1164/rccm.201209-1665OC

8 Steiner M, McMillan V, Lowe D, Saleem Khan M, Holzhauer-Barrie J, Mortier K RJ, CM R. National COPD Audit Programme Pulmonary rehabilitation: An exercise in improvement. 2018. doi:www.rcplondon.ac.uk/nacap

9 Zhou F, Yu T, Du R, *et al.* Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020;**395**:1054–62. doi:10.1016/S0140-6736(20)30566-3

10 Guan W, Liang W, He J, *et al.* Cardiovascular comorbidity and its impact on patients with Covid-19. *Eur Respir J* 2020;:2001227. doi:10.1183/13993003.01227-2020

11 Greenhalgh T, Knight M, A'Court C, *et al.* Management of post-acute covid-19 in primary care. *BMJ* 2020;**370**:m3026. doi:10.1136/bmj.m3026

12 Steiner M, Holzhauer-Barrie J, Lowe D, Searle L, Skipper E, Welham S RC. National COPD Audit Programme: Pulmonary Rehabilitation: Time to breathe better. 2015.

13 Docherty AB, Harrison EM, Green CA, *et al.* Features of 16,749 hospitalised UK patients with COVID-19 using the ISARIC WHO Clinical Characterisation Protocol. *medRxiv* 2020;:2020.04.23.20076042. doi:10.1101/2020.04.23.20076042

14 Azoulay E, Vincent JL, Angus DC, *et al.* Recovery after critical illness: Putting the puzzle together-a consensus

of 29. Crit. Care. 2017;**21**. doi:10.1186/s13054-017-1887-7

15 Hsieh MJ, Lee WC, Cho HY, *et al.* Recovery of pulmonary functions, exercise capacity, and quality of life after pulmonary rehabilitation in survivors of ARDS due to severe influenza A (H1N1) pneumonitis. *Influenza Other Respi Viruses* 2018;**12**:643–8. doi:10.1111/irv.12566

16 ERS. In the line of duty | European Respiratory Society. https://www.ersnet.org/covid-19-blog (accessed 4 May 2020).

17 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101. doi:10.1191/1478088706qp063oa

18 Dalal HM, Doherty P, Taylor RS. Cardiac rehabilitation. *BMJ* 2015;**351**:h5000. doi:10.1136/BMJ.H5000

19 Needham DM, Sepulveda KA, Dinglas VD, *et al.* Core outcome measures for clinical research in acute respiratory failure survivors an international modified delphi consensus study. *Am J Respir Crit Care Med* 2017;**196**:1122–30. doi:10.1164/rccm.201702-0372OC

20 NHS England. NHS England » NHS to offer 'long covid' sufferers help at specialist centres. 2020.https://www.england.nhs.uk/2020/10/nhs-to-offer-long-covid-help/ (accessed 20 Oct 2020).

21 Singh, SJ; Bolton, C; Nolan, C; Harvey-Dunstand, T; Connolly B; Man, W; Walker P. Delivering rehabilitation to patients surviving COVID-19 using an adapted pulmonary rehabilitation approach – BTS guidance. 2020. https://www.brit-thoracic.org.uk/document-library/quality-improvement/covid-19/pulmonary-rehabilitation-for-covid-19-patients/

22 Spruit MA, Holland AE, Singh SJ, *et al.* COVID-19: Interim Guidance on Rehabilitation in the Hospital and Post-Hospital Phase from a European Respiratory Society and American Thoracic Society-coordinated International Task Force. *Eur Respir J* 2020;:2002197. doi:10.1183/13993003.02197-2020

23 Post-COVID Survey (28/04/2020). https://auk2016.typeform.com/to/LlhQXR (accessed 7 May 2020).

24 National Institute for Heath and Care Excellence, NICE. Rehabilitation after critical illness in adults. *Natl Inst Heal Care Excell* 2009;**CG83**:1–27. doi:http://dx.doi.org/10.1001/jama.2015.9496

25 Connolly B, Douiri A, Steier J, *et al.* A UK survey of rehabilitation following critical illness: implementation of NICE Clinical Guidance 83 (CG83) following hospital discharge. *BMJ Open* 2014;**4**:4963. doi:10.1136/bmjopen-2014-004963

Figure 1: The essential components of an early phase recovery programme (first few weeks after discharge/episode)

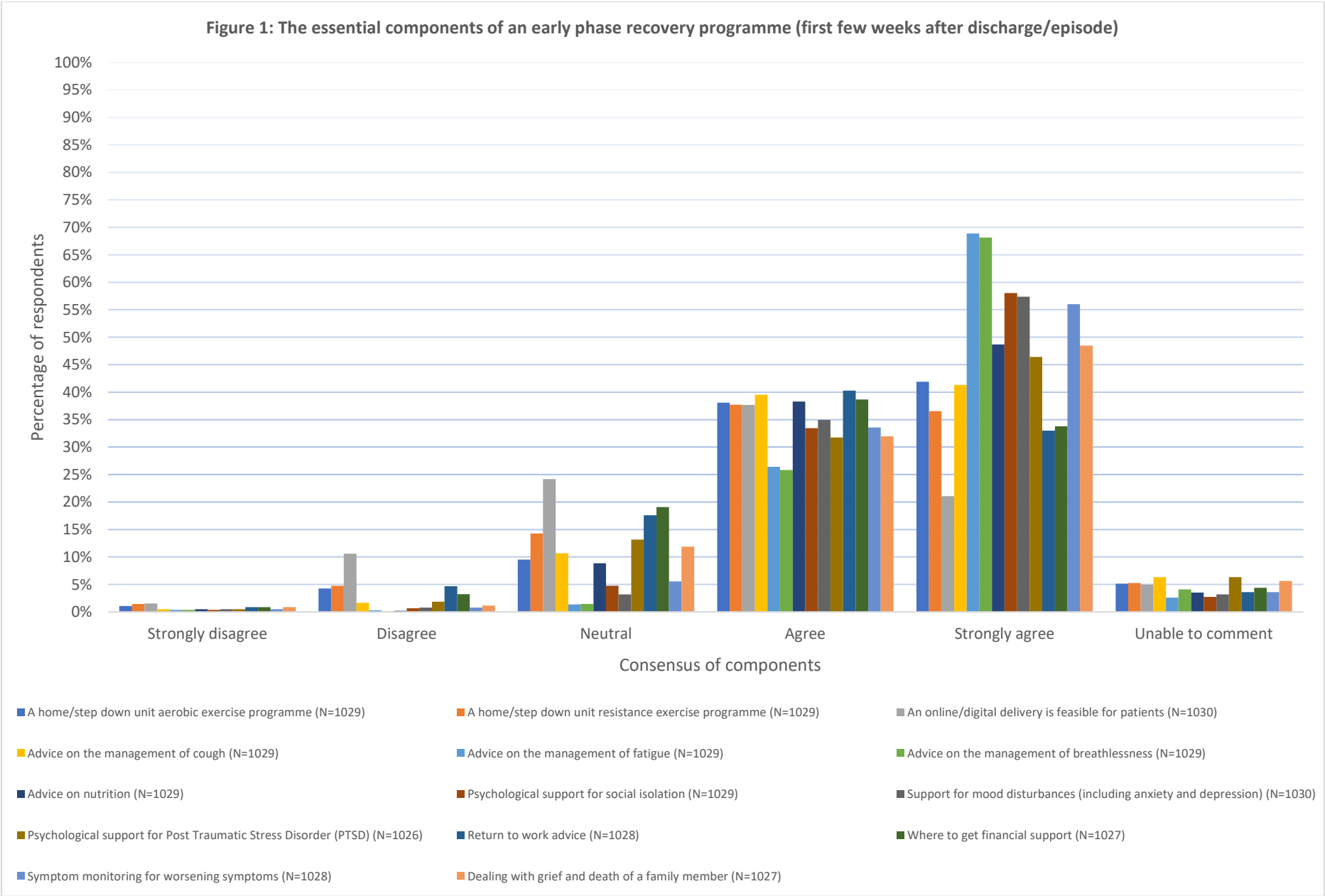


Figure 2: The essential components of an assessment at 6-8weeks post hospital (step down unit) discharge

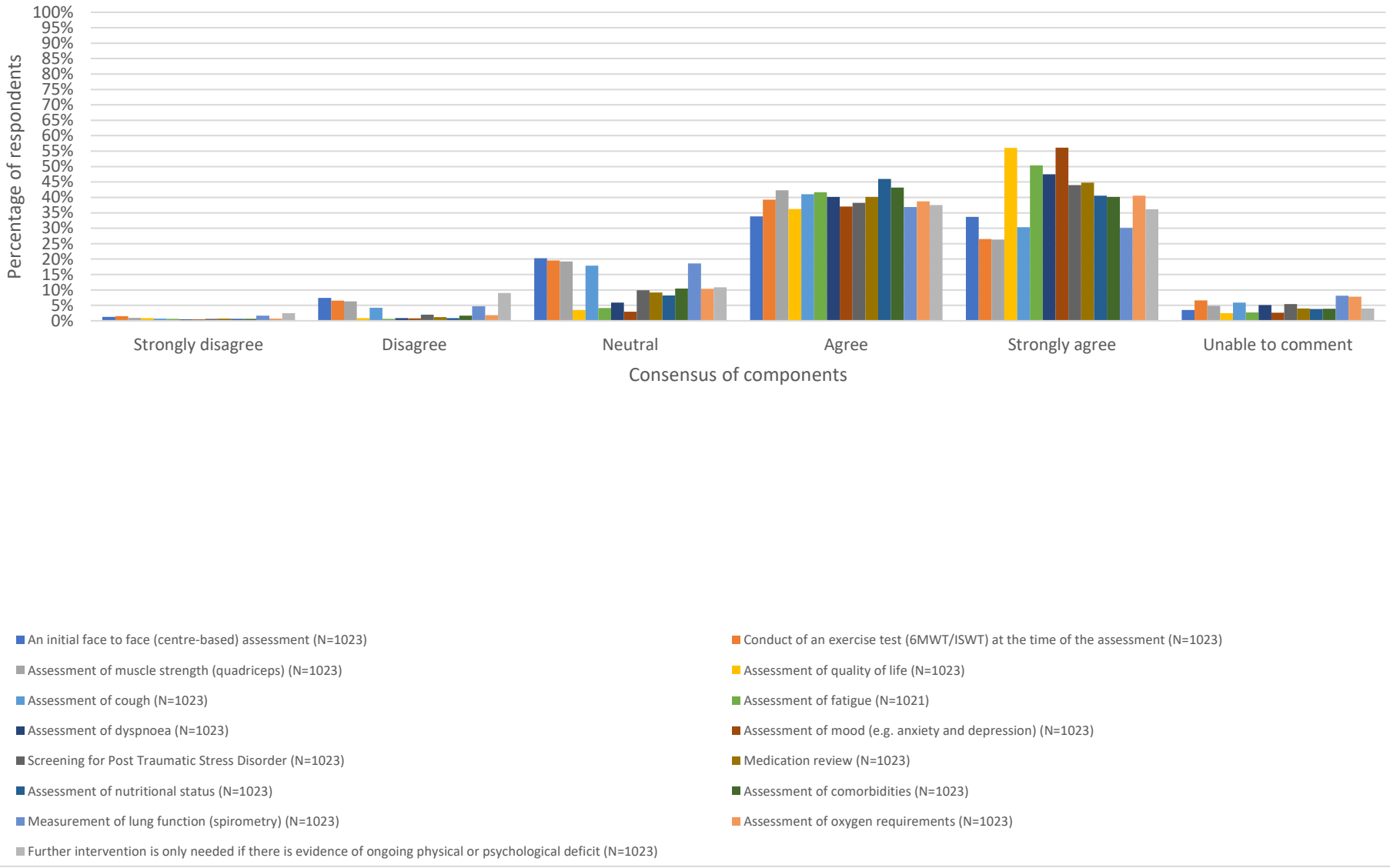
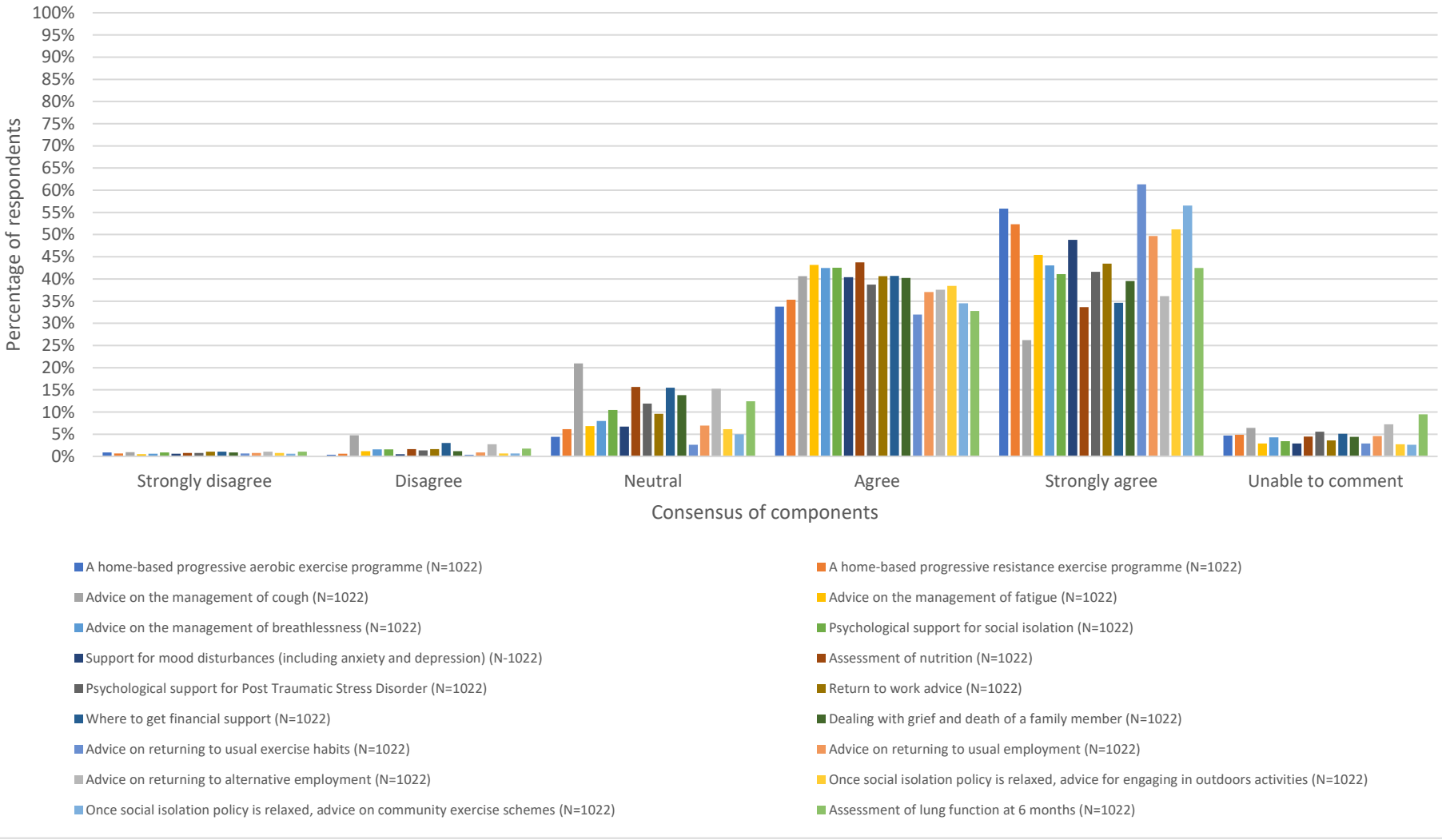


Figure 3: The essntial components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge



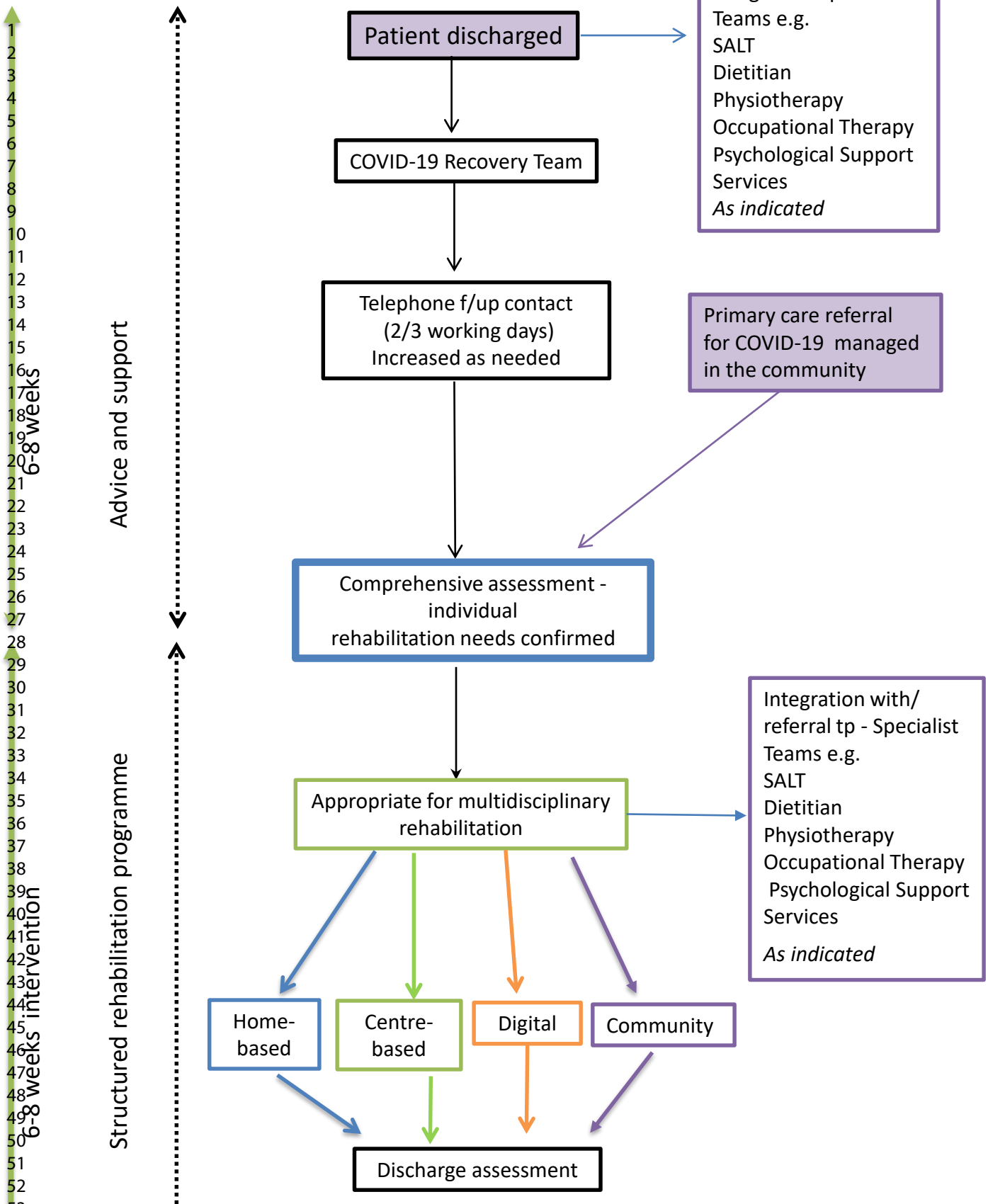


Figure 4: Recovery pathway for patients recovering from COVID-19

Support of people recovering from Covid-19

We are developing guidance on the care of all people recovering from COVID-19, following either a hospital discharge or a managed episode in the community.

We would appreciate your opinion on various components of a support package focusing on recovery; the package at this stage would have a focus on the delivery of a holistic rehabilitation-based intervention. All data collected will be anonymised.

We are also hoping to secure views from those who have first-hand experience of treating COVID-19.

We hope the questionnaire should take less than five minutes of your time, and will help inform what might be the best approach to support people recovering from COVID-19.

We have identified a range of components that may be included in a recovery programme. We would like you to indicate whether you think these are essential components of the package.

Please complete this by Wednesday 15 April.

Could you please tell us a little bit about you? This informs the data collected and will not be used to identify individual responses in any way.

1. **What is your gender?**
   - Male
   - Female
   - Prefer not to say

2. **What age are you?**
   - 18-24
   - 25-34
   - 35-44
   - 45-54
   - 55-64
   - 65+
   - Prefer not to say

3. **What is your ethnicity?**
   - White British
   - White Irish
   - Gypsy/Irish Traveller
   - Any other White Background

- White and Black Caribbean
- White and Black African
- White and Asian
- Any other mixed/ multiple ethnic background
- Indian
- Bangladeshi
- Pakistani
- Chinese
- Any other Asian background
- African
- Caribbean
- Any other black background
- Arab
- Any other ethnic group
- Not stated
- Prefer not to say

4. To what speciality do you belong?

- Anaesthetics
- General Medicine
- Acute Medicine
- Respiratory
- Cardiac
- Healthcare of the Elderly
- Primary Care
- Sports and Exercise
- Psychology
- Psychiatry
- Other, please specify

5. What is your professional status?

- Consultant physician
- Trainee physician
- Nurse
- Physiotherapist

- Physician associate
- Speech and language therapist
- Occupational therapist
- Healthcare assistant
- Primary care physician
- Dietician
- Other, please specify

6. Where are you based/in what environment do you work?

- Acute hospital
- Community hospital/service
- Private hospital
- Primary care
- Other, please specify

7. In what country/continent do you work?

- England
- Scotland
- Wales
- Northern Ireland
- Rest of Europe
- North America
- South America
- Australasia
- Asia
- Africa
- Prefer not to say

8. **Have you been involved in the care of people with COVID-19?**

Please select all that apply

- Yes – ITU
- Yes – Acute Medical Ward
- Yes – step down unit
- Yes – Community
- No

- Other, please specify

9. Are you routinely employed as part of a rehabilitation programme?

- Please select all that apply
- Yes – pulmonary rehabilitation
- Yes – cardiac rehabilitation
- Yes – healthcare of the eldery
- No

Other – please specify

For the following questions, respondents were asked to give one of the following answers Strongly disagree, Disagree, Neutral, Agree, Strongly Agree, Unable to comment

10. The essential components of an early phase recovery programme (first few weeks after discharge/episode) recovery programme are:

- A home/step down unit aerobic exercise programme
- A home/step down unit resistance exercise programme
- An online/digital delivery is feasible for patients
- Advice on the management of cough
- Advice on the management of fatigue
- Advice on the management of breathlessness
- Advice on nutrition
- Psychological support for social isolation
- Support for mood disturbances (including anxiety and depression)
- Psychological support for Post Traumatic Stress Disorder (PTSD)
- Return to work advice
- Where to get financial support
- Symptom monitoring for worsening symptoms
- Dealing with grief and death of a family member

11. The essential components of an assessment at 6-8 weeks post hospital (step down unit) discharge are:

- An initial face to face (centre-based) assessment
- Conduct of an exercise test (6MWT/ISWT) at the time of the assessment
- Assessment of muscle strength (quadriceps)

- Assessment of quality of life
- Assessment of cough
- Assessment of fatigue
- Assessment of dyspnoea
- Assessment of mood (e.g. anxiety and depression)
- Screening for Post Traumatic Stress Disorder
- Medication review
- Assessment of nutritional status
- Assessment of comorbidities
- Measurement of lung function (spirometry)
- Assessment of oxygen requirements
- Further intervention is only needed if there is evidence of ongoing physical or psychological deficit

12. The essential components of a continued recovery programme beyond 6 weeks post hospital (step down unit) discharge are:

- A home-based progressive aerobic exercise programme
- A home-based progressive resistance exercise programme
- Advice on the management of cough
- Advice on the management of fatigue
- Advice on the management of breathlessness
- Psychological support for social isolation
- Support for mood disturbances (including anxiety and depression)
- Assessment of nutrition
- Psychological support for Post Traumatic Stress Disorder
- Return to work advice
- Where to get financial support
- Dealing with grief and death of a family member
- Advice on returning to usual exercise habits
- Advice on returning to usual employment
- Advice on returning to alternative employment
- Once social isolation policy is relaxed, advice for engaging in outdoors activities
- Once social isolation policy is relaxed, advice on community exercise schemes
- Assessment of lung function at 6 months

13. Please provide your email address

This will only be used to contact you for clarification regarding your answers

14. Do you have any further comments or suggestions?

Supplementary Table: Generated themes and sub-themes from the survey's free text comments (expanded table)	
Theme	**Sub-theme(s)**
A collaborative effort for rehabilitation development To develop this model of rehab a collaborative effort is needed from experts within the field and around the world. We can learn from international findings, current models of rehab and the specialists that deliver them. The following staff were identified as important for the development of this new model of rehabilitation: pulmonary/cardiac/neurological rehabilitation teams, dieticians, psychologists, respiratory consultants, respiratory and muscular skeletal physiotherapists, nurses, occupational therapists, speech and language therapists. *"I feel an effective service can only be designed if all specialists within the MDT are part of the development stage: physio, OT, dietitian, nurse, SLT, psychologist and any other relevant member, by contacting their professional associations directly."*	**Clear guidance for COVID-19 management** There is an identified need for clear guidance and protocols for COVID-19 management, including COVID-19 rehabilitation. *"I would love to see a nationally agreed follow-up programme rather than being trust specific as this would lead to huge variation."*
	A campaign to promote COVID-19 rehabilitation It is important to raise awareness of the COVID-19 rehabilitation service across population (service providers, referrers, patients/carers). There are suggestions to advertise it as a health promotion programme to normalise it as part of recovery on TV, radio etc. *"And/or big public health campaign to ensure people are aware about rehabilitation."*
Continued learning from COVID-19 for service development It will be important to collate data for the development of the COVID-19 rehabilitation service, its evaluation and research into overall COVID-19 management. This theme acknowledges the iterative process of refining the rehabilitation service as new information comes to light and how this will inform future pandemics. *"I think we need to understand the demographics of covid survivors, as service planning for post-covid rehab without understanding transport availability, digital literacy, ongoing psychosocial / PTSD related issues, usual working status amongst other things could result in significant oversights of what these patients are able to, and want to, engage with."*	
COVID-19 patient management Overall patient management in COVID-19 recovery; including recommendations for inpatient and outpatient care.	**Managing the acute phase** Recommendations for inpatient care; including assessment of physical and psychological wellbeing to inform personalised follow up care plans, and upon discharge, the provision of a discharge bundle of assessments and advice/documentation about self-management and support for carers/family. *"I think thorough assessment will highlight those patients requiring specific intervention and early treatment will minimise long term problems."* *"I feel patients would benefit from clear discharge booklet that explains what COVID 19 is and what to expect symptom wise for patients and families. When to contact doctor and some management advise like breathing exercises and strengthening exercises."*
	Early phase of recovery Recommendations for continued outpatient follow up; including physical/psychological assessment, individualised advice on symptom management and/or referral to specialist services for additional support (e.g. rehabilitation, IAPT, peer support etc.) *"Nutrition intervention important esp if underlying conditions prior to covid19/elderly/frail."*

	"The 'Aftershock' isn't necessarily immediate. You can experience the euphoria of having cheated death, which may go on for some weeks/months. However, when reality hits, it can hit hard, literally overnight. Some warning that it could happen and somewhere to turn to is very important, be it professional or peer support. Long term support, the recognition that PTSD or at least anxiety/depression is a very likely outcome, is I think essential."
Methods of rehabilitation delivery This theme encompasses the recommendations for how rehabilitation should be delivered and when. It is felt this is an opportunity to develop upon telerehabilitation and early rehab/prehab services, including adaptations and flexibility when measuring pre and post rehabilitation outcomes.	**Flexibility in assessment** Recognising the inability to perform face to face consultations so adaptations to assessments are needed. Many psychometric measures can be delivered via telephone/video calls/online and alternative measures of exercise capacity can be done at home (e.g. grip strength, timed up and go, sit to stand etc.) *"Currently planning to use grip strength, 30s sit to stand, and probably repeated timed up and go (x5 or x10) as measures of function and outcome, as doing any sort of corridor walk test (6WT, ISWT or ESWT) not going to be practical, limited equipment to do cycle ergometry, and patient group too poor re: balance to do step tests."*
	Early/delayed rehabilitation There is debate about whether rehabilitation should be delivered early/later during a patient's recovery. Some respondents felt inpatient rehabilitation was appropriate, whereas others felt this would be too early for a patient's lungs and/or psychological status to have prepared for rehabilitation. *"…acute rehabilitation phase prior to people leaving hospital. Intensive inpatient rehabilitation supports discharge, and improved outcomes of people requiring subacute rehabilitation and community rehabilitation."* *"Thus far it seems that people need time to recover from the acute effects before starting more of a resp rehab programme."*
	Group-based rehabilitation Safety issues inhibit group-based rehabilitation as an option currently, however there is the option for virtual group sessions, or the delivery of these once social distancing measures have relaxed. These are important for social support, especially when people are feeling isolated and alone in their recovery. *"I consider face to face and group support essential not only for fitness but to manage the psychological impact of this illness."*
	Referral and re-referral The ability for anyone to refer to rehabilitation (e.g. self-referral and re-referral as per patient request). This needs to be a simple process which is widely known. *"Ensure pathway for referral is documented is essential as some of these clients will go home and be ok initially but 6 plus months down the track will not be back at baseline and require pulmonary rehab."*
	Telerehabilitation This is a popular and viable option for home-rehabilitation. This circumstance offers an opportunity to grow home-based rehabilitation services.

	"…programmes could be run online BUT need to ensure there is a supervised element and that access to, willingness to use and actual use are measured."
	Personalised rehabilitation The need for patient-centred rehabilitation and not a one size fits all approach. There may be an opportunity to develop a multi-module rehabilitation service where modules can be selected if they are important to the patient's needs. *"I feel that post COVID-19 support needs to be person-centred and tailored to the individual. All the components listed are important but some may be more relevant for some people than others. In order not to overwhelm survivors, undertake unnecessary assessment/interventions and make best use of resources, a specific and MDT recovery plan made in partnership with the person is key."*
Components for COVID-19 rehabilitation The components highlighted as important to a COVID-19 rehabilitation model.	**Take guidance from established rehabilitation models** We should look to use/adapt/learn from current models of rehabilitation and/or holistic care services. Suggestions include pulmonary/cardiac/neurological/palliative/post-intensive care rehabilitation, psychological support (e.g. IAPT, CBT), occupational therapy, music therapy, yoga/tai chi, speech & language therapy, community gyms, pastoral support, acupuncture, hydrotherapy. *"I feel that we have enough resources to sign post and or refer on as necessary, ie Cardiac and pulmonary mental health, SOHAS etc."* *"Yes - feel strongly pts will struggle with post COVID standard exercise prog. For example look at problems recruiting to post AECOPD PR. Feel should be replaced by physical activity prog plus something like yoga / tai chi or similar. If we disproportionately focus on the exercise - like we do in standard PR - only most motivated pts will complete and they will probably be the ones who would have gone away and exercised anyway."*
	Education, exercise and social support Proposed components for the new rehabilitation model, separated by education, exercise and social support: 1. Education for self-management with topics to include: cough, sputum clearance, breathlessness, fatigue, frailty, pain, psych wellbeing, behaviour change, impact of comorbidities, energy conservation, falls, improving function for daily activities, nutrition, inhaler technique, signposting, skin integrity, swallowing and voice care 2. Exercises (physical/psychological): - cognitive function, exercise programme, inspiratory muscle training, neurorehabilitation 3. Social support: - caregiver support, guidance in line with government recommendations, group activities to facilitate peer engagement
A team of specialist COVID-19 rehabilitation staff The need for an interdisciplinary team to deliver rehabilitation. They need to have been trained appropriately/have specialist skills for this patient population.	**Keep our staff physically safe** The need to maintain the physical health of staff who deliver rehabilitation (e.g. COVID-19 testing for staff and patients, appropriate supply of PPE).

We will need a *"trained and expert team in rehabilitation medicine..."*	*"Please make sure staff who work in any settings have appropriate PPE for doing any face to face consultations with patients."*
	Keep our staff psychologically safe The monitoring of staff psychological wellbeing and the provision of psychological support to support their mental health. *"We should also, and I feel this very strongly indeed, should be assessed ourselves for signs of any signs of distress or psychological trauma, and rapidly be offered help and support to allow us, the members of the society, to survive this experience in ways which allow us to heal as individuals, and grow as clinicians."*
The reassurance of financial support Recognition of the financial input and service support needed to develop, deliver and sustain this programme. It will need considerable financial engagement to ensure it can be rolled out nationally/internationally. *"The reality of available funding and staffing post covid19 pandemic should be taken into account when creating rehabilitation programs for patients. Most services were stretched prior to the outbreak and will struggle afterwards to deliver comprehensive services for patients who are being discharged."*	