OPEN ACCESS

Patient outcomes after hospitalisation with COVID-19 and implications for follow-up: results from a prospective UK cohort

David T Arnold ,[1] Fergus W Hamilton,[1] Alice Milne,[1] Anna J Morley,[1] Jason Viner,[1] Marie Attwood,[2] Alan Noel,[2] Samuel Gunning,[1] Jessica Hatrick,[1] Sassa Hamilton,[1] Karen T Elvers,[3] Catherine Hyams ,[1] Anna Bibby,[1] Ed Moran,[1] Huzaifa I Adamali,[1] James William Dodd,[1] Nicholas A Maskell,[1] Shaney L Barratt[1]

[1]Academic Respiratory Unit, North Bristol NHS Trust, Bristol, UK
[2]Bristol Centre for Antimicrobial Research (BCARE), North Bristol NHS Trust, Bristol, UK
[3]Medicines Discovery Institute Cardiff, Cardiff University, Cardiff, UK

Correspondence to
Dr Nicholas A Maskell, Academic Respiratory Unit, North Bristol NHS Trust, Bristol BS10 5NB, UK; Nick.Maskell@bristol.ac.uk

DTA and FWH are joint first authors.

Received 26 August 2020
Revised 29 September 2020
Accepted 5 October 2020
Published Online First
3 December 2020

Linked

► http://dx.doi.org/10.1136/thoraxjnl-2020-215818
► http://dx.doi.org/10.1136/thoraxjnl-2020-216226

Check for updates

To cite: Arnold DT, Hamilton FW, Milne A, *et al*. *Thorax* 2021;**76**:399–401.

ABSTRACT

The longer-term consequences of SARS-CoV-2 infection are uncertain. Consecutive patients hospitalised with COVID-19 were prospectively recruited to this observational study (n=163). At 8–12 weeks postadmission, survivors were invited to a systematic clinical follow-up. Of 131 participants, 110 attended the follow-up clinic. Most (74%) had persistent symptoms (notably breathlessness and excessive fatigue) and limitations in reported physical ability. However, clinically significant abnormalities in chest radiograph, exercise tests, blood tests and spirometry were less frequent (35%), especially in patients not requiring supplementary oxygen during their acute infection (7%). Results suggest that a holistic approach focusing on rehabilitation and general well-being is paramount.

INTRODUCTION

Limited studies exist on the longer-term outcomes of patients admitted to the hospital due to COVID-19. Although several guidelines have been published,[1 2] these are based on extrapolation of complications from other coronavirus infections.[3 4] Disease-specific data on the outcomes for survivors of COVID-19 are essential to properly inform guidelines.

We report a prospectively recruited UK cohort of hospitalised patients with COVID-19. Consecutively hospitalised patients were recruited at diagnosis and followed-up at 8–12 weeks with a face-to-face medical review, spirometry, exercise test, blood tests, chest radiograph and assessment of the health-related quality of life (HRQoL).

METHODS

Subjects

Patients were recruited from the Diagnostic and Severity markers of COVID-19 to Enable Rapid triage (DISCOVER) study, a single-centre prospective study (Bristol, UK) recruiting consecutive patients (≥18 years of age) admitted with COVID-19. Ethics approval was via South Yorkshire (REC: 20/YH/0121). The inclusion criteria were a positive PCR result for SARS-CoV-2 or a clinico-radiological diagnosis of COVID-19 disease (see online supplementary material).

Baseline assessment and 28-day follow-up

Baseline demographics, comorbidities and blood test results were extracted from the medical record. At 28 days, survivors were defined as having had severe disease (invasive mechanical ventilation, non-invasive ventilation and/or intensive care admission), moderate disease (supplementary oxygen during admission) or mild disease (no supplementary oxygen or intensive care).

Face-to-face outpatient follow-up

All patients who survived were offered follow-up at a respiratory outpatient clinic (except for nursing home residents or current hospital inpatients) 8–12 weeks after their hospital admission. Those attending had a face-to-face review with a respiratory clinician, chest radiograph (CXR), spirometry, exercise testing (using 1 min sit to stand test (STS)),[5] routine blood tests, and SF-36 quality-of-life and Warwick-Edinburgh Mental Wellbeing Scales (WEMWBS) questionnaires. The severity and nature of abnormalities detected on CXR were scored and described (online supplementary material for full details).[6]

RESULTS

Between 30 March and 3 June 2020, 163 participants with COVID-19 were recruited. Of these, 19 patients died and 13 were inpatients from hospital/nursing home. The remaining 131 were invited for follow-up and 110 attended. Eighteen declined: ongoing shielding (n=10), being care providers (n=3) and felt unnecessary (n=5). Three were uncontactable (see supplementary material: Consolidated Standards of Reporting Trials). Table 1 shows the baseline demographics and clinical outcomes of those who attended follow-up divided by severity of COVID-19 illness (median age 60 years (IQR 46–73); 56% (n=91) male individuals). Patients were followed-up with a median of 83 days (IQR 74–88 days) after hospital admission and 90 days (IQR 80–97 days) after COVID-19 symptom onset.

Symptoms

Although most symptoms were improving, 81 (74%) patients reported at least one ongoing symptom: 39% breathlessness, 39% fatigue and 24% insomnia (see figure 1). Sixteen (59%) patients in the mild COVID-19 group reported ongoing symptoms compared with 49 (75%) and 16 (89%) in the moderate and severe group, respectively (figure 2).

Table 1 Demographics and admission factors of patients attending follow-up (n=110)

Characteristic	Mild (n=27)	Moderate (n=65)	Severe (n=18)
Demographics			
Age (18+), years	47 (32–61)	57 (48–67)	62 (54–71)
BAME	5 (19%)	15 (23%)	3 (19%)
Male	13 (48%)	44 (68%)	11 (61%)
BMI (mean)	31.2	32.5	32.5
Comorbidities			
T1DM	1 (3.7%)	1 (1.5%)	1 (5.6%)
T2DM	2 (7.4%)	12 (18%)	2 (11%)
Heart disease	6 (22%)	11 (17%)	3 (17%)
Chronic lung disease	4 (15%)	16 (25%)	8 (44%)
Severe liver disease	0 (0%)	1 (1.5%)	0 (0%)
Severe kidney disease	1 (3.7%)	4 (6.2%)	2 (11%)
Hypertension	4 (15%)	16 (25%)	7 (39%)
HIV	0 (0%)	0 (0%)	1 (5.6%)
Laboratory testing			
SARS-CoV-2 PCR+ve (as inpatient)	21 (78%)	50 (77%)	10 (56%)
SARS-CoV-2 IgG+ve (Abbott/Roche) (at follow-up)	18 (67%)	56 (86%)	15 (83%)
SARS-CoV-2 PCR–ve (as inpatient) and SARS-CoV-2 IgG–ve (at follow-up)	3 (11%)	6 (9%)	2 (11%)
Outcomes			
Admission NEWS score (IQR)	2 (1–3)	4 (2–6)	5 (4–8)
Radiographic severity score on admission chest radiograph	0 (0–2)	3 (1.75–4)	3 (1.25–6)
Invasive or non-invasive ventilation required	0 (0%)	0 (0%)	16 (89%)
Supplementary oxygen required	0 (0%)	65 (100%)	18 (100%)
Hospital length of stay, days	2 (1–4)	5 (2–8)	10 (7–17)

BAME, Black, Asian and minority ethnic; BMI, body mass index; NEWS, National Early Warning Score; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus.

Radiology

Of the 15/110 (14%) patients with abnormal follow-up radiographs (n=10 moderate group, n=5 severe group), 2 had worsened from hospital admission with higher radiographic severity scores (both had known previous interstitial lung disease). Findings seen included consolidation (one patient), reticulation (eight patients), atelectasis (five patients) and pleural effusion (one patient). High-resolution CT (HRCT) scans performed on the basis of the clinical, spirometric or radiological findings (nine patients) showed fibrotic changes in two patients with moderate disease at baseline (other HRCT results: normal (four), minor persistent ground glass changes (two), pleural effusion(one)).

Pulmonary function testing

Eleven patients had restrictive spirometry and 15 had a significant desaturation on the STS test, all within the severe or moderate group (see the online supplementary material).

Health-related quality of life

SF-36 scores demonstrated a reduction in reported health status across all domains compared with age-matched population norms.[7] In particular, physical scores were significantly lower in the severe cohort compared with mild/moderate (see the online supplementary material). In contrast, WEMWBS scores were comparable with published population norms,[8] with no significant difference between groups.

Blood results

Thirty-five (32%) patients had significantly deranged liver (n=12) or renal (n=9) function recorded during admission. All improved and 32 of 35 results had returned to baseline. Two additional patients had an ongoing lymphopenia and two were with a C-reactive protein level greater than 10 mg/L.

DISCUSSION

Over 130 000 people have been admitted to hospital with COVID-19 in the UK alone. As admission rates begin to fall, the potential impact of 'post-COVID' syndromes on patients and the health services is becoming apparent. We present a UK cohort study of consecutively recruited patients hospitalised with COVID-19

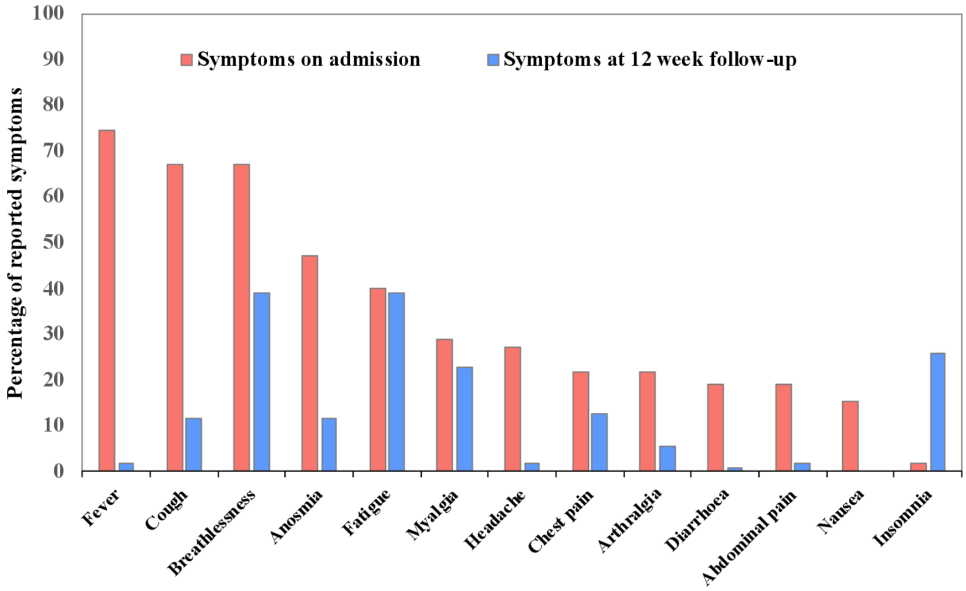


Figure 1 Frequency of symptoms reported at a 12-week follow-up compared with hospital admission.

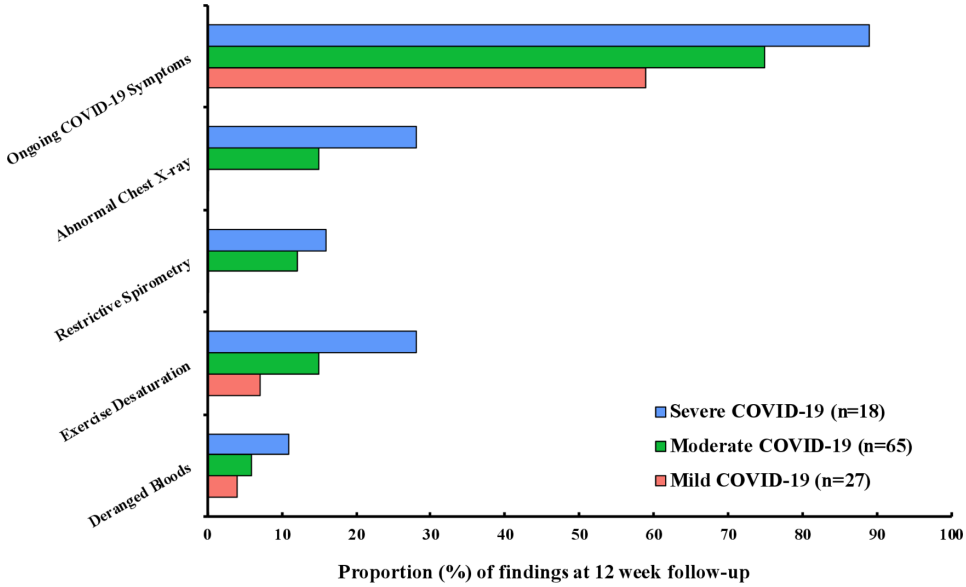


Figure 2 Summary of symptomatology and clinical results by disease severity.

and systematically assessed after discharge. Our key finding is that nearly three-quarters of patients remain symptomatic at 3 months, while clinical abnormalities were rare in mild disease.

Few studies have reported results from systematic prospective follow-up after hospitalisation. Our findings are in keeping with an Italian cohort of patients asked to recall their admission symptoms and HRQoL at a median of 60 days postdischarge, finding that 87% had at least one ongoing symptom with fatigue (53%) and shortness of breath (43%) predominating.[9] Similar findings have been demonstrated in other follow-up studies.[10]

The British Thoracic Society (BTS) COVID-19 Guidance advises follow-up guidance depending on whether the patient required intensive/higher care versus ward/community care (equivalent to severe vs mild/moderate in this cohort).[1] For mild/moderate disease, BTS recommends virtual follow-up with a CXR. This study demonstrated a low likelihood of follow-up CXR abnormalities in patients not requiring oxygen for their acute infection, suggesting that this approach may not be necessary.

The wide range of symptoms and reduced HRQoL seen in this study re-enforces the importance of a holistic approach advocated by the BTS and other guidelines.[1 2] All patients in our follow-up clinics were offered a referral to specialist psychological support services.

We recognise potential limitations of this study including the single-centre design and relatively small patient numbers that may limit the generalisability of results. Second, patients residing in a nursing home or hospital inpatients were not followed-up in line with local infection control protocols.

The study demonstrates the persistence of symptoms at 8–12 weeks in the majority of patients, even those admitted with mild disease. There was a reassuring improvement in clinical measures with only a minority having abnormal biochemical, radiological or spirometric tests. These results provide information useful to clinicians caring for survivors of COVID-19 disease. The role(s) of rehabilitation and/or psychological services in the management of such patients warrant research.

Twitter Fergus W Hamilton @gushamilton, Catherine Hyams @cathyams and James William Dodd @theotherdodd

Acknowledgements The authors would like to thank the North Bristol NHS Trust COVID-19 research team as well as the University of Bristol UNCOVER group for guidance in data analysis and study design. They would also like to thank all the patients who took part in the DISCOVER study.

Contributors DTA, SLB, NAM, JWD and FWH generated the research question and analysis plan. AM, AJM, MA, AN, CH, AB, EM, HA, JWD, NAM, DTA, FWH were involved in data collection and clinical appointments. SG, JH, SH and KTE were involved in data analysis. All authors were involved in the final manuscript preparation.

Funding The DISCOVER study was supported by donations to Southmead Hospital Charity (Registered Charity Number: 1055900).

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iDs
David T Arnold http://orcid.org/0000-0003-3158-7740
Catherine Hyams http://orcid.org/0000-0003-3923-1773

REFERENCES

1 George PM, Barratt SL, Condliffe R, *et al*. Respiratory follow-up of patients with COVID-19 pneumonia. *Thorax* 2020;75:1009–16.
2 Greenhalgh T, Knight M, A'Court C, *et al*. Management of post-acute covid-19 in primary care. *BMJ* 2020;370:m3026.
3 Das KM, Lee EY, Singh R, *et al*. Follow-Up chest radiographic findings in patients with MERS-CoV after recovery. *Indian J Radiol Imaging* 2017;27:342–9.
4 Hui DS, Wong KT, Ko FW, *et al*. The 1-year impact of severe acute respiratory syndrome on pulmonary function, exercise capacity, and quality of life in a cohort of survivors. *Chest* 2005;128:2247–61.
5 Briand J, Behal H, Chenivesse C, *et al*. The 1-minute sit-to-stand test to detect exercise-induced oxygen desaturation in patients with interstitial lung disease. *Ther Adv Respir Dis* 2018;12:1753466618793028.
6 Wong HYF, Lam HYS, Fong AH-T, *et al*. Frequency and distribution of chest radiographic findings in patients positive for COVID-19. *Radiology* 2020;296:E72–8.
7 Burholt V, Nash P. Short form 36 (SF-36) health survey questionnaire: normative data for Wales. *J Public Health* 2011;33:587–603.
8 WEMWBS population norms in health survey for England data 2011, 2011. Available: https://www.corc.uk.net/media/1243/wemwbs_populationnorms2011.pdf
9 Carfì A, Bernabei R, Landi F, *et al*. Persistent symptoms in patients after acute COVID-19. *JAMA* 2020;324:603.
10 Halpin SJ, McIvor C, Whyatt G, *et al*. Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: a cross-sectional evaluation. *J Med Virol* 2020. doi:10.1002/jmv.26368

SUPPLEMENTARY MATERIAL

Supplementary Methods

Inclusion criteria of DISCOVER study

Adult patients (>18yo) admitted to North Bristol NHS Trust with;

(a) typical symptoms of COVID-19 (e.g. influenza-like illness with fever and muscle pain, or respiratory illness with cough and shortness of breath) and a positive PCR result for SARS-CoV-2, using the established PHE assay in use at the time,

Or

(b) Suspected SARS-CoV-2 infection, namely presenting with (i) typical symptoms (e.g. influenza-like illness with fever and muscle pain, or respiratory illness with cough and shortness of breath); and (ii) compatible chest X-ray findings (consolidation or ground-glass shadowing); and (iii) alternative causes have been considered unlikely or excluded (e.g. heart failure, influenza).

Baseline assessment

Routine demographics were recorded including ethnicity, and presence of important comorbidities. The earliest admission National Early Warning Score (NEWS) was extracted from the clinical record. This is a numeric score (from 1-20), reflecting the degree of physiological dysfunction. Routine biochemistry and haematology results were extracted from the clinical record (C-reactive protein (CRP), neutrophils, lymphocytes, neutrophil:lymphocyte ratio), using the admission results. Chest radiography was performed on admission and radiological severity score calculated (see below).

28-day remote follow-up

All recruited patients were followed up remotely at 28-days after admission by review of hospitals notes and/or general practice records. This included 28-day mortality, hospital length of stay, readmissions, requirement for intensive care, ventilation, renal replacement therapy, and inotropes. We also recorded complications including acute renal failure, acute liver injury, venous thromboembolic events (both pulmonary emboli and deep vein thromboses), cardiac events (including myocardial infarction, myocarditis, congestive cardiac failure and arrythmias), and neurological events (cerebrovascular events, meningitis or encephalitis).

At 28 days, surviving participants were defined as having had severe disease (requirement for non-invasive ventilation (NIV), intensive care or high dependency unit admission), moderate disease (requirement for oxygen during hospital stay), or mild disease (no requirement for oxygen or enhanced care during stay).

8-12 week face-to-face outpatient follow up.

All patients who survived were invited to a follow up at a respiratory outpatient clinic (with the exception of nursing home residents or current hospital inpatients), 8-12 weeks after hospital admission. Patients were followed

up a median of 83 days (IQR 74-88 days) after hospital admission and 90 days (IQR 80-97 days) after COVID-19 symptom onset. All patients who attended this appointment had a face-to-face review with a respiratory or infectious disease clinician, chest radiograph, spirometry, exercise testing, routine bloods, routine observations (blood pressure, heart rate, temperature, pulse oximetry, respiratory rate) and HRQoL questionnaires (see details below).

Chest radiograph

Non-portable radiography equipment was used to obtain posterior-anterior (PA) projection radiographs with standard techniques at a 180-cm focus-film distance.

The radiological severity score was calculated for the baseline radiograph using the method described by Wong et al, 2020.[1] A score of 0-4 was assigned to each lung depending on the extent of involvement by consolidation or ground glass opacities. 0 = no involvement, 1 = <25%, 2 = 25 - 49%, 3= 50 - 75%, 4 = >75% involvement. The scores for each lung were summed to produce a final severity score ranging from 0-8. Radiographs were scored by one physician (respiratory or infectious diseases physician).

All follow-up chest radiographs were categorised into two groups, normal or abnormal, based on lung parenchymal, airway, pleural, hilar and mediastinal findings as reported by a consultant radiologist. In those chest x-rays demonstrating an abnormality, the lung parenchyma and airways were evaluated for the following: 1) consolidation, 2) ground-glass opacity (GGO), 3) nodular opacity, and 4) reticular opacity 5) atelectasis 6) pleural pathology, by consultant radiologists and according to standardised terminology.[2]

Spirometry

Forced expiratory volume during first second of expiration (FEV1) and forced vital capacity (FVC) were performed in accordance with ATS/ERS guidelines.[3] The MRC score, height (meters), and body weight of the patients (kilograms) were also recorded.[4] Restrictive spirometry was defined by a FEV1/FVC ratio <0.7 AND FVC <80%. [5]

Lung physiology staff wore full personal protective equipment (PPE) during testing including FFP-3 masks.

Sit to stand test (STS)

Given the importance of social distancing in clinical areas, exercise testing was assessed using the 1-min sit-to-stand test (STS) as opposed to the 6-minute walk test (6MWT). All 1-min STS tests were performed according to a standardised protocol using a standard chair (height 46–48 cm) with a flat seat and no armrests. Patients were instructed to stand completely straight from a seated position and touch the chair with their bottom when sitting,

but that they need not sit fully back on the chair. Patients were asked to complete the manoeuvre without using their hands or arms to assist movement and to perform as many repetitions as possible in 1 min. A minimum of three sit to stands were required in order for this to be recorded as an adequate test. The resting oxygen saturation was recorded via pulse oximetry, in addition to the nadir oxygen saturation during the test and up to one minute during recovery. A mild desaturation was classified as ≥ 4% but with a nadir ≥94%, a significant desaturation was classified as any desaturation with a nadir <94%.[6]

Health status questionnaires

The SF-36 is a questionnaire of 36 items, measuring eight multi-item variables; physical functioning (PF), social functioning (SF), role limitations due to physical (RP) or emotional problems (RE), mental health (MH), energy and vitality (VT), bodily pain (BP) and general perception of health (GH).[7] With regards to the measurement of mental health, the SF-36 measures general mental health status, that includes four major mental health dimensions: anxiety, depression, loss of behavioural/emotional control, and psychological well-being. There is a further single item for perception of change in health over the past year. For each variable, items are scored and transformed into a scale of 0 to 100 (best possible health status). Subsequently, a composite physical and mental composite score (PCS, MCS) are generated from each individual variant. The WEMWBS is a scale of 14 positively worded items focusing on the positive aspects of mental health and measuring psychological functioning: optimism, autonomy, agency, curiosity, clarity of thought, positive relationships and positive affect (feelings), with 5 response categories of 'none of the time' 'to 'all of the time'. Scores ranged from 14-70, with higher scores indicating greater positive mental wellbeing.[8]

Statistical analysis

Categorical variables were presented as counts with percentages. All continuous data were non-parametric and therefore presented with medians and interquartile range (IQR), unless otherwise specified. Differences between patient groups were evaluated using Mann Whitney-U and Kruskal Wallis tests for continuous data and Fisher's exact test or Chi-squared testing for categorical data. Statistical significance was taken as $p \leq 0.05$. Data were analysed using R version 4.0.0 with the packages "tidyverse" and "gtsummary".

Supplementary Table 1: Demographics and admission factors of followed-up cohort (n=110) and those who did not attend follow-up (n=34)

Characteristic	**Followed-up (n=110)**	**Did not attend follow-up* (n=34)**
Demographics		
Age (18+)	60 (IQR: 44-76)	71 (38-81)
BAME	23 (21%)	4 (12%)
Male	68 (61%)	12 (35%)
Co-morbidities		
T1DM	3 (3%)	0 (0%)
T2DM	16 (15%)	10 (29%)
Heart disease	20 (18%)	7 (21%)
Chronic Lung disease	28 (25%)	1 (3%)
Severe Liver disease	1 (1%)	4 (9%)
Severe kidney disease	7 (6%)	6 (18%)
Hypertension	27 (25%)	11 (32%)
HIV	1 (1%)	0 (0%)
Laboratory Testing		
SARS CoV-2 PCR+ve (as inpatient)	81 (73%)	25 (73%)
SARS CoV-2 Antibody +ve (at follow-up)- Abbott antibody test	89 (81%)	N/A
Admission (ED) NEWS score (IQR)	4 (2-6)	4 (2-5)
Radiographic severity score on admission chest radiograph (IQR)	2 (1-4)	2 (2-4)

BAME- Black, Asian and Minority Ethnic, DM- Diabetes mellitus, HIV- Human Immunodeficiency Virus, NEWS- National Early Warning Score.
**of 34 patients who did not attend follow up clinic, 12 were in Mild severity group, 22 in Moderate, 0 in Severe.*

Supplementary Table 2: Ongoing symptoms reported at follow-up by severity of disease

Symptom reported	**Mild** (n = 27)	**Moderate** (n = 65)	**Severe** (n = 18)
Fever	0 (0%)	1 (2%)	0 (0%)
Cough	2 (7%)	10 (15%)	1 (6%)
Breathlessness	7 (26%)	26 (40%)	10 (56%)
Anosmia	3 (11%)	6 (9.2%)	4 (22%)
Excessive Fatigue	7 (26%)	26 (40%)	10 (56%)
Myalgia	4 (15%)	14 (22%)	7 (39%)
Headache	1 (4%)	1 (2%)	0 (0%)
Chest pain	2 (7.4%)	10 (15%)	2 (11%)
Arthralgia	1 (4%)	1 (2%)	3 (16%)
Diarrhoea	0 (0%)	1 (2%)	0 (0%)
Abdominal pain	1 (2%)	1 (2%)	0 (0%)
Nausea	0 (0%)	0 (0%)	0 (0%)
Insomnia	6 (22%)	11 (17%)	9 (50%)
Any symptom	16 (59%)	49 (75%)	16 (89%)

Supplementary Table 3: Spirometry and Sit-to-Stand desaturation test results

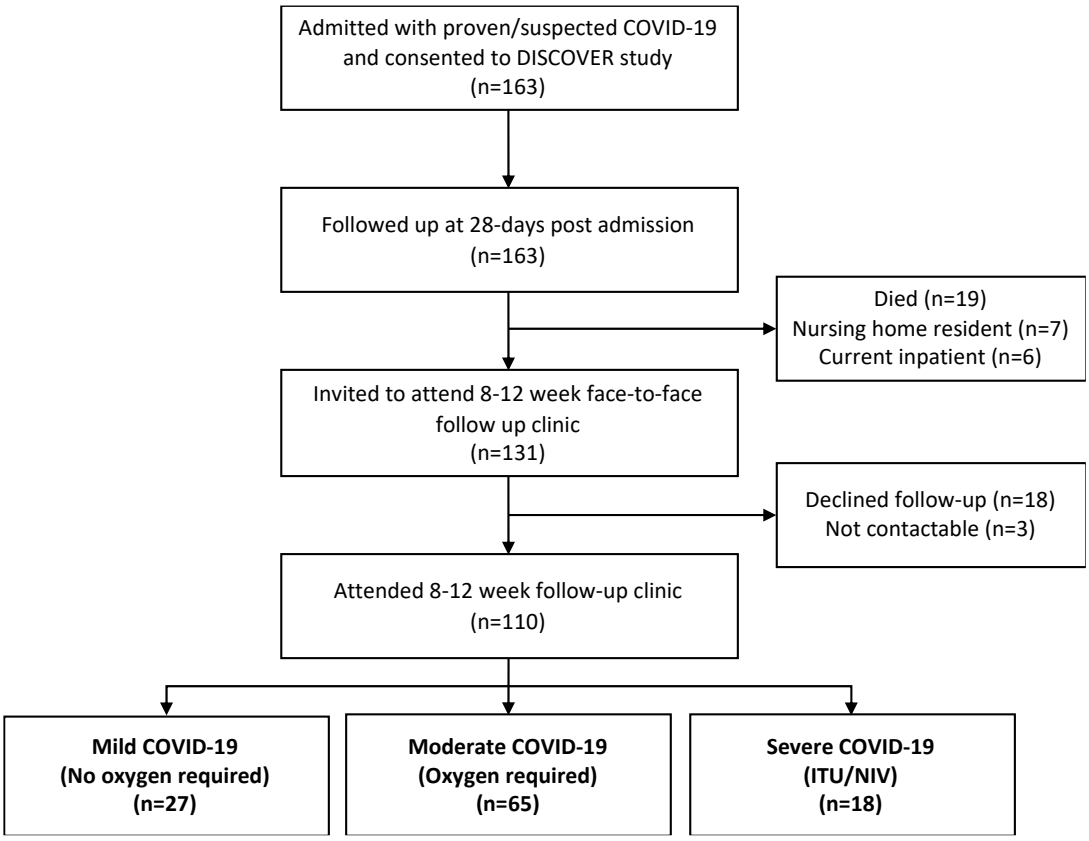
	Mild (n = 27)	**Moderate (n = 65)**	**Severe (n = 18)**	**p-value**
O2 Saturations (%)	98.0 (96.5, 99.0)	97.00 (96.0, 98.00)	97.0 (96.0, 98.0)	0.88
Nadir of O2 saturations on STS test (IQR)	96.0 (95.0, 97.0)	95.0 (93.0, 96.5)	95.0 (91.8, 96.0)	0.75
Respiratory rate (IQR)	17.0 (14.0, 18.0)	17.0 (14.2, 19.8)	17.0 (16.0, 18.0)	0.95
FVC (L) (IQR)	3.58 (3.13, 4.31)	3.52 (2.75, 4.36)	3.65 (2.55, 4.14)	0.70
FVC (% predicted) (IQR)	97 (90, 105)	91 (78, 100)	89 (76, 98)	0.05
FEV1 (L) (IQR)	2.97 (2.56, 3.42)	2.71 (2.12, 3.49)	2.54 (1.88, 3.23)	0.50
FEV1 (% predicted) (IQR)	94 (82, 101)	90 (78, 100)	89 (73, 101)	0.30
Spirometry not performed*	0/27	5/65	0/18	N/A
Restrictive pattern spirometry (%)	0 (0%)	8 (12%)	3 (17%)	0.03
Severe desaturation on STS test (%)	0 (0%)	10 (15%)	5 (28%)	0.02

*STS- 1 minute Sit to Stand desaturation test, FVC- Forced Vital Capacity, FEV1- Forced expiratory volume during first second of expiration. *Spirometry not performed for clinical reason (n=3) and patient declined (n=2).*

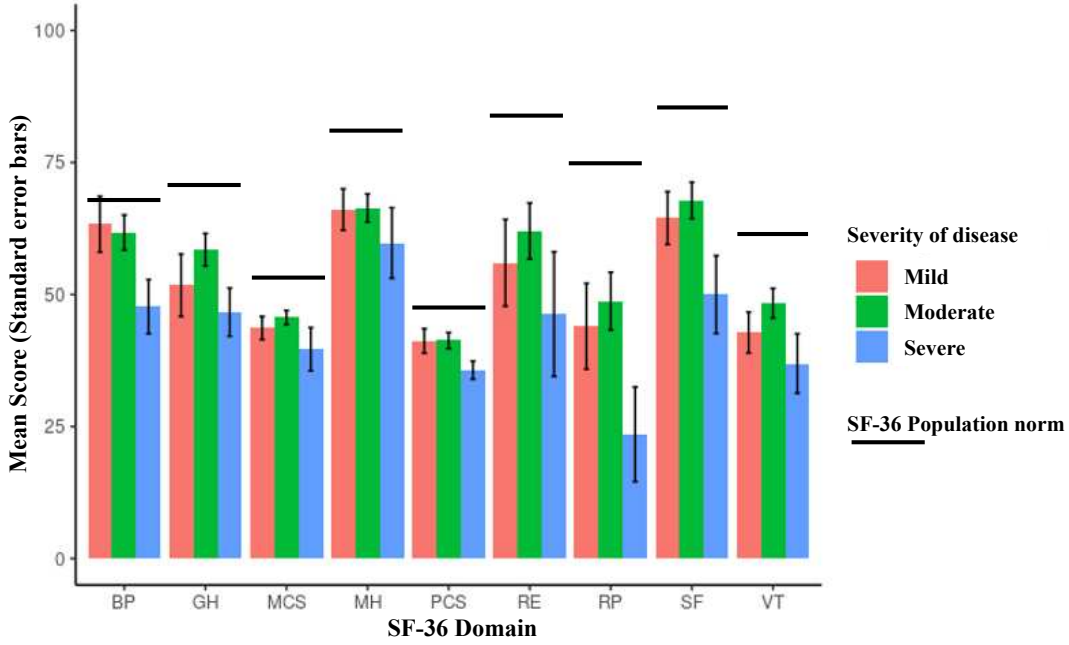
Supplementary Table 4: Full SF-36 results by severity of disease

Characteristic*	**Mild** (n = 27)	**Moderate** (n = 65)	**Severe** (n = 18)
Physical Function	66 (27)	65 (30)	56 (23)
Role – physical	43 (41)	50 (43)	24 (38)
Bodily pain	64 (28)	62 (27)	46 (21)
General Health	53 (30)	58 (25)	47 (20)
Vitality	43 (20)	49 (22)	36 (24)
Social Functioning	65 (25)	69 (28)	49 (32)
Role - emotional	57 (42)	64 (42)	43 (50)
Mental health	68 (19)	67 (21)	58 (28)
Physical composite score	41 (12)	41 (12)	36 (7)
Mental composite score	45 (11)	46 (11)	40 (17)
*Statistics presented: mean (SD)			

Supplementary Figure 1: CONSORT diagram



Supplementary Figure 2: SF-36 results, mean and standard error, with age-matched population norm means (BP- Bodily pain, GH- General Health, MCS- Mental Health Component Summary, MH-Mental Health, PCS- Physical Component Summary, RE- Emotional Role Functioning, RP-Physical Role Functioning, SF-Social Role Functioning, VT-Vitality).



REFERENCES

1. Wong HYF, Lam HYS, Fong AH, et al. Frequency and Distribution of Chest Radiographic Findings in Patients Positive for COVID-19. *Radiology* 2020;296(2):E72-E78. doi: 10.1148/radiol.2020201160 [published Online First: 2020/03/29]
2. Hansell DM, Bankier AA, MacMahon H, et al. Fleischner Society: glossary of terms for thoracic imaging. *Radiology* 2008;246(3):697-722. doi: 10.1148/radiol.2462070712 [published Online First: 2008/01/16]
3. Graham BL, Steenbruggen I, Miller MR, et al. Standardization of Spirometry 2019 Update. An Official American Thoracic Society and European Respiratory Society Technical Statement. *Am J Respir Crit Care Med* 2019;200(8):e70-e88. doi: 10.1164/rccm.201908-1590ST [published Online First: 2019/10/16]
4. Bestall JC, Paul EA, Garrod R, et al. Usefulness of the Medical Research Council (MRC) dyspnoea scale as a measure of disability in patients with chronic obstructive pulmonary disease. *Thorax* 1999;54(7):581-6. doi: 10.1136/thx.54.7.581 [published Online First: 1999/06/22]
5. Aaron SD, Dales RE, Cardinal P. How accurate is spirometry at predicting restrictive pulmonary impairment? *Chest* 1999;115(3):869-73. doi: 10.1378/chest.115.3.869 [published Online First: 1999/03/20]
6. Briand J, Behal H, Chenivesse C, et al. The 1-minute sit-to-stand test to detect exercise-induced oxygen desaturation in patients with interstitial lung disease. *Ther Adv Respir Dis* 2018;12:1753466618793028. doi: 10.1177/1753466618793028 [published Online First: 2018/08/10]
7. Lins L, Carvalho FM. SF-36 total score as a single measure of health-related quality of life: Scoping review. *SAGE Open Med* 2016;4:2050312116671725. doi: 10.1177/2050312116671725 [published Online First: 2016/10/21]
8. Tennant R, Hiller L, Fishwick R, et al. The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): development and UK validation. *Health Qual Life Outcomes* 2007;5:63. doi: 10.1186/1477-7525-5-63 [published Online First: 2007/11/29]