Supplementary Appendix

'Long-COVID': A cross-sectional study of persisting symptoms, biomarker and imaging abnormalities, following hospitalisation for COVID-19

Mandal S, *et al. Thorax* 2020;0:1–3. doi: 10.1136/thoraxjnl-2020-215818

Detailed Method:

An attempt was made to contact every patient who had been discharged from our hospitals following an acute illness compatible with COVID-19, and who had tested positive using a nasopharyngeal swab for SARS-CoV-2.

We aimed to complete the review at between four and six weeks following hospital discharge. The timing and method of delivering the follow-up varied to reflect local Trust resources. The service was conducted from Royal Free London NHS Foundation Trust (Barnet and Hampstead sites), and University College London Hospitals NHS Foundation Trust, between April and June 2020.

The data presented here were collected as part of a novel service evaluation and in line with UK national guidance for such work (available at http://www.hra-decisiontools.org.uk/research/docs/DefiningResearchTable_Oct2017-1.pdf), ethics committee approval is not required. In addition, during COVID (https://www.hra.nhs.uk/covid-19-research/guidance-using-patient-data/) "*anonymised information can then be used in health and care research*". All appropriate service evaluation forms were completed and approved at our Trusts. All data were de-identified prior to analysis and the Authors had all necessary clinical administrative permissions to access the data.

A minimum dataset was agreed by members of the North Central London 'Assessing Recovery from COVID-19' (ARC) consortium and is attached as Appendix 1. We first collated a summary of the participants' medical history and details of the acute admission from the medical record. This was used to inform the need for further blood testing and imaging and to guide the follow-up discussion. All patients with abnormal blood tests and or chest radiograph findings at discharge were invited to have those tests repeated.

We specifically assessed current physical and psychological symptom burden (PHQ2 score), and the trajectory of symptom recovery. Subjective breathlessness, cough, fatigue and sleep quality were assessed on an eleven-point scale from 0-10 (where 0 represented 'I do not have this problem' to 10 = 'this symptom is very significant'). Participants were also asked to grade the maximum intensity of each symptom during the acute illness. Current breathlessness was assessed further using the Medical Research Council scale [1]. Participants were asked to rate their satisfaction with the call.

Most assessments were made by telephone, employing trained medical students and junior medical staff under the supervision of higher trainees and Consultants.

In addition to the agreed dataset, we agreed local onward pathways for referral to physical rehabilitation resources and psychological support, and/or further investigations. A copy of the consultation and actions was sent to the patient's primary care physician.

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The British Society of Thoracic Imaging (BSTI) classification [2] was used to code chest radiographs; follow-up chest radiographs were compared with the last radiograph obtained prior to discharge. Blood biomarkers were measured using standard laboratory analysers.

Data were recorded on an encrypted database and password protected NHS computer. Data analysis was conducted in SPSS (version 22) and GraphPad (version 8). Data were tested for normality and reported as mean and standard deviation (SD), median and interquartile range (IQR) or number (%) as appropriate. Comparison of symptoms at maximum and follow-up was achieved using a Wilcoxon Signed Rank test. Symptom trajectories were examined based on time from discharge to the follow-up assessment, using absolute values of symptom intensity as reported by the patient, and interpolation with 90% confidence intervals (CI). $p \leq 0.05$ was considered statistically significant.

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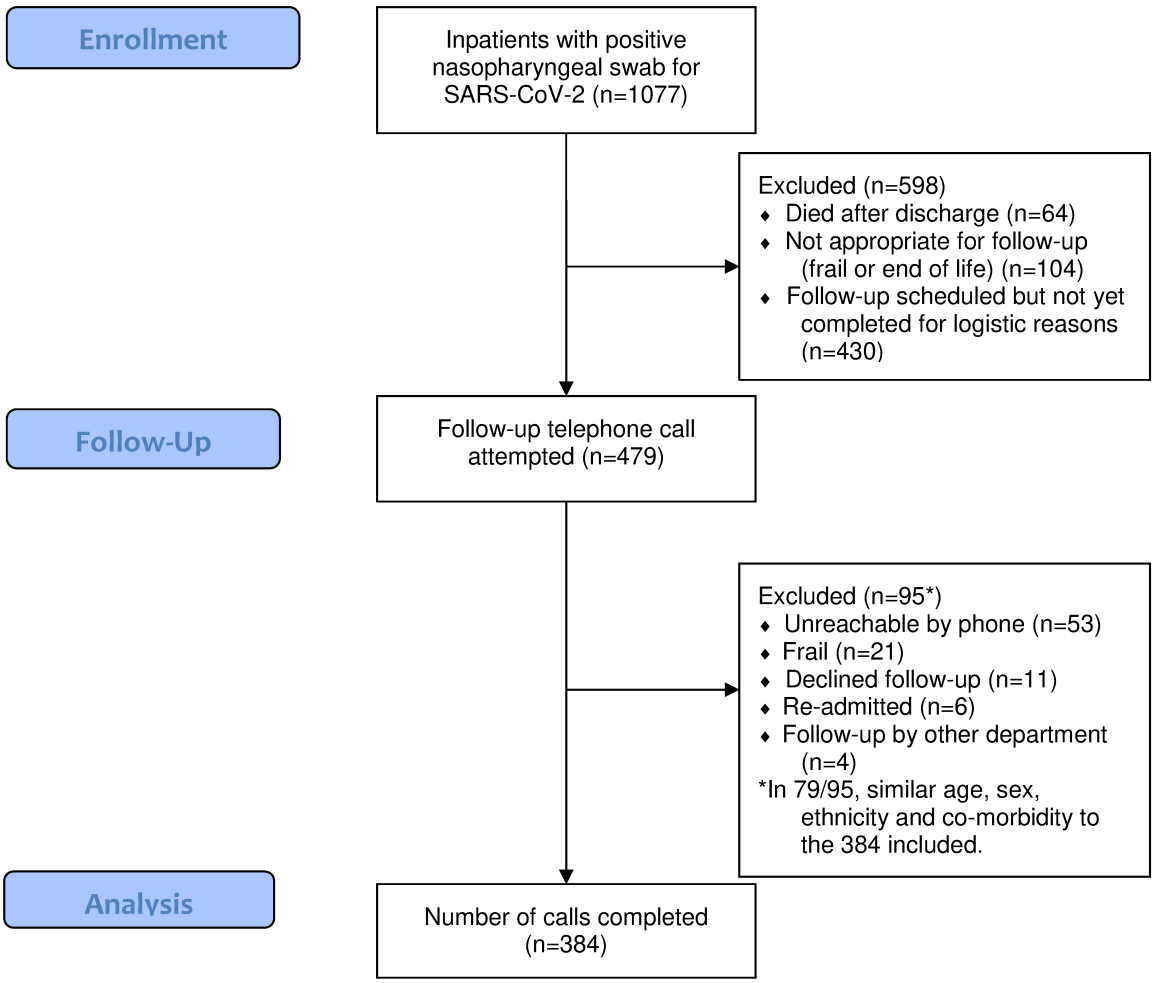
Additional Results:

SUPPLEMENTARY FIGURE 1: *Service participants.*



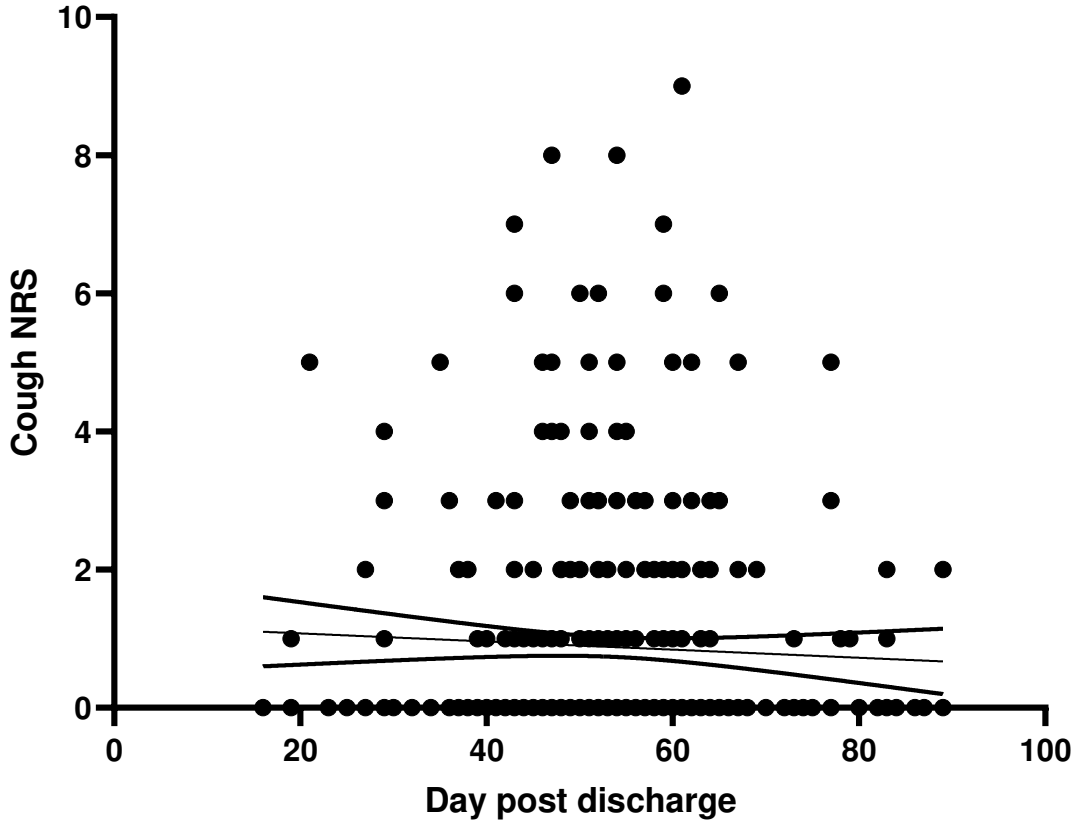
SUPPLEMENTARY TABLE 1: *Symptom recovery following discharge from hospital with COVID-19. Data presented as median (IQR).*

Symptom	Maximum Intensity	Intensity at Six Weeks	% reporting improving	% reporting unchanged	% reporting deteriorating
Breathlessness	7 (2-9)	1 (0-3)	80.8	18.6	0.6
Cough	3 (0-8)	0 (0-1)	74.5	24.1	1.4
Fatigue	8 (5-10)	2 (0-5)	80.4	18.5	1.2
Sleep Quality	5 (1-5)	3 (0-6)	66.2	29.7	4.2

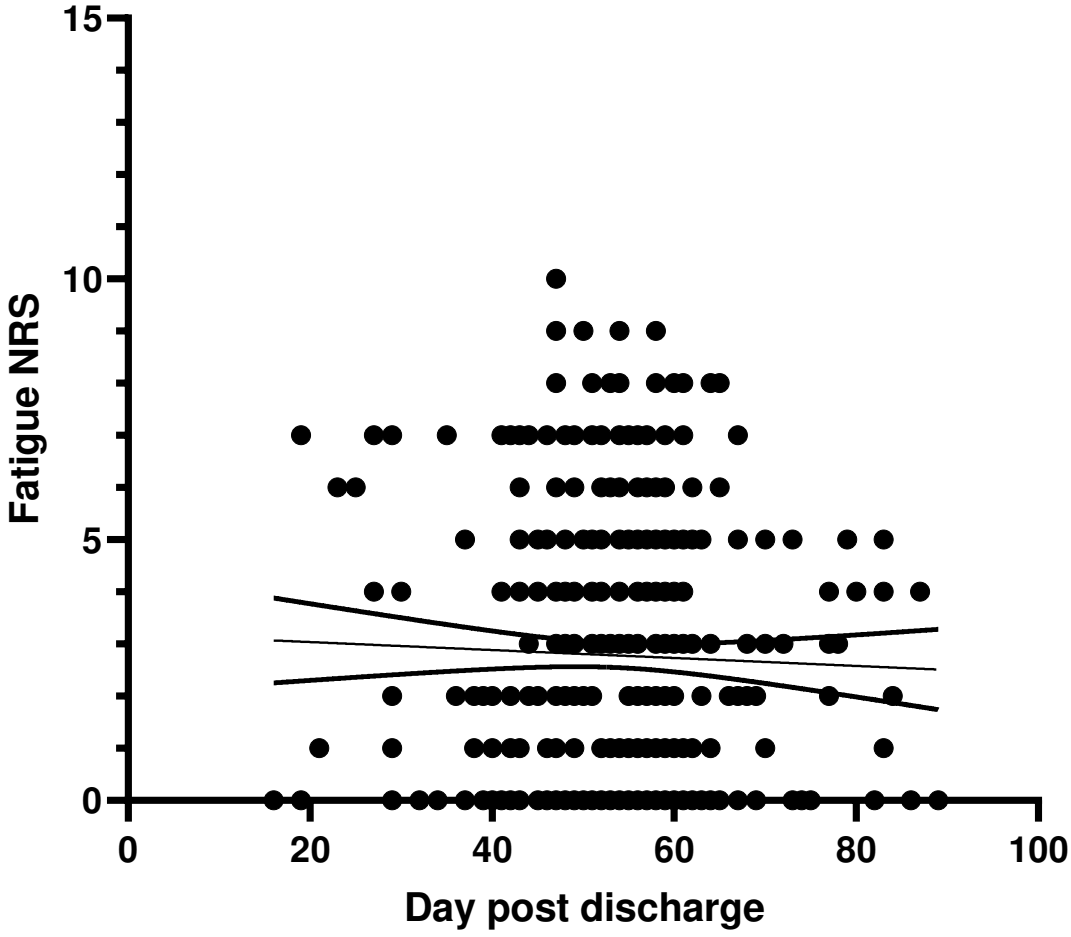
8.5% of people had persisting anosmia.

When looking at the four main symptoms (breathlessness, cough, fatigue and poor sleep quality), only 42/384 (11%) patients scored zero on all four of these symptoms at follow-up.

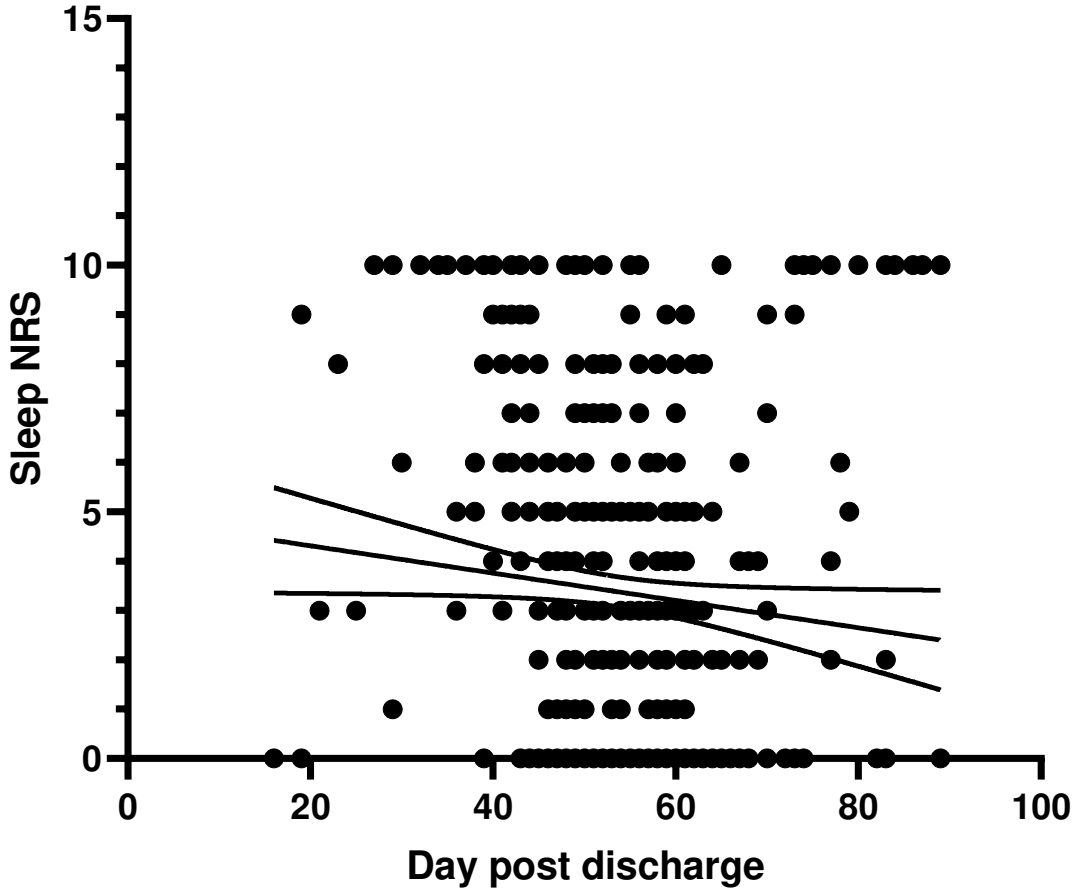
SUPPLEMENTARY FIGURE 2*: Patient reported cough intensity (0-10 scale) versus time of follow-up from hospital discharge. Each circle represents an individual patient at follow-up, with interpolation line and 90%CI. A higher score represents more burdensome symptoms.*



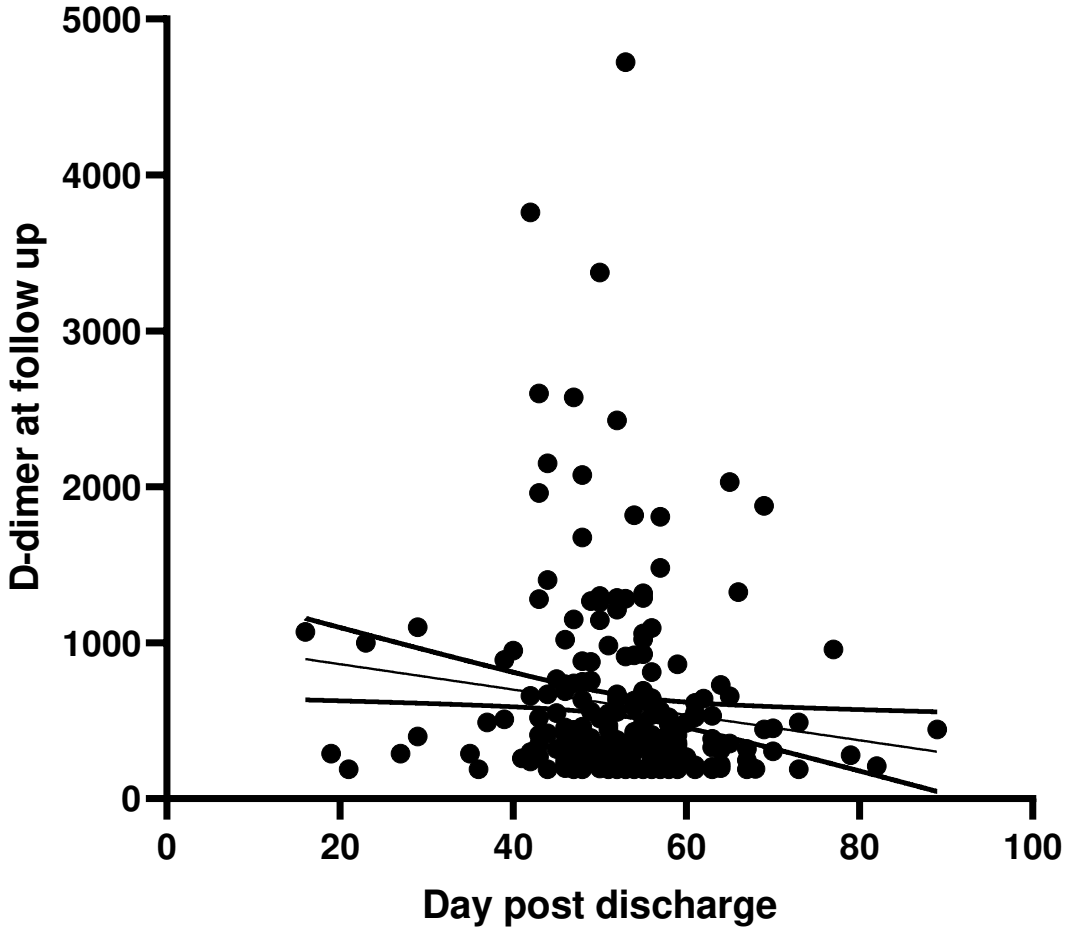
SUPPLEMENTARY FIGURE 3*: Patient reported fatigue intensity (0-10 scale) versus time of follow-up from hospital discharge. Each circle represents an individual patient at follow-up, with interpolation line and 90%CI. A higher score represents more burdensome symptoms.*



SUPPLEMENTARY FIGURE 4*: Patient reported impairment in sleep quality (0-10 scale) versus time of follow-up from hospital discharge. Each circle represents an individual patient at follow-up, with interpolation line and 90%CI. A higher score represents more burdensome symptoms.*



SUPPLEMENTARY FIGURE 5*: D-dimer versus time of follow-up after hospital discharge with COVID-19. Each circle represents an individual patient at follow-up, with interpolation line and 90%CI.*



References:

1. MRC Dyspnoea Scale. Available at https://mrc.ukri.org/research/facilities-and-resources-for-researchers/mrc-scales/mrc-dyspnoea-scale-mrc-breathlessness-scale/ - last accessed June 20th 2020

2. British Society of Thoracic Imaging COVID-19 chest x-ray classification. Available at: https://www.bsti.org.uk/media/resources/files/BSTI_COVID_CXR_Proforma_v.3-1.pdf, last accessed August 24th 2020.

Clinical Data Proforma

NCEL ARC – Post admission clinical information

The **N**orth **C**entral and **E**ast **L**ondon – **A**ssessing **R**ecovery from **C**OVID project (NCEL-ARC) is a collaborative effort to define the recovery of patients from COVID in a safe and effective way, whilst allowing comparison across different areas of NCEL.

This document outlines the initial dataset that is suggested to ensure that the key clinical features of this illness, and subsequent recovery are recorded in a consistent way across clinical services. This will allow patterns of disease, complications, and long term sequelae to be recognised efficiently, and described accurately for the benefit of patients experiencing this disease in the future.

Patients should be contacted between 4-6 weeks after their hospital admission for assessment.

This is a clinical project, aimed at providing appropriate follow-up care to the following patients, to ensure resolution of symptoms, and identify those who require additional input from Respiratory Services and onward referral / signposting to other teams and services.

Patients to be included:

- Adults discharged from hospital with a confirmed diagnosis of COVID19 – **(Swab +ve cohort)**

Adults are defined as patients seen in adult clinics. This will vary locally, and is likely to include patients aged 16-18 at some centres.

The collection of information for these consultations will include a variety of sources – EPR, PACS, etc. These forms are intended to simplify this process, and set out the minimum dataset agreed by the NCL ARC working group.

The collection of full information for each patient is likely to be beyond that which can be extracted during a typical clinic visit, and much of the information is static, and extractable from computer systems. The 'script' for consultations is predominantly pages 5 and 6. The collection of additional information can be delegated to others engaged in this project, or conducted at a different time to the clinical contact.

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Baseline Information

PATIENT DETAILS:

NAME DOB SEX MRN

NHS no: Ethnic Group ***(See gov.uk guide for categorisation)***

Shielding status: Not / Voluntary shielding / extremely vulnerable / letter issued by HCP

THIS CALL:

Date and Time

Unreachable?

Unable to complete? - Why? e.g. language / refused / died

Clinician completing call (Name and position):

First Admission details – please record additional admissions on duplicate forms.

Admitting Site:

Date of admission: Estimated day of illness on admission:

Date of Discharge:

Rockwood (Clinical Frailty Score) on admission:

TEP status during admission: DNACPR / Not for NIV/CPAP / For NIV/CPAP / FULL

Smoking Status on admission: current smoker/ex-smoker/never smoker

PACK YEARS:

At time of FU: current smoker/ex-smoker/never smoker

If still smoking offer referral to smoking cessation services:

Agreed to referral Yes☐ No☐

Maximum Respiratory Support: none / O2 / CPAP / NIV / IV: Max FiO2____

Total number of days on CPAP___ NIV___ IPPV____

Last available SpO2 _____ / FiO2 prior to discharge_____

Currently requiring carers? Yes☐ No☐

Level of care in place: OD/BD/TDS/QDS Residential Home / Nursing Home

INVESTIGATIONS

Bloods:

Swab result: Swab Date: No swab ☐

Item	Admission	Follow Up
Hb g/dL		
Neutrophils x10^9/L		
Lymphocytes x10^9/L		
D-dimer ng/mL		
Ferritin mcg/L		
Creatinine mcmol/L		
Glucose mmol/L		
CRP mg/L		
BNP ng/L		

Radiology:

Chest xray on admission (date): normal / typical COVID / indeterminate / abnormal other

If available – radiologist estimation of severity:

Chest x-ray at follow up visit(date) : normal / typical COVID / indeterminate / abnormal other

If available – radiologist estimation of severity:

Was a CT performed? Date of first CT:

Lung ultrasound? BSTI Score ___/36

Pulmonary Embolism: confirmed / excluded / not investigated

Limb DVT: confirmed / excluded / not investigated

Additional: Any specific issues identified on discharge summary for follow up?

COMORBIDITIES

Free text, list major co-morbidities

Hypertension ☐	Anaemia ☐
Type II DM ☐	Active solid organ cancer ☐
Type I DM ☐	Solid organ cancer in remission ☐
Dyslipidaemia ☐	Organ transplant / other immunosuppressed eg HIV ☐
IHD ☐	Autoimmune disease requiring current immunosuppression ☐
Heart failure ☐	Autoimmune disease not requiring immunosuppression ☐
AF / arrhythmia ☐	GORD ☐
Cerebrovascular disease ☐	Depression ☐
COPD ☐	Anxiety ☐
Asthma ☐	Other mental health disorder☐
ILD ☐	**Lung Function if available pre-morbid**
CKD ☐	Date – FEV1 (%)
Height ____ Weight ____	FVC (%)
BMI:	DLCO (%)

MEDICATION / NOVEL Treatments

Have there been any changes in medication since discharge? Yes☐ No☐

If yes what has changed_____

Treated with systemic corticosteroids? Y / N

Was the patient enrolled in any trials of treatment for COVID 19? If so – which trial(s) and which treatments did they receive (if known)?

Follow-up questions

On a scale of 1-10 (where 0 = I do not have this problem and 10 = this symptom is very significant), please rate the following symptoms. Also grade the severity at maximum and in general whether staying the same, getting better or getting worse.

	0	1	2	3	4	5	6	7	8	9	10	Max	Trajectory
Breathlessness													S / B / W
Cough													S / B / W
Fatigue													S / B / W
Sleep quality													S / B / W

Current exercise tolerance: "on a good day, on a flat surface, how far are you able to walk before you have to stop"_____ (distance in yards / m)

MRC Dyspnoea Scale: /5

ET limited by: breathlessness ☐ fatigue ☐ Other☐

Rockwood (Clinical Frailty Score) at Follow Up:

Ask about persistence of:

Myalgia ('aching in our muscles') Yes☐ No☐

Anosmia ('reduced sense of smell') Yes☐ No☐

Loss of Taste Yes☐ No☐

Ongoing Other Symptoms:

Chest pain ☐	Confusion/fuzzy head ☐
Chest tightness ☐	Diarrhoea ☐
Peripheral oedema ☐	Abdo pain☐
Focal weakness/numbness ☐	Anorexia ☐

Any other persistent symptoms_____

How close to 100% of your usual best health do you currently feel? _____

Would you feel able to return to work if permitted? Full Time / Part Time / Not at all

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PSYCHOLOGICAL

PHQ2: Over the last 2 weeks, how often have you been bothered by the following problems?

Little interest or pleasure in doing things

Feeling down, depressed or hopeless

On this scale: Not at all (0), Several days (score 1), More than half the days (score 2), Nearly every day (score 3).

Score of 3 or more is positive

Evidence of depression/anxiety – direct patient to relevant IAPT services / GP if out of area

FREE TEXT FOR OTHER CONCERNS:

_____

_____

COMPLETION:

Opportunity to answer any questions

Would you be willing to be contacted again to take part in research? No / Yes
Did you find this call useful? Yes / No / Not Sure

_____