Supplementary Appendix

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This appendix has been provided by the authors to give readers additional information about the work.

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Supplement to Hampshire et al. Cognition and Memory after Covid-19 in a Large Community Sample

Cognition and Memory after Covid-19 in a Large Community Sample

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Supplemental methods. Cognitive task designs

Immediate Memory - 20 images are displayed with an encoding time of 2000ms and inter stimulus interval of 500ms. After the full sequence is finished, each stimulus is then presented in turn within a grid of 7 distractors. The distractors are categorised by how similar they are to the stimulus along 3 dimensions. The dimensions are:

- Item - Whether the image is of the same item as the target.
- Precision - Whether the image is of the same pose or artistic style as the target.
- Mis-binding - Whether the image is flipped left or right.

The main outcome measure is the number of points accrued, where points are awarded for each trial as incorrect item = 0, correct item = 1, correct item + precision = 2, correct item, precision and binding = 3, summed across trials. Secondary scores include error types and median response times.

2D Mental Manipulation - A target grid of coloured blocks is displayed above a set of 4 similar grids of colored blocks. 3 of the grids have been subtly altered from the target and the 4th is identical to the target. The grids have all been randomly oriented at 90, 180 or 270 degrees from the target grid. The volunteer must click the grid that is identical to the target as quickly and accurately as possible. They have 3 minutes to complete as many trials as they can. The main outcome measure is the total number of correctly identified matches divided by the total number of trials completed. Secondary score is median response time.

Spatial Working Memory - A grid of 16 squares is presented. A sequence of these squares lights up, with each square lit up for 1500ms with an inter-stimulus interval of 0ms. The volunteer must remember the sequence and when it is finished, must click the sequence of squares in the correct order. If the volunteer gets a trial correct, then the number of squares in the sequence increases by 1. If the volunteer fails on a sequence of the same number of items 3 times in a row, the game ends. The main outcome measure is the maximum length sequence correctly remembered by the volunteer. Secondary score is median response time.

Spatial Planning (Tower of London) - The volunteer is presented with 10 sets of 2 rows of pegs with colored rings on them. They must identify the minimum number of moves that it would take to transform the top row of pegs to the same configuration as the bottom row of pegs. They must do this in their head and cannot use trial and error to move the rings around. The main outcome measure is the total number of correct trials divided by the total number of trials. Secondary score is median response time.

Verbal Analogical Reasoning - The volunteer is presented with a set of comparative analogies, for example “light is to heavy as fast is to slow”. The volunteer must work out if the comparison is correct. In the given example, this comparison is correct as they are both opposites of each other. An example of an incorrect analogical comparison would be “human is to ape as fast is to slow”. The volunteer must complete as many comparisons as possible in 3 minutes as accurately as possible. The main outcome measure is the total number of correct trials divided by the total number of completed trials. Secondary score is median response time.

Word Definitions - The volunteer is presented with a series of trials on which a word is displayed alongside four possible definitions. The words are are sampled to give the same balance of variability of frequency of use in the general population. The volunteer must indicate which of the definitions matches the currently presented word, responding as quickly and accurately as they can. If they do not know the definition they must make their best guess. The volunteer must complete a fixed number of trials as quickly and accurately as they can. The main outcome measure is the total

number of correct trials. The secondary score is median response time on trials where their answer is correct.

Information Sampling - The volunteer must decide which out of two colors they judge to be the most common in an unseen bag of beads. They select one bead at a time until they have sufficient evidence to make that decision. If they choose the correct color, then they are awarded points. The more beads that are selected, the fewer points they are awarded. However, certainty in their decision increases the more beads that they select. Therefore, they must balance higher reward against higher certainty. The task completes after 15 trials. The main outcome measure is the number of points awarded. Secondary outcome measures include mean number of selections before decision, percent correct decisions and mean response time when selecting beads.

Delayed Memory - The volunteer is presented with the same task as the Object Memory (Immediate Memory) task described above, however the encoding period is removed. This means the volunteer must remember the stimuli from the beginning of the battery. The main outcome measure is the total number of points accrued as described in the Object Memory (Immediate Memory). Secondary scores include error types and median response times.

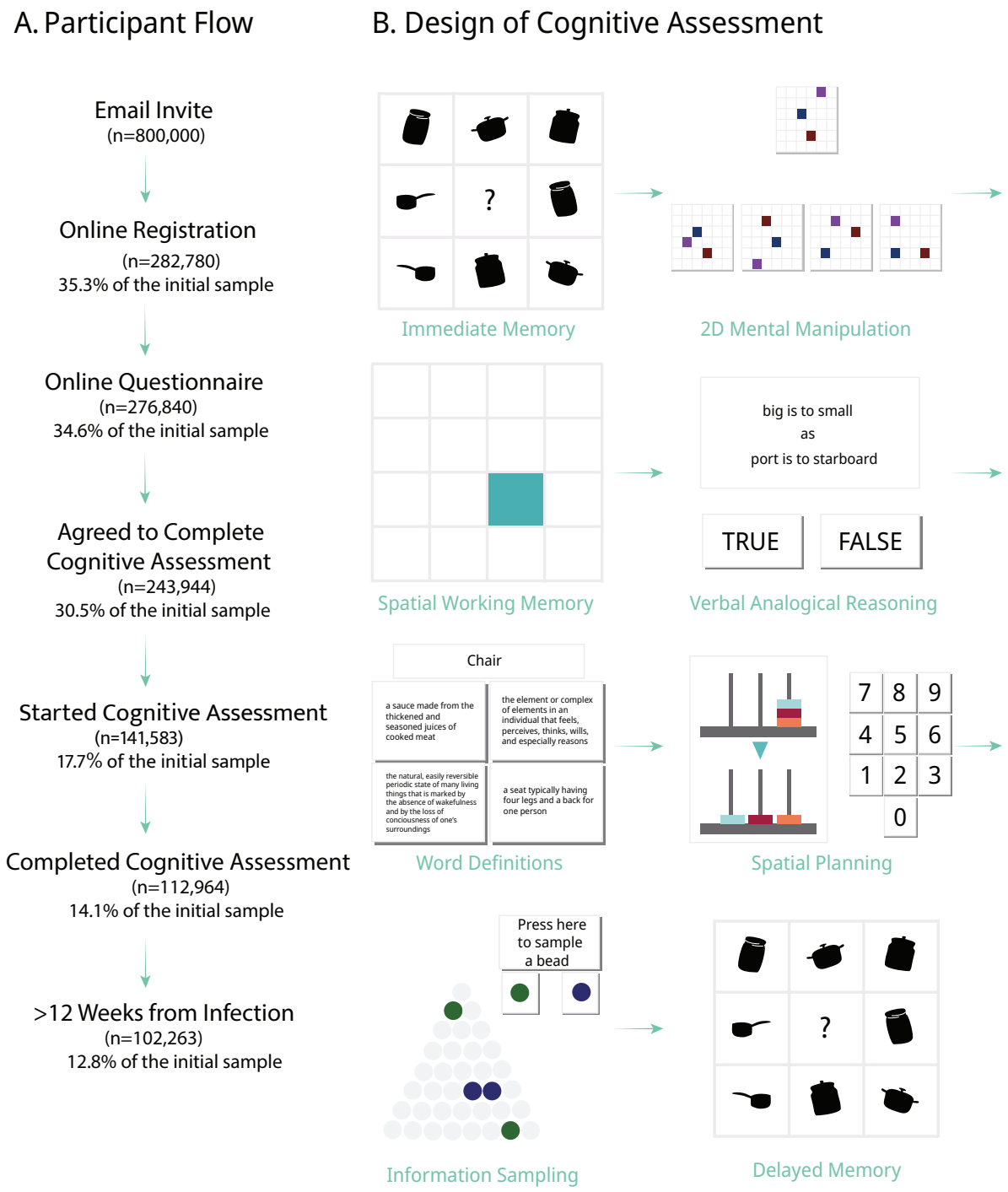


Figure S1. Study and cognitive task designs

A. *The steps in recruitment to the study from the REACT cohort.* ***B.*** *The sequence of 8 cognitive tasks undertaken by participants.*

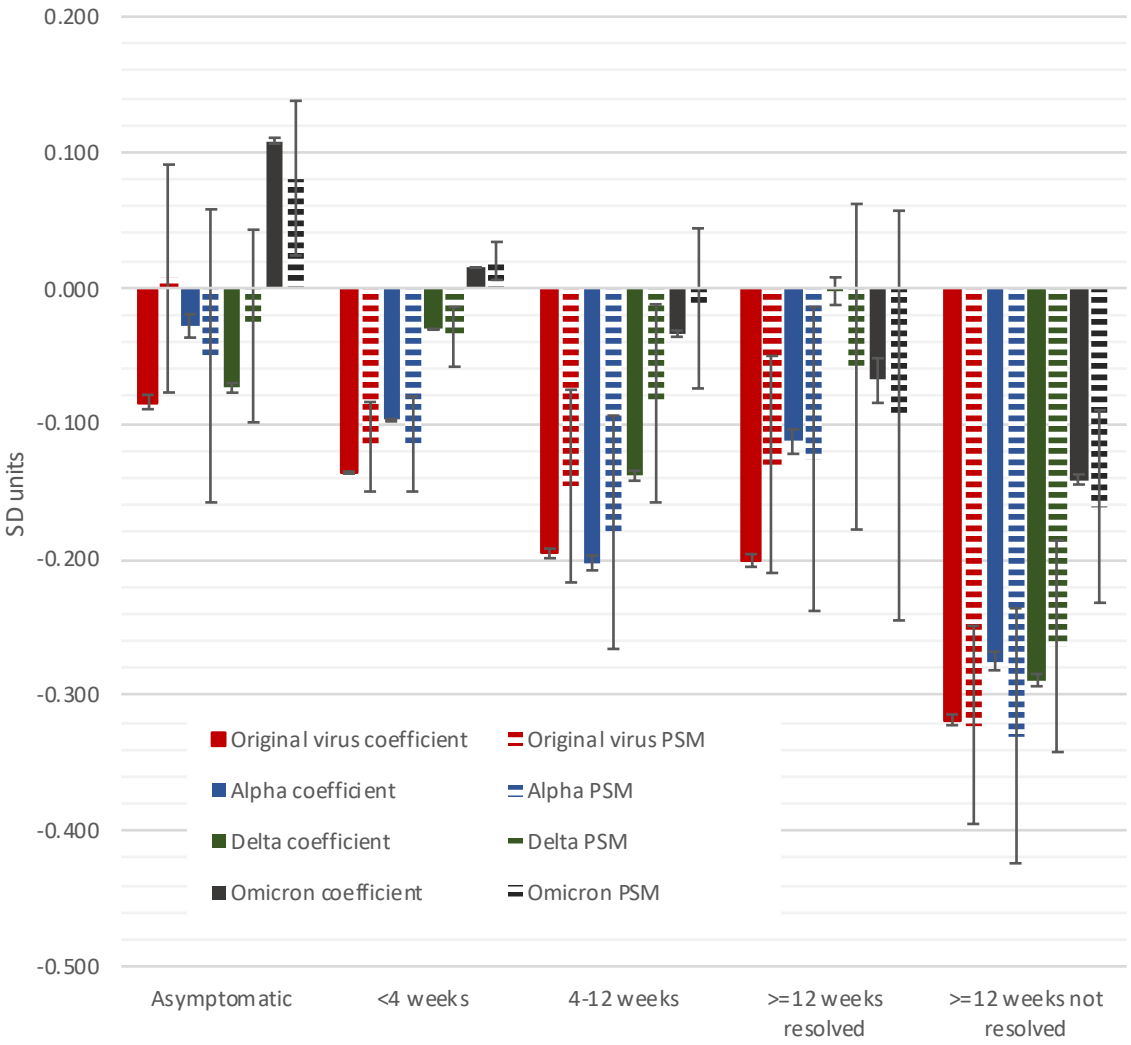
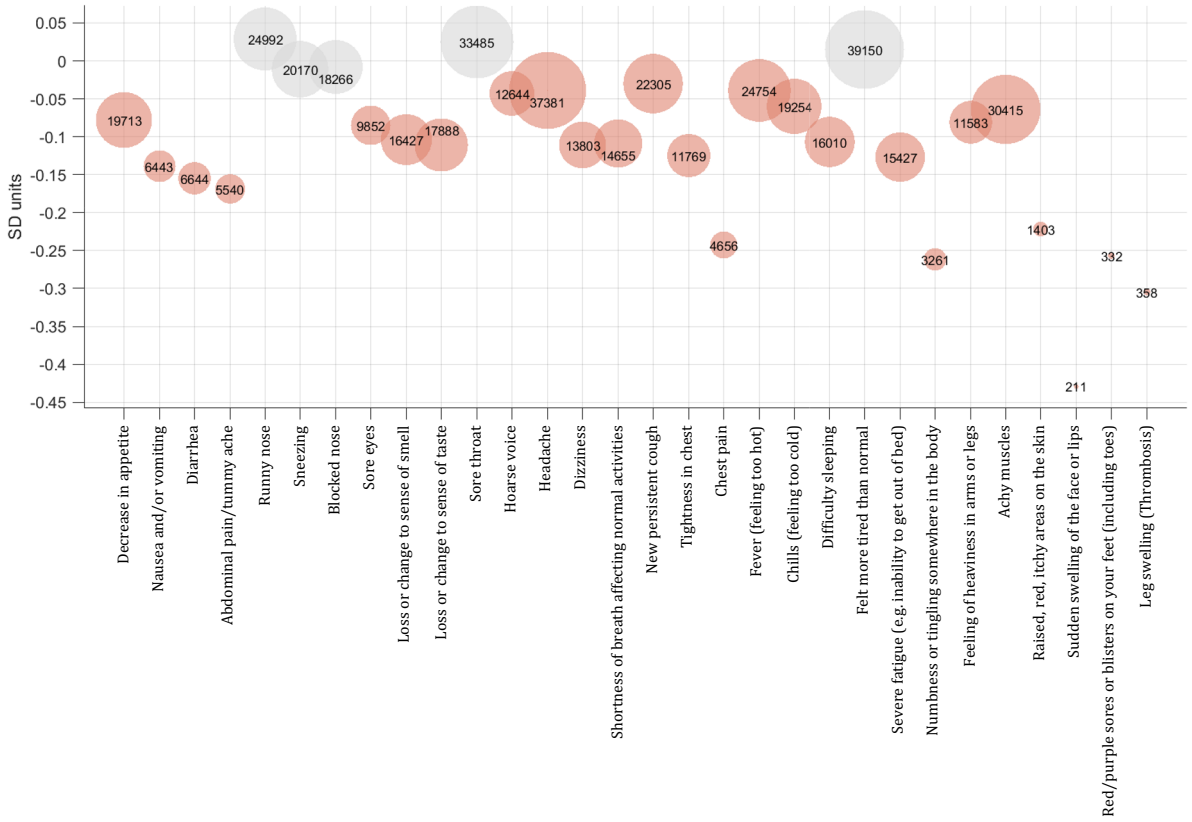


Figure S2. Estimates from analyses of associations of global cognitive score with illness duration stratified by variant period

Solid bars show coefficient estimates from the linear regression model, relative to the No-Covid-19 group, stratified by variant period. Adjacent patterned bars show corresponding mean differences from the propensity score matched (PSM) analysis, matching to the No-Covid-19 group by demographic factors and pre-existing conditions separately for each combination of illness-duration and variant period. Error bars are the 95% confidence interval.

S3A. For people assessed at least 12 weeks since their Covid-19 infection onset, the mean differences in global cognitive scores between those indicating presence minus those indicating absence of individual symptoms as part of their illness.



S3B. For ongoing persistent Covid-19 cases, the mean difference in global cognitive scores between those indicating presence minus those indicating absence of individual symptoms within the past two weeks.

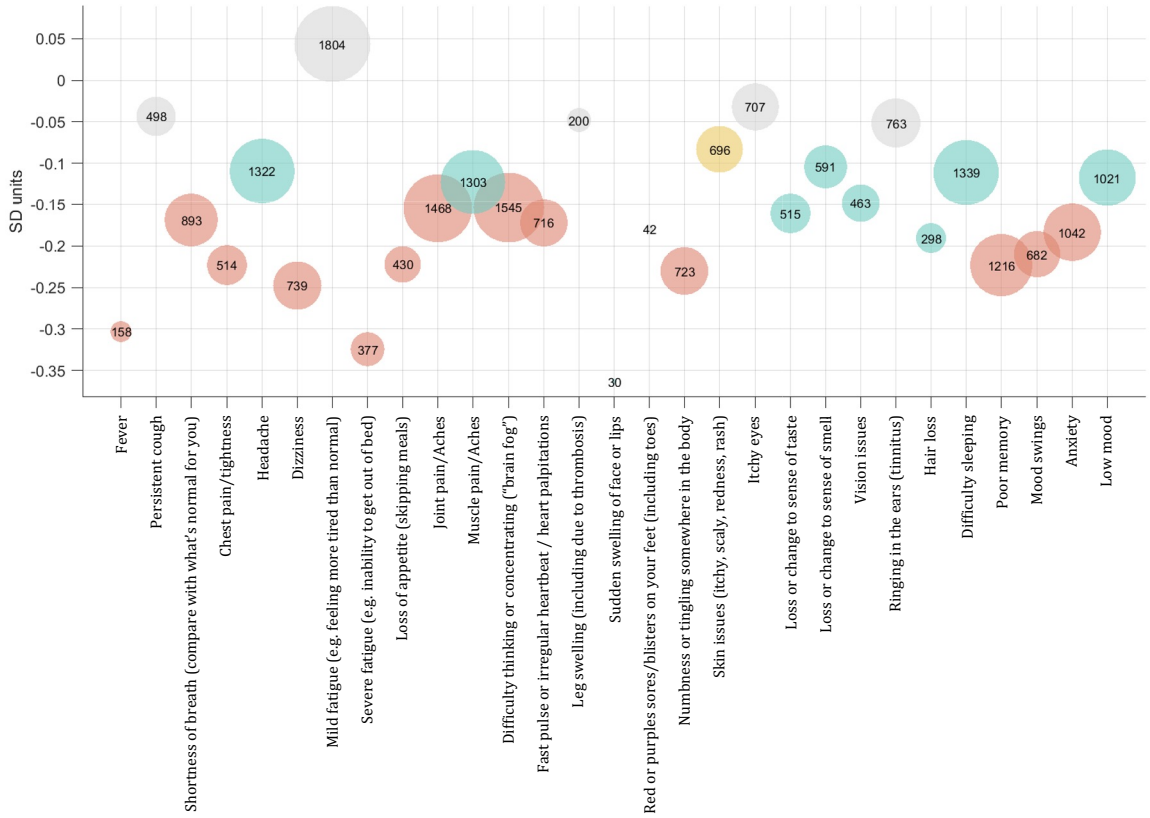


Figure S3. Relationship of global cognitive score with symptoms

A. For people whose illness was at least 12 weeks prior to cognitive assessment, comparing global cognitive score between those answering yes vs. no to each individual symptom in response to the question "Which of the following symptoms were part of your Covid-19 illness?". **B.** For people with ongoing persistent symptoms, comparing global cognitive score between those answering yes vs. no to each individual symptom in response to the question "Indicate which persistent symptoms (lasting more than 12 weeks) you think may be linked to your having had Covid-19?" Size of circles is proportional to number of participants reporting the symptom, numbers are also presented. Position represents differences in the mean between those answering yes vs. no in standard deviation units. Color represents whether the difference falls below the lower 99.9% (pink), 95.0% (blue) or 90.0% (yellow) confidence interval unadjusted for multiple comparisons.

Table S1. Questionnaire transcript

Full questionnaire transcripts for REACT are available on this link: https://www.imperial.ac.uk/medicine/research-and-impact/groups/react-study/for-researchers/react-long-covid-materials/

Specific questionnaire items analysed in this study were phrased as below.

In the last two weeks, that is since <DAY/MONTH>, have you experienced any of the following symptoms? Please include any symptom you have experienced over the last two weeks, including those that have resolved or lasted only a few days. Please select all that apply.	1. Fever 2. Persistent cough 3. Shortness of breath (compare with what's normal for you) 4. Chest pain/tightness 5. Headache 6. Dizziness 7. Mild fatigue (e.g. feeling more tired than normal) 8. Severe fatigue (e.g. inability to get out of bed) 9. Loss of appetite (skipping meals) 10. Joint pain/Aches 11. Muscle pain/Aches 12. Difficulty thinking or concentrating ("brain fog") 13. Fast pulse or irregular heartbeat / heart palpitations 14. None of these – FIXED CODE (EXCLUSIVE) 15. Prefer not to say – FIXED CODE (EXCLUSIVE)
How about these? Have you experienced any of the following in the last two weeks, that is since <DAY/MONTH>? Please include any symptom you have experienced over the last two weeks, including those that have resolved or lasted only a few days. Please select all that apply.	1. Leg swelling (including due to thrombosis) 2. Sudden swelling of face or lips 3. Red or purples sores/blisters on your feet (including toes) 4. Numbness or tingling somewhere in the body 5. Skin issues (itchy, scaly, redness, rash) 6. Itchy eyes 7. Loss or change to sense of taste 8. Loss or change to sense of smell 9. Vision issues 10. Ringing in the ears (tinnitus) 11. Hair loss 12. Difficulty sleeping 13. Poor memory 14. Mood swings 15. Anxiety 16. Low mood 17. Other (please write in) (Free text box max 200 characters) 18. None of these 19. Prefer not to say
Which symptom(s), if any, started after 1 January 2020? [DISPLAY LIST OF SYMPTOMS AS ABOVE SO THEY CAN BE SELECTED]	
Have you ever had a coronavirus vaccine?	1. Yes 2. No 3. Don't know
Most of the vaccines require more than one dose which are given as separate injections some time apart. How many doses (injections) have you had so far?	1. One 2. Two 3. Three 4. More than three

Do you think that you have or have had Covid-19?	1. Yes 2. No 3. Not sure 4. Prefer not to say
Do you think you have had Covid-19 more than once?	1. Yes 2. Not sure 3. No 4. Prefer not to say
How many times do you think you have had Covid-19?	
When did your first symptoms start when you had Covid-19 IF < HADCovid = 1 AND HADCovidTIMES =1<the first time> (as best as you can remember)?	DAY/MONTH/YEAR
When did your symptoms finish when you had Covid-19 [IF < HADCovid = 1 AND HADCovidTIMES =1<the first time>] (as best as you can remember)?	DAY/MONTH/YEAR I still have symptoms
What kind of medical attention, if any, did you access for your illness when you IF CovidA2=1 had; IF CovidA2=2 or 3 thought you had Covid-19 the most recent time? Please select all that apply.	1. None 2. Contacted NHS 111, by phone or online 3. Visited pharmacist 4. Consulted GP/practice nurse over the phone or online 5. Consulted GP/practice nurse face to face 6. Walk-in centre 7. Accident and Emergency 8. Hospital admission 9. Hospital admission: intensive care unit 10. Other, please write in ……. [free text]
Thinking about [IF < HADCovid = 1 AND HADCovidTIMES =1 all the times you had] [HADCovid = 1 AND HADCovidTIMES =2, 3 OR 4 the time you had] Covid-19, did any of your symptoms last more than 12 weeks?	1. Yes 2. No 3. Don't know
Do you have any of the following (or do any of the following apply to you)? Please select all that apply.	1. Organ transplant recipient 2. Diabetes (type I or II) 3. Heart disease or heart problems such as heart failure 4. Hypertension (high blood pressure) 5. Stroke 6. Kidney failure (kidneys do not work well) 7. Liver disease 8. Anaemia 9. Allergy (eczema, hay fever, rhinitis) 10. None of these – FIXED CODE (EXCLUSIVE) 11. Prefer not to say – FIXED CODE (EXCLUSIVE)

How about these? Do you have any of the following (or do any of the following apply to you)? Please select all that apply.	1. Asthma 2. Other condition affecting lungs (such as chronic obstructive lung disease (COPD), bronchitis or emphysema) 3. Cancer 4. Fibromyalgia 5. Epilepsy 6. Other condition affecting the brain and nerves (e.g. Dementia, Parkinson's, Multiple Sclerosis, Myasthenia Gravis) 7. Osteoarthritis 8. A weakened immune system/reduced ability to deal with infections (as a result of a disease or treatment) 9. Hepatitis, tuberculosis or other chronic infection. 10. None of these – FIXED CODE (EXCLUSIVE) 11. Prefer not to say – FIXED CODE (EXCLUSIVE)
How about these? Do you have any of the following? Please select all that apply.	1. Dementia 2. Anxiety 3. Depression 4. Any other psychiatric condition e.g. bipolar disorder, schizophrenia, anorexia or bulimia 5. Rheumatoid arthritis 6. Hypothyroidism (underactive thyroid gland) 7. Hyperthyroidism (overactive thyroid gland) 8. Addison's or Cushing's disease (poor functioning of the adrenal glands) 9. Sleep apnoea/ narcolepsy 10. Any other serious illness Please write in: [free text] -_[FIXED CODE] 11. None of these – FIXED CODE (EXCLUSIVE) 12. Prefer not to say – FIXED CODE (EXCLUSIVE)
Which of the following symptoms were part of your Covid-19 illness? Please select all the symptoms you had, whether or not you saw a doctor.	1. Decrease in appetite 2. Nausea and/or vomiting 3. Diarrhoea 4. Abdominal pain/tummy ache 5. Runny nose 6. Sneezing 7. Blocked nose 8. Sore eyes 9. Loss or change to sense of smell 10. Loss or change to sense of taste 11. Sore throat 12. Hoarse voice 13. Headache 14. Dizziness 15. None of these –FIXED CODE (EXCLUSIVE) 16. Prefer not to say –FIXED CODE (EXCLUSIVE)
Which of the followingsymptoms were part of your Covid-19 illness? Please select all the symptoms you had, whether or not you saw a doctor.	1. Shortness of breath affecting normal activities 2. New persistent cough 3. Tightness in chest 4. Chest pain 5. Fever (feeling too hot) 6. Chills (feeling too cold) 7. Difficulty sleeping 8. Felt more tired than normal 9. Severe fatigue (e.g. inability to get out of bed) 10. Numbness or tingling somewhere in the body 11. Feeling of heaviness in arms or legs 12. Achy muscles 13. Raised, red, itchy areas on the skin 14. Sudden swelling of the face or lips 15. Red/purple sores or blisters on your feet (including toes) 16. Leg swelling (Thrombosis)

17. Other symptom (please write in)
18.None of these –FIXED CODE (EXCLUSIVE)
19. Prefer not to say –FIXED CODE (EXCLUSIVE)

Table S2a. Normative model estimates for primary summary scores

Parameter estimates from normative modelling of primary measures for each task. Note, models are run separately for each task version.

	Information Sampling Score	2D Mental Manipulation V1	2D Mental Manipulation V2	Immediate Memory	Delayed Memory	Spatial Working Memory Maximum Span	Verbal Analogies V1	Verbal Analogies V2	Word Definitions	Spatial Planning V1	Spatial Planning V2
N	115380	42355	94127	141582	112964	129543	37382	82448	117587	37694	83253
(Intercept)	-0.22	0.53	0.48	-0.04	-0.04	0.66	-0.07	-0.56	-1.61	-0.16	-0.27
AGE_NOW_20	0.01	-0.07	-0.12	0.02	0.13	-0.02	-0.31	-0.03	0.04	-0.15	-0.07
AGE_NOW_25	0.04	-0.18	-0.17	0.06	0.11	-0.06	-0.36	0.04	0.15	-0.15	-0.04
AGE_NOW_30	0.00	-0.39	-0.28	0.05	0.07	-0.15	-0.43	0.05	0.24	-0.25	-0.08
AGE_NOW_35	-0.01	-0.41	-0.40	-0.05	-0.06	-0.26	-0.46	-0.05	0.30	-0.27	-0.10
AGE_NOW_40	-0.05	-0.49	-0.49	-0.12	-0.11	-0.39	-0.52	-0.07	0.37	-0.27	-0.15
AGE_NOW_45	-0.07	-0.67	-0.66	-0.17	-0.16	-0.47	-0.49	-0.07	0.48	-0.36	-0.20
AGE_NOW_50	-0.06	-0.85	-0.85	-0.22	-0.20	-0.60	-0.52	-0.11	0.57	-0.35	-0.24
AGE_NOW_55	-0.08	-1.04	-1.02	-0.28	-0.27	-0.78	-0.62	-0.16	0.67	-0.42	-0.30
AGE_NOW_60	-0.08	-1.17	-1.18	-0.34	-0.34	-0.93	-0.69	-0.25	0.79	-0.51	-0.39
AGE_NOW_65	-0.03	-1.35	-1.33	-0.40	-0.40	-1.04	-0.76	-0.28	0.91	-0.59	-0.47
AGE_NOW_70	0.00	-1.54	-1.51	-0.48	-0.47	-1.17	-0.80	-0.32	1.01	-0.66	-0.55
AGE_NOW_75	0.03	-1.70	-1.67	-0.59	-0.57	-1.32	-0.92	-0.40	1.05	-0.74	-0.67
AGE_NOW_80	0.05	-1.88	-1.85	-0.78	-0.72	-1.55	-1.08	-0.51	1.06	-0.86	-0.71
AGE_NOW_85	0.15	-1.96	-1.98	-0.82	-0.78	-1.65	-1.14	-0.59	1.07	-0.78	-0.86
AGE_NOW_90	0.19	-2.19	-2.03	-1.07	-0.79	-1.94	-1.37	-0.73	1.08	-0.77	-1.07
AGE_NOW_95	0.14	-1.95	-2.47	-1.15	-1.21	-1.74	-1.11	-0.62	0.98	-1.20	-0.98
AGE_NOW_100	-0.59	0.00	-2.14	0.27	-0.55	-1.33	0.00	-1.00	0.42	0.00	-0.58
U_GENDER_male	0.09	0.00	0.02	-0.08	-0.06	0.25	0.02	0.04	0.08	0.27	0.27
U_GENDER_unknown	-0.28	0.56	0.17	-0.49	-0.42	0.49	2.65	0.47	-0.45	-1.83	-0.32
ethnic_black	-0.07	-0.37	-0.33	-0.06	-0.07	-0.46	-0.34	-0.27	-0.02	-0.37	-0.33
ethnic_mixed	0.10	0.33	0.38	0.22	0.18	-0.01	0.54	0.39	0.60	0.32	0.24
ethnic_other	0.04	0.06	0.06	-0.03	-0.08	-0.04	-0.08	-0.01	0.05	0.09	-0.06
ethnic_unknown	0.06	0.33	0.37	0.07	0.08	-0.16	0.36	0.24	0.51	0.16	0.16
ethnic_white	0.12	0.49	0.50	0.23	0.23	-0.05	0.45	0.36	0.57	0.34	0.30
IMD_Q_2	0.04	0.06	0.03	0.06	0.05	0.04	0.08	0.14	0.11	0.10	0.08
IMD_Q_3	0.08	0.08	0.06	0.11	0.09	0.06	0.12	0.20	0.15	0.14	0.14
IMD_Q_4	0.08	0.06	0.07	0.12	0.10	0.09	0.12	0.21	0.16	0.14	0.16
IMD_Q_5	0.10	0.08	0.07	0.14	0.11	0.11	0.17	0.27	0.18	0.15	0.18
IMD_Q_unknown	0.07	-0.23	0.09	0.15	0.14	0.06	0.20	0.23	0.17	0.38	0.14
educ_Degree	0.08	0.03	0.02	0.15	0.15	0.09	0.51	0.51	0.51	0.25	0.25
educ_GCSE<5	-0.05	-0.05	-0.11	-0.18	-0.18	-0.17	-0.53	-0.51	-0.46	-0.32	-0.34
educ_GCSE>5	-0.01	-0.01	-0.02	-0.07	-0.08	-0.03	-0.20	-0.14	-0.16	-0.08	-0.09
educ_Higher	0.01	-0.01	-0.02	0.04	0.03	-0.01	0.06	0.08	0.06	0.04	0.05
educ_None	-0.04	-0.10	-0.08	-0.25	-0.19	-0.16	-0.68	-0.54	-0.66	-0.40	-0.43
educ_Other	0.03	-0.11	-0.07	-0.04	-0.01	-0.05	-0.21	-0.15	-0.15	-0.11	-0.08
educ_unknown	0.04	-0.13	-0.02	0.03	0.05	0.02	-0.44	0.19	0.17	-0.23	0.08
preexisting_Organ_transplant	-0.01	-0.01	0.13	0.00	-0.06	-0.16	-0.10	-0.09	-0.12	-0.14	-0.06
preexisting_Diabetes	-0.04	-0.05	-0.06	-0.03	-0.03	-0.07	-0.06	-0.13	-0.09	-0.03	-0.08
preexisting_Heart_disease	-0.01	-0.01	-0.03	-0.02	-0.04	0.00	-0.05	-0.08	-0.04	-0.05	-0.01
preexisting_Hypertension	-0.01	0.00	0.00	0.00	-0.01	-0.03	-0.02	-0.04	0.00	-0.06	-0.04

preexisting_Stroke	0.02	-0.15	-0.16	-0.10	-0.13	-0.12	-0.12	-0.06	-0.08	-0.12	-0.07
preexisting_Kidney_failure	-0.01	-0.09	-0.06	-0.02	0.03	-0.01	-0.02	-0.12	-0.01	0.05	-0.04
preexisting_Liver_disease	-0.05	0.01	0.01	-0.05	-0.03	-0.04	-0.14	-0.04	-0.05	-0.06	-0.23
preexisting_Anaemia	0.00	-0.06	-0.05	-0.03	-0.01	-0.04	0.03	-0.07	0.01	-0.02	-0.06
preexisting_Allergy	0.02	0.04	0.03	0.09	0.09	0.02	0.07	0.12	0.14	0.08	0.12
preexisting_Asthma	-0.03	0.01	-0.01	-0.03	-0.03	-0.02	-0.07	-0.09	-0.04	-0.07	-0.06
preexisting_Other_lung_disease	-0.04	-0.02	-0.07	-0.04	-0.03	-0.04	-0.10	-0.08	-0.09	-0.04	-0.05
preexisting_Cancer	-0.01	-0.02	0.04	0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.02	0.01
preexisting_Fibromyalgia	-0.04	-0.04	-0.07	-0.10	-0.05	-0.07	-0.14	-0.13	-0.14	-0.04	-0.13
preexisting_Epilepsy	0.04	-0.21	-0.27	-0.25	-0.29	-0.21	-0.11	-0.16	-0.11	-0.35	-0.19
preexisting_Other_brainnerve	0.03	-0.19	-0.17	-0.11	-0.08	-0.11	-0.11	0.00	0.04	-0.05	-0.01
preexisting_Osteoarthritis	-0.02	-0.01	-0.01	0.02	0.03	-0.01	0.01	0.02	0.06	0.02	0.01
preexisting_Immunosupression	-0.02	-0.02	-0.05	-0.01	-0.01	-0.04	-0.02	-0.08	-0.04	-0.01	-0.06
preexisting_Chronic_infection	0.05	-0.14	-0.02	-0.13	-0.08	0.01	-0.02	0.00	-0.21	0.09	0.07
preexisting_Dementia	-0.25	-0.47	-0.26	-0.58	-0.35	-0.44	-0.10	-0.40	-0.74	0.04	-0.11
preexisting_Anxiety	-0.02	-0.04	-0.05	-0.08	-0.07	-0.06	-0.05	-0.10	-0.06	-0.08	-0.14
preexisting_Depression	-0.03	0.00	-0.01	-0.01	0.01	-0.04	-0.02	0.01	-0.01	-0.04	-0.01
preexisting_Other_psych_disease	0.07	-0.20	-0.08	-0.11	-0.11	-0.11	0.01	0.02	0.14	-0.05	-0.05
preexisting_Rheumatoid_arthritis	-0.01	0.00	-0.01	-0.06	-0.07	-0.03	-0.16	-0.15	-0.20	-0.10	-0.06
preexisting_Hypothyroid	0.00	-0.02	-0.02	0.02	0.03	0.01	0.00	-0.03	0.04	0.04	-0.01
preexisting_Adrenal_gland	0.15	0.14	-0.06	-0.41	-0.17	-0.13	0.18	-0.02	-0.07	-0.17	-0.07
preexisting_Sleepapnoea_narco	0.00	0.01	0.06	0.01	-0.04	0.00	-0.06	-0.08	-0.09	-0.01	-0.06
preexisting_Other_serious_illness	-0.02	-0.06	-0.07	-0.02	0.02	-0.03	-0.02	-0.04	0.00	-0.02	0.00

Table S2b. Normative model estimates for secondary summary scores

Parameter estimates from normative modelling of secondary measures for each task. Models are run separately for each task version.

	Information Sampling Response Time	Information Sampling N Samples	Information Sampling Percent Correct	Information Sampling Total Points	2D Mental Manipulation V1 RT	2D Mental Manipulation V2 RT	Spatial Working Memory RT	Verbal Analogies V1 RT	Verbal Analogies V2 RT	Word Definitions RT	Spatial Planning V1 RT	Spatial Planning V2 RT
N	115380	115380	115380	115380	42344	94074	129368	37382	82428	117572	37694	83253
(Intercept)	-0.61	-0.15	-0.40	-0.22	-0.53	-0.54	-0.61	-1.08	-0.88	-0.11	-0.67	-0.78
AGE_NOW_20	0.02	0.02	0.01	0.01	-0.09	0.10	0.02	0.13	-0.03	0.10	-0.14	0.05
AGE_NOW_25	0.05	0.03	0.03	0.04	0.06	0.15	0.07	0.17	0.09	0.35	-0.13	0.05
AGE_NOW_30	0.16	0.12	0.00	0.00	0.21	0.27	0.18	0.39	0.24	0.48	-0.08	0.14
AGE_NOW_35	0.22	0.17	0.01	-0.01	0.25	0.36	0.22	0.55	0.40	0.57	-0.06	0.18
AGE_NOW_40	0.27	0.23	0.00	-0.05	0.32	0.44	0.32	0.63	0.50	0.58	0.00	0.20
AGE_NOW_45	0.33	0.25	0.02	-0.07	0.45	0.61	0.43	0.76	0.59	0.57	0.08	0.27
AGE_NOW_50	0.38	0.23	0.07	-0.06	0.62	0.76	0.58	0.92	0.77	0.62	0.23	0.38
AGE_NOW_55	0.50	0.25	0.12	-0.08	0.80	0.91	0.68	1.08	0.92	0.65	0.38	0.49
AGE_NOW_60	0.56	0.20	0.13	-0.08	0.92	1.06	0.74	1.24	1.04	0.63	0.47	0.57
AGE_NOW_65	0.60	0.13	0.15	-0.03	1.07	1.19	0.78	1.39	1.20	0.62	0.62	0.68
AGE_NOW_70	0.58	0.03	0.15	0.00	1.24	1.33	0.84	1.61	1.36	0.66	0.78	0.77
AGE_NOW_75	0.56	-0.07	0.18	0.03	1.37	1.46	0.90	1.78	1.53	0.73	0.89	0.83
AGE_NOW_80	0.55	-0.13	0.17	0.05	1.53	1.57	0.99	1.95	1.69	0.82	1.00	1.01
AGE_NOW_85	0.44	-0.26	0.21	0.15	1.60	1.72	1.00	2.09	1.86	0.85	1.34	1.01
AGE_NOW_90	0.19	-0.48	0.20	0.19	1.85	1.78	0.97	2.58	2.05	0.98	1.58	1.20
AGE_NOW_95	0.33	-0.37	0.15	0.14	1.21	2.16	1.18	2.09	2.42	1.06	0.61	1.21
AGE_NOW_100	-0.83	-1.33	-1.48	-0.59	0.00	2.07	0.50	0.00	0.14	0.88	0.00	0.90
U_GENDER_male	0.08	0.02	0.10	0.09	0.07	0.05	0.24	0.19	0.18	0.19	0.14	0.12
U_GENDER_unknown	0.13	0.02	0.20	-0.28	-0.82	-0.13	-0.06	-1.47	0.32	-2.00	-2.02	-0.66
ethnic_black	0.19	0.07	-0.11	-0.07	0.22	0.13	0.07	0.14	0.05	0.14	0.05	-0.02
ethnic_mixed	0.10	0.02	0.07	0.10	-0.21	-0.29	-0.12	-0.15	-0.09	-0.37	0.10	0.14
ethnic_other	-0.01	-0.02	0.01	0.04	-0.07	-0.12	-0.06	0.11	0.06	0.03	-0.01	-0.03
ethnic_unknown	-0.04	-0.02	0.00	0.06	-0.37	-0.40	-0.21	-0.22	-0.30	-0.43	-0.07	-0.04
ethnic_white	0.04	0.01	0.08	0.12	-0.37	-0.44	-0.16	-0.23	-0.24	-0.42	0.05	0.06
IMD_Q_2	0.02	0.01	0.06	0.04	0.00	0.01	0.01	0.06	0.05	-0.03	0.05	0.08
IMD_Q_3	0.03	0.01	0.08	0.08	-0.01	0.00	0.00	0.07	0.07	-0.05	0.11	0.12
IMD_Q_4	0.04	0.01	0.08	0.08	0.02	0.01	0.01	0.07	0.07	-0.05	0.11	0.14
IMD_Q_5	0.05	0.01	0.11	0.10	0.02	0.02	0.01	0.06	0.09	-0.07	0.10	0.16
IMD_Q_unknown	0.05	0.01	0.07	0.07	0.41	-0.03	0.01	0.21	0.07	-0.06	0.29	0.12
educ_Degree	0.17	0.04	0.12	0.08	0.07	0.06	0.13	0.03	0.09	-0.32	0.20	0.20
educ_GCSE<5	-0.12	-0.07	-0.07	-0.05	-0.09	-0.03	-0.10	0.01	-0.01	0.27	-0.16	-0.24
educ_GCSE>5	-0.05	-0.02	-0.03	-0.01	-0.03	-0.03	-0.04	0.01	-0.01	0.09	-0.05	-0.07
educ_Higher	0.00	-0.03	0.02	0.01	0.03	0.03	0.02	0.08	0.10	0.01	0.05	0.06
educ_None	-0.16	-0.12	-0.09	-0.04	-0.12	-0.14	-0.13	-0.03	-0.04	0.42	-0.35	-0.41
educ_Other	-0.07	-0.07	0.02	0.03	0.08	0.03	0.01	0.16	0.12	0.21	-0.03	-0.03
educ_unknown	0.05	-0.01	0.05	0.04	0.01	0.04	0.03	0.11	0.07	-0.10	-0.14	0.07

preexisting_Organ_transplant	-0.09	-0.10	-0.02	-0.01	0.06	-0.26	-0.13	-0.03	0.03	-0.06	-0.06	-0.15
preexisting_Diabetes	-0.02	-0.04	-0.04	-0.04	0.01	0.01	0.03	-0.05	-0.06	0.07	-0.09	-0.10
preexisting_Heart_disease	-0.01	-0.02	-0.02	-0.01	-0.01	0.00	0.03	0.00	0.02	0.02	-0.05	0.00
preexisting_Hypertension	-0.02	-0.01	-0.01	-0.01	0.00	-0.01	0.00	0.00	-0.03	0.00	-0.03	-0.03
preexisting_Stroke	-0.01	-0.06	-0.06	0.02	0.12	0.15	0.06	0.17	0.07	0.15	0.02	-0.01
preexisting_Kidney_failure	0.00	-0.04	0.07	-0.01	0.13	0.04	-0.04	0.02	-0.01	0.10	-0.02	-0.05
preexisting_Liver_disease	0.00	0.00	-0.09	-0.05	0.01	-0.04	-0.14	-0.01	-0.03	0.01	0.00	-0.23
preexisting_Anaemia	-0.05	-0.04	-0.02	0.00	0.03	0.00	-0.01	0.04	0.00	0.01	0.04	-0.02
preexisting_Allergy	0.05	-0.01	0.04	0.02	0.00	0.00	0.06	0.01	0.03	-0.08	0.08	0.09
preexisting_Asthma	0.00	0.02	-0.04	-0.03	-0.01	0.00	-0.06	-0.06	-0.05	0.02	-0.09	-0.07
preexisting_Other_lung_disease	0.00	-0.01	0.00	-0.04	-0.08	0.04	0.01	-0.06	-0.01	0.07	-0.10	-0.05
preexisting_Cancer	0.00	-0.01	-0.01	-0.01	0.00	-0.04	0.01	0.00	-0.05	-0.02	-0.06	0.02
preexisting_Fibromyalgia	-0.01	0.01	-0.09	-0.04	-0.01	0.00	-0.01	0.06	-0.02	0.03	-0.03	-0.08
preexisting_Epilepsy	-0.01	-0.16	-0.11	0.04	0.06	0.17	0.16	-0.10	0.17	0.01	0.07	0.03
preexisting_Other_brainnerve	0.04	-0.07	0.02	0.03	0.16	0.19	0.20	0.23	0.19	0.08	0.12	0.13
preexisting_Osteoarthritis	-0.01	-0.02	-0.01	-0.02	0.02	0.01	-0.04	0.00	-0.02	-0.02	0.05	0.01
preexisting_Immunosupression	-0.03	-0.02	-0.01	-0.02	0.00	0.03	0.02	0.00	0.01	0.05	0.02	-0.03
preexisting_Chronic_infection	-0.12	0.03	0.09	0.05	0.09	-0.07	-0.02	0.30	-0.09	0.09	0.01	-0.18
preexisting_Dementia	0.01	0.14	-0.26	-0.25	0.66	-0.01	-0.29	0.31	-0.22	0.13	-0.14	-0.30
preexisting_Anxiety	-0.04	0.00	-0.01	-0.02	0.01	0.01	-0.02	0.01	-0.02	0.02	-0.04	-0.07
preexisting_Depression	0.02	-0.01	-0.04	-0.03	-0.01	-0.01	0.05	0.00	-0.03	-0.04	-0.03	-0.07
preexisting_Other_psych_disease	-0.07	-0.12	-0.03	0.07	0.14	0.05	-0.01	0.07	0.03	-0.09	0.09	0.05
preexisting_Rheumatoid_arthritis	-0.04	-0.05	-0.06	-0.01	-0.03	0.01	0.00	-0.03	-0.02	0.12	-0.09	-0.08
preexisting_Hypothyroid	-0.02	-0.01	-0.01	0.00	0.04	0.01	-0.03	0.00	-0.01	-0.01	0.04	-0.02
preexisting_Adrenal_gland	-0.11	-0.18	0.00	0.15	-0.23	-0.01	-0.10	-0.06	-0.13	-0.04	-0.09	0.06
preexisting_Sleepapnoea_narco	-0.07	-0.04	-0.06	0.00	0.00	-0.08	-0.02	-0.01	0.01	0.04	-0.10	-0.03
preexisting_Other_serious_illness	0.02	-0.02	0.01	-0.02	0.06	0.06	0.05	0.09	0.08	0.03	0.05	0.06

Table S2c. Normative model estimates for memory error types

Parameter estimates from normative modelling of memory error scores. Note, models are run separately for tasks with different versions of stimuli.

	Delayed Memory RT	Delayed Memory Precision Errors	Delayed Memory Binding Errors	Delayed Memory Correct	Immediate Memory RT	Immediate Memory Precision Errors	Immediate Memory Binding Errors	Immediate Memory Correct
N	141582	141582	141582	141582	108171	112964	112964	112964
(Intercept)	-0.37	-0.03	-0.10	0.00	-0.57	-0.07	-0.19	-0.01
AGE_NOW_20	0.04	0.01	0.02	0.00	-0.05	-0.04	-0.03	0.12
AGE_NOW_25	0.05	-0.01	0.03	0.02	0.01	-0.01	0.00	0.10
AGE_NOW_30	0.11	-0.01	0.04	0.01	0.11	0.01	0.01	0.06
AGE_NOW_35	0.17	0.06	0.11	-0.09	0.19	0.08	0.08	-0.06
AGE_NOW_40	0.19	0.13	0.15	-0.15	0.25	0.13	0.11	-0.12
AGE_NOW_45	0.29	0.17	0.20	-0.21	0.41	0.19	0.15	-0.17
AGE_NOW_50	0.38	0.22	0.24	-0.26	0.57	0.22	0.19	-0.21
AGE_NOW_55	0.48	0.26	0.30	-0.33	0.76	0.27	0.23	-0.28
AGE_NOW_60	0.56	0.31	0.34	-0.39	0.90	0.31	0.26	-0.35
AGE_NOW_65	0.64	0.38	0.36	-0.45	1.05	0.36	0.27	-0.41
AGE_NOW_70	0.74	0.43	0.41	-0.52	1.21	0.41	0.29	-0.48
AGE_NOW_75	0.91	0.49	0.46	-0.63	1.38	0.47	0.33	-0.58
AGE_NOW_80	1.05	0.62	0.52	-0.81	1.57	0.54	0.33	-0.71
AGE_NOW_85	1.24	0.66	0.48	-0.83	1.73	0.69	0.30	-0.75
AGE_NOW_90	1.62	0.81	0.50	-1.04	2.05	0.66	0.29	-0.76
AGE_NOW_95	1.25	0.95	0.25	-1.02	1.77	0.56	-0.07	-1.13
AGE_NOW_100	0.92	-0.36	-0.39	0.46	0.16	0.47	-0.04	-0.21
U_GENDER_male	0.19	0.05	-0.06	-0.03	0.11	0.08	-0.06	-0.02
U_GENDER_unknown	-0.68	-0.08	0.32	-0.59	-0.75	-0.16	-0.63	-0.46
ethnic_black	0.25	0.01	-0.01	-0.07	0.35	-0.01	0.02	-0.08
ethnic_mixed	-0.15	-0.16	-0.07	0.20	-0.19	-0.07	0.02	0.16
ethnic_other	-0.12	0.02	0.02	-0.04	-0.14	0.04	-0.01	-0.07
ethnic_unknown	-0.29	-0.02	-0.01	0.06	-0.32	-0.02	-0.01	0.07
ethnic_white	-0.26	-0.13	-0.09	0.21	-0.29	-0.11	0.01	0.20
IMD_Q_2	0.02	-0.04	-0.03	0.07	0.01	-0.04	0.01	0.04
IMD_Q_3	0.02	-0.08	-0.04	0.11	0.01	-0.08	0.00	0.08
IMD_Q_4	0.04	-0.09	-0.05	0.12	0.01	-0.09	-0.01	0.09
IMD_Q_5	0.06	-0.11	-0.06	0.13	0.01	-0.09	-0.01	0.10
IMD_Q_unknown	0.02	-0.10	-0.07	0.15	-0.01	-0.09	0.01	0.13
educ_Degree	0.07	-0.13	-0.07	0.14	0.03	-0.10	-0.01	0.14
educ_GCSE<5	-0.06	0.12	0.09	-0.18	-0.01	0.13	0.07	-0.19
educ_GCSE>5	-0.01	0.06	0.01	-0.07	-0.01	0.06	-0.01	-0.07
educ_Higher	0.01	-0.04	-0.01	0.03	0.01	-0.04	0.00	0.02
educ_None	-0.09	0.18	0.11	-0.25	-0.05	0.11	0.10	-0.20

educ_Other	0.01	0.03	-0.01	-0.03	0.03	-0.01	0.00	-0.01
educ_unknown	0.03	-0.03	-0.02	0.03	0.06	-0.04	0.01	0.04
preexisting_Organ_transplant	0.02	-0.04	-0.02	0.01	0.11	-0.03	0.12	-0.08
preexisting_Diabetes	-0.06	0.02	0.00	-0.03	0.02	0.00	-0.03	-0.02
preexisting_Heart_disease	0.01	0.02	0.02	-0.02	0.01	0.02	0.00	-0.03
preexisting_Hypertension	-0.02	-0.01	0.00	0.00	-0.02	0.02	0.01	-0.01
preexisting_Stroke	0.07	0.07	0.04	-0.10	0.09	0.12	0.04	-0.13
preexisting_Kidney_failure	0.09	0.01	0.01	-0.01	0.03	-0.01	-0.06	0.05
preexisting_Liver_disease	-0.02	0.10	-0.03	-0.04	0.00	0.02	-0.01	-0.04
preexisting_Anaemia	-0.05	0.05	0.01	-0.04	-0.01	-0.01	0.02	-0.02
preexisting_Allergy	0.03	-0.07	-0.04	0.08	0.04	-0.06	-0.03	0.09
preexisting_Asthma	-0.04	0.03	0.00	-0.03	-0.05	0.02	-0.01	-0.03
preexisting_Other_lung_disease	0.04	0.05	0.00	-0.04	0.04	0.03	0.01	-0.04
preexisting_Cancer	-0.03	0.00	0.00	0.01	0.02	-0.01	-0.01	-0.01
preexisting_Fibromyalgia	-0.04	0.12	-0.01	-0.08	0.01	0.11	-0.04	-0.03
preexisting_Epilepsy	0.17	0.19	0.09	-0.24	0.20	0.07	-0.08	-0.25
preexisting_Other_brainnerve	0.25	0.07	0.03	-0.10	0.21	0.08	0.07	-0.08
preexisting_Osteoarthritis	-0.03	-0.01	-0.01	0.02	-0.01	-0.02	-0.01	0.03
preexisting_Immunosupression	0.00	0.02	-0.01	0.00	0.02	0.00	-0.01	-0.01
preexisting_Chronic_infection	0.00	0.05	0.13	-0.15	-0.06	0.07	0.10	-0.07
preexisting_Dementia	0.09	0.54	-0.03	-0.51	-0.15	0.28	0.10	-0.34
preexisting_Anxiety	0.02	0.05	0.04	-0.07	0.02	0.05	0.00	-0.07
preexisting_Depression	-0.02	0.01	-0.03	0.00	0.00	0.02	0.02	0.01
preexisting_Other_psych_disease	0.09	0.07	0.04	-0.11	0.09	0.03	0.06	-0.14
preexisting_Rheumatoid_arthritis	-0.04	0.04	0.02	-0.06	-0.05	0.04	-0.04	-0.06
preexisting_Hypothyroid	0.01	-0.04	0.01	0.02	0.02	-0.02	0.00	0.03
preexisting_Adrenal_gland	-0.18	0.33	0.17	-0.39	-0.11	0.16	0.32	-0.21
preexisting_Sleepapnoea_narco	-0.05	-0.04	0.03	0.00	-0.03	0.00	-0.01	-0.04
preexisting_Other_serious_illness	0.08	0.00	0.02	-0.02	0.05	0.00	-0.01	0.03

Table S3. Factors used in propensity score matching analyses

Contrasted factors	Propensity matched factors
1. Participants from the no-Covid-19 group were matched to each cell within the illness duration * variant period factorial independently.	Age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, presence of subjective cognitive symptoms (poor memory or "brain fog").
2. People who had one or more than one vaccination vs. people who had not been vaccinated prior to their Covid-19 illness.	Age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, variant period
3. People who had two initial AstraZeneca vaccinations vs. people who had two initial Pfizer vaccinations.	Age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, variant period
4. People who visited the emergency department, were admitted to hospital or intensive care, or sought non-hospital medical assistance vs. i) people who were infected but did not visit the hospital or seek non-hospital medical assistance, and ii) vs. people from the No-Covid-19 group.	Age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, variant period, vaccination status and illness-duration.
5. People who had one vs. people who had more than one Covid-19 episode.	Age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions
6. People who had one vs. people who had more than one Covid-19 episode, controlling for additional covariates.	Age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, variant period, vaccination status, illness duration, emergency department visit, hospital admission or ICU.

Participants were propensity score matched between groups as defined in the left column using logistic regression to generate propensity scores from factors as defined in the right column. Selection of matched samples was then done within contiguous set ranges across the propensity scale. The width of the ranges was optimised to minimise the effect size difference between the mean propensity scores of the contrasted groups while maximising the number of observations in the contrasted groups.

Table S4a. Demographics and group distributions relative to the sampling frame

	800,000 contacted		Started Cognitron		Completed Cognitron	
Covid group	**Count**	**Percent**	**True**	**False**	**True**	**False**
REACT1&2 positive	99239	12.40%	10.09%	12.93%	9.98%	12.80%
>=12weeks	52501	6.60%	7.55%	6.34%	7.71%	6.37%
REACT No-Covid-19	648260	81.00%	82.35%	80.73%	82.31%	80.82%
Age						
18to19	11876	1.50%	0.80%	1.64%	0.67%	1.62%
20to24	27929	3.50%	1.80%	3.88%	1.58%	3.80%
25to29	37031	4.60%	2.70%	5.07%	2.46%	4.99%
30to34	48349	6.00%	3.90%	6.53%	3.60%	6.45%
35to39	56301	7.00%	5.04%	7.49%	4.84%	7.40%
40to44	64373	8.10%	6.65%	8.36%	6.63%	8.28%
45to49	67502	8.40%	7.63%	8.62%	7.80%	8.54%
50to54	82844	10.40%	10.36%	10.35%	10.66%	10.31%
55to59	90918	11.40%	12.95%	11.00%	13.33%	11.04%
60to64	88128	11.00%	14.20%	10.29%	14.69%	10.41%
65to69	79741	10.00%	13.75%	9.11%	14.15%	9.28%
70to74	70265	8.80%	10.96%	8.29%	10.88%	8.44%
75to79	48000	6.00%	6.63%	5.86%	6.35%	5.94%
80+	26743	3.30%	2.64%	3.50%	2.37%	3.50%
Sex						
male	345792	43.20%	40.30%	43.89%	39.60%	43.82%
female	454197	56.80%	59.70%	56.11%	60.40%	56.18%
Ethnicity and race						
white	739355	93.45%	95.28%	93.04%	95.59%	93.10%
asian	27474	3.47%	2.31%	3.74%	2.10%	3.70%
black	7455	0.94%	0.64%	1.01%	0.57%	1.00%
other	6356	0.80%	0.63%	0.84%	0.60%	0.84%
mixed	10495	1.33%	1.14%	1.37%	1.14%	1.36%
Index of Multiple Deprivation_Q						
1 (most deprived)	78052	9.80%	7.89%	10.21%	7.66%	10.12%
2	126326	15.80%	14.70%	16.08%	14.50%	16.04%
3	171326	21.50%	21.43%	21.47%	21.35%	21.48%
4	198825	24.90%	25.55%	24.76%	25.65%	24.78%
5 (most affluent)	223780	28.00%	30.44%	27.48%	30.83%	27.57%
Region						
London	87727	11.00%	10.92%	10.98%	10.84%	10.99%
East Midlands	91964	11.50%	11.05%	11.60%	11.04%	11.57%
South East	170674	21.30%	22.16%	21.15%	22.31%	21.17%
Yorkshire & The	59218	7.40%	7.50%	7.38%	7.47%	7.39%
West Midlands	75373	9.40%	8.94%	9.53%	8.93%	9.50%
North East	31383	3.90%	3.72%	3.97%	3.67%	3.96%
North West	93355	11.70%	10.81%	11.87%	10.63%	11.84%
East of England	109720	13.70%	13.93%	13.67%	14.00%	13.67%
South West	80586	10.10%	10.98%	9.87%	11.10%	9.91%

Table S4b. Selection bias for people with subjective cognitive symptoms

	No subjective cognitive symptoms	Poor memory or "brain fog" within the past two weeks
No-Covid-19	0.55	0.59
Asymptomatic	0.56	0.59
<4 weeks	0.54	0.57
4-12 weeks	0.55	0.59
>= 12 weeks resolved	0.55	0.56
>= 12 weeks unresolved	0.52	0.58
Unknown duration	0.32	0.41

Proportion of people undertaking the cognitive assessment on completion of the survey from different illness-duration categories according to whether they reported experiencing poor memory or "brain fog" within the past two weeks.

Table S4c. Demographics and group distributions for participants who started and completed the cognitive study

		Started		Completed	
	Group	**Count**	**Percent**	**Count**	**Percent**
Age	18-	1106	0.78%	754	0.67%
	20-	2501	1.77%	1787	1.58%
	25-	3818	2.70%	2776	2.46%
	30-	5514	3.89%	4068	3.60%
	35-	7156	5.05%	5465	4.84%
	40-	9539	6.74%	7491	6.63%
	45-	10951	7.73%	8809	7.80%
	50-	14813	10.46%	12043	10.66%
	55-	18438	13.02%	15056	13.33%
	60-	20176	14.25%	16592	14.69%
	65-	19429	13.72%	15980	14.15%
	70-	15344	10.84%	12294	10.88%
	75-	9196	6.50%	7175	6.35%
	80-	2742	1.94%	2045	1.81%
	85-	702	0.50%	517	0.46%
	90-	132	0.09%	92	0.08%
	95-	25	0.02%	19	0.02%
	100+	1	0.00%	1	0.00%
Total		**141583**		**112964**	
Education	A-levels	13620	9.62%	10570	9.36%
	Degree	46632	32.94%	37963	33.61%
	GCSE<5	3311	2.34%	2517	2.23%
	GCSE>5	11433	8.08%	8827	7.81%
	Higher Education	10741	7.59%	8441	7.47%
	None	2883	2.04%	2107	1.87%
	Other	5276	3.73%	4102	3.63%
	unknown	47687	33.68%	38437	34.03%

Sex	Female	85193	60.17%	68230	60.40%
	Male	56384	39.82%	44729	39.60%
	Unknown	6	0.00%	5	0.00%
Ethnicity and race	Asian	3205	2.26%	2351	2.08%
	Black	884	0.62%	635	0.56%
	Mixed	1611	1.14%	1277	1.13%
	Other	888	0.63%	675	0.60%
	Unknown	1316	0.93%	1010	0.89%
	White	133679	94.42%	107016	94.73%
Index of Multiple Deprivation Quintile	1 (most deprived)	10912	7.71%	8480	7.51%
	2	20380	14.39%	16034	14.19%
	3	29635	20.93%	23564	20.86%
	4	35267	24.91%	28273	25.03%
	5 (most affluent)	42136	29.76%	34031	30.13%
	Unknown	3253	2.30%	2582	2.29%
Illness Duration	4-12 weeks	4065	2.87%	3246	2.87%
	>=12 unresolved	3103	2.19%	2580	2.28%
	>=12 resolved	1692	1.20%	1350	1.20%
	Asymptomatic	3800	2.68%	2947	2.61%
	No-Covid-19	58173	41.09%	46261	40.95%
	<4 weeks resolved	57480	40.60%	45879	40.61%
	Unknown	13270	9.37%	10701	9.47%
Variant period	Wild	7912	9.49%	6251	9.37%
	Alpha	6102	7.32%	4812	7.21%
	Delta	14942	17.91%	11838	17.75%
	Omicron	53790	64.49%	43323	64.95%
	Unknown	664	0.80%	479	0.72%
Vaccines	0	96425	68.10%	77013	68.17%
	1	989	0.70%	731	0.65%
	2	44169	31.20%	35220	31.18%
Hospital	ED	868	0.61%	672	0.59%
	Hospital admission	649	0.46%	527	0.47%
	ICU	282	0.20%	228	0.20%

GCSE General Certificate of Secondary Education
ED Emergency Department visit
ICU Intensive Care Unit

Table S4d. Representativeness of study participants

Disease under investigation	**Cognitive deficits in people who have survived Covid-19**
Special considerations related to:	
Sex and gender	Research indicates that Covid 19 affects males and females differently in the UK as elsewhere, with males more likely to have severe disease, be hospitalized and to die.[1] Females are more likely to report persistent ongoing symptoms consistent with Long Covid.[2]
Age	Older adults are substantially more likely than younger people to develop severe acute Covid-19 symptoms, be hospitalized or die from Covid-19.[3] Self-reported Long Covid is more likely in people aged 35 to 69 in the UK.[4]
Race or ethnic group	People from minority ethnic groups were disproportionally affected by Covid-19 in the UK, particularly in the first year, being more likely to have infection and to be hospitalized.[5,6]
Geography	Death rates early in the pandemic were twice as high amongst people living in urban and deprived areas of the UK.[7] People living in deprived areas also are more likely to report persistent symptoms consistent with Long Covid.[8] Increased rates of severe illness and death among males and older adults are a global characteristic of Covid-19; however, it has been reported that the sex differences vary geographically, e.g., in the US state by state; therefore, they may reflect other mediating factors, e.g., higher rates of underlying health conditions that exacerbate the effects of Covid-19, engagement in riskier behavior regarding virus exposure and health-seeking behaviors, which vary across cultures.[9]
Other considerations	People with severe cognitive outcomes from Covid-19 may not have been able to engage in the survey. People who died from Covid-19 are not accounted for in the analyses.
Overall representativeness of this study	Biological sex, age and residential address were available from the recruitment database. Residential postcodes were used to generate social deprivation scores and expected ethnic distribution. Overall, the respondents in the present study compared to the baseline sample of 800,000 people showed small biases in response rates favoring females and people of white ethnic background, and with slightly lower participation among young people and those living in the most deprived areas. Multivariate modelling of potential confounders and propensity score matching, as well as stratification-based sensitivity analyses, were undertaken to address these imbalances. The large sample size means that adequate numbers are available in each of these demographic groups (e.g. by age, sex, ethnicity and race, region, deprivation) to contribute meaningfully to the comparative findings on cognitive performance post-Covid.
Data sources	The above information has been published by the Office for National Statistics, UK government and journal articles. It was identified via literature searches on PubMed and Google Scholar.

Table S5. Numbers of participants and linear model estimates (SD units) of global cognitive score per infection onset date

Counts

Infection date (days from Jan. 1, 2020)	Original virus		Alpha		Delta		Omicron	
	Worst	1 infection	Worst	1 infection	Worst	1 infection	Worst	1 infection
0-99	2,718	1,500						
100-199	979	515						
200-299	1,647	937						
300-399	1,147	688	3,486	2,100				
400-499			1,430	1,090	124	96		
500-599					2,299	1,638		
600-699					5,051	3,903		
700-799					4,541	3,905	11,019	10,215
800-899							17,785	17,529
900-999							12,374	12,368
1000-1099							1,624	1,624

Estimates

Infection date (days from Jan. 1, 2020)	G single confirmed infection		G residual	
	Mean	SEM	Mean	SEM
0-99	-0.133	0.027	0.001	0.027
100-199	-0.235	0.046	-0.130	0.046
200-299	-0.069	0.034	0.043	0.034
300-399	-0.102	0.019	0.018	0.019
400-499	-0.138	0.029	-0.032	0.029
500-599	-0.097	0.025	-0.049	0.025
600-699	-0.033	0.016	0.012	0.016
700-799	-0.010	0.008	-0.025	0.008
800-899	0.054	0.008	0.023	0.008
900-999	0.030	0.009	0.003	0.009
1000-1099	0.008	0.026	-0.029	0.026
No-Covid-19	0.014	0.005	0.014	0.005
ANOVA				
DF	(10,58097)		(10,58097)	
F	19.4		3.67	
p	<0.001		<0.001	

Upper. Counts for participants by worst (longest duration) episode and for single episode, by date of infection (days from Jan. 1, 2020). **Lower.** Mean cognitive score by date of infection for single Covid-19 episode cases, before (G) and after (G residual) adjusting for covariates: illness duration, variant period, emergency department visit or hospital admission and vaccination status at the time of infection. SEM=standard error of the mean. Statistics from one way ANOVA across time categories.

Table S6. Probability distributions for global cognitive score score by variant period, illness duration and emergency department visit or hospital admission / other medical assistance

Variant period

SD	Original virus	Alpha	Delta	Omicron	No-Covid-19
<-3	0.003	0.003	0.001	0.001	0.001
<-2	0.035	0.030	0.024	0.018	0.021
<-1	0.155	0.154	0.144	0.133	0.132
<0	0.354	0.357	0.344	0.336	0.342
<1	0.310	0.324	0.332	0.348	0.344
<2	0.124	0.116	0.133	0.140	0.137
<3	0.017	0.016	0.021	0.023	0.022
>3	0.002	0.000	0.001	0.001	0.001

Illness duration

SD	>= 12 weeks unresolved	>= 12 weeks resolved	4-12 weeks	<4 weeks	Asymptomatic	No-Covid-19
<-3	0.004	0.002	0.005	0.001	0.001	0.001
<-2	0.048	0.033	0.023	0.021	0.021	0.021
<-1	0.173	0.154	0.146	0.137	0.135	0.132
<0	0.375	0.338	0.356	0.338	0.337	0.342
<1	0.282	0.338	0.331	0.344	0.324	0.344
<2	0.105	0.117	0.121	0.136	0.157	0.137
<3	0.013	0.016	0.018	0.021	0.025	0.022
>3	0.000	0.002	0.001	0.001	0.000	0.001

Hospital/ other medical assistance

SD	Intensive care	Hospital admission	ED	Other medical	No medical	No-Covid-19
<-3	0.013	0.010	0.009	0.002	0.001	0.001
<-2	0.066	0.055	0.046	0.029	0.019	0.021
<-1	0.241	0.175	0.219	0.160	0.131	0.132
<0	0.355	0.414	0.350	0.341	0.340	0.342
<1	0.215	0.258	0.258	0.326	0.346	0.344
<2	0.096	0.083	0.106	0.123	0.140	0.137
<3	0.013	0.004	0.012	0.018	0.022	0.022
>3	0.000	0.002	0.001	0.001	0.001	0.001

Performance <-1SDs from the population mean when correcting for age and education level is considered below average. Performance<-0.2SDs is considered indicative of moderate cognitive impairment. <-3SDs is considered indicative of profound cognitive impairment. Other medical = called NHS 111 helpline, or sought help from pharmacist, GP or walk-in centre.

Table S7. Linear modelling of main effects in relation to global cognitive score in SD units

Coefficients				95% CI	
	Estimate	SE	tStat	Lower	Upper
(Intercept)	0.226	0.073	3.114	0.083	0.369
No-Covid-19 (ref)	0	na	na	na	na
Asymptomatic	-0.168	0.054	-3.119	-0.274	-0.062
<4 weeks	-0.225	0.051	-4.423	-0.325	-0.125
4-12 weeks resolved	-0.255	0.055	-4.659	-0.363	-0.147
>=12 weeks resolved	-0.238	0.060	-4.005	-0.356	-0.120
>=12 weeks unresolved	-0.422	0.056	-7.577	-0.532	-0.312
ED	-0.247	0.044	-5.559	-0.333	-0.161
Hospital admission	-0.334	0.050	-6.720	-0.432	-0.236
Intensive care	-0.349	0.074	-4.691	-0.494	-0.204
Vaccine doses 1	-0.130	0.043	-3.054	-0.214	-0.046
Vaccine doses >=2	-0.057	0.014	-4.078	-0.084	-0.030
Variant - Original virus	0.006	0.021	0.278	-0.035	0.047
Variant - Alpha (ref)	0	na	na	na	na
Variant - Delta	0.100	0.020	4.886	0.061	0.139
Variant - Omicron	0.167	0.019	8.682	0.130	0.204
Variant - unknown	-0.104	0.053	-1.948	-0.208	0.000
AGE 18-19(ref)	0	na	na	na	na
AGE 20-24	0.010	0.050	0.205	-0.088	0.108
AGE 25-29	0.002	0.047	0.048	-0.090	0.094
AGE 30-34	-0.026	0.045	-0.562	-0.114	0.062
AGE 35-39	-0.027	0.044	-0.604	-0.113	0.059
AGE 40-44	-0.026	0.044	-0.600	-0.112	0.060
AGE 45-49	-0.029	0.043	-0.660	-0.113	0.055
AGE 50-54	-0.040	0.043	-0.931	-0.124	0.044
AGE 55-59	-0.046	0.043	-1.083	-0.130	0.038
AGE 60-64	-0.058	0.043	-1.367	-0.142	0.026
AGE 65-69	-0.066	0.043	-1.541	-0.150	0.018
AGE 70-74	-0.063	0.043	-1.470	-0.147	0.021
AGE 75-79	-0.058	0.044	-1.322	-0.144	0.028
AGE 80-84	-0.059	0.049	-1.213	-0.155	0.037
AGE 85-89	-0.078	0.065	-1.193	-0.205	0.049
AGE 90-94	-0.058	0.126	-0.465	-0.305	0.189
AGE 95+	-0.007	0.262	-0.029	-0.521	0.507
Sex female (ref)	0	na	na	na	na
Sex - male	-0.004	0.007	-0.510	-0.018	0.010
Sex - unknown	-0.064	0.548	-0.117	-1.138	1.010
Asian (ref)	0	na	na	na	na
Black	0.004	0.051	0.071	-0.096	0.104
Mixed	-0.038	0.040	-0.941	-0.116	0.040
Other	-0.010	0.050	-0.198	-0.108	0.088
Unknown	-0.012	0.043	-0.269	-0.096	0.072
White	-0.031	0.024	-1.280	-0.078	0.016

Coefficients (continued)					
	Estimate	SE	tStat		
Education - degree (ref)	0	na	na	na	na
Education - higher	0.018	0.014	1.293	-0.009	0.045
Education Alevels	0.019	0.013	1.468	-0.006	0.044
Education - GCSE >5	0.021	0.014	1.489	-0.006	0.048
Education - GCSE <5	0.009	0.024	0.376	-0.038	0.056
Education -none	0.010	0.026	0.399	-0.041	0.061
Education - unknown	-0.013	0.011	-1.187	-0.035	0.009
Education - other	0.035	0.019	1.795	-0.002	0.072
IMD Q 1 (ref, most deprived)	0	na	na	na	na
IMD Q 2	-0.012	0.015	-0.762	-0.041	0.017
IMD Q 3	-0.022	0.015	-1.470	-0.051	0.007
IMD Q 4	-0.023	0.014	-1.570	-0.050	0.004
IMD Q 5	-0.017	0.014	-1.188	-0.044	0.010
IMD Q unknown	-0.028	0.026	-1.076	-0.079	0.023
Organ transplant	-0.021	0.104	-0.198	-0.225	0.183
Diabetes	-0.005	0.020	-0.269	-0.044	0.034
Heart disease	-0.014	0.023	-0.597	-0.059	0.031
Hypertension	-0.009	0.012	-0.711	-0.033	0.015
Stroke	0.003	0.046	0.056	-0.087	0.093
Kidney failure	0.021	0.049	0.423	-0.075	0.117
Liver disease	0.018	0.056	0.322	-0.092	0.128
Anaemia	-0.015	0.031	-0.490	-0.076	0.046
Allergy	-0.020	0.012	-1.646	-0.044	0.004
Asthma	0.006	0.017	0.358	-0.027	0.039
Other lung disease	-0.002	0.029	-0.068	-0.059	0.055
Cancer	-0.015	0.025	-0.600	-0.064	0.034
Fibromyalgia	0.007	0.035	0.187	-0.062	0.076
Epilepsy	-0.022	0.059	-0.372	-0.138	0.094
Other brain/nerve	-0.003	0.040	-0.065	-0.081	0.075
Osteoarthritis	-0.006	0.015	-0.397	-0.035	0.023
Immunosupression	0.001	0.022	0.026	-0.042	0.044
Chronic infection	-0.019	0.105	-0.183	-0.225	0.187
Dementia	-0.036	0.192	-0.190	-0.412	0.340
Anxiety	-0.007	0.014	-0.503	-0.034	0.020
Depression	-0.010	0.018	-0.541	-0.045	0.025
Other psych disease	-0.024	0.048	-0.494	-0.118	0.070
Rheumatoid arthritis	-0.004	0.027	-0.155	-0.057	0.049
Hypothyroid	-0.007	0.020	-0.341	-0.046	0.032
Adrenal gland	-0.024	0.143	-0.168	-0.304	0.256
Sleep apnoea narco	0.001	0.032	0.024	-0.062	0.064
Other serious illness	0.003	0.018	0.140	-0.032	0.038

Ref=reference category. GCSE=General Certificate of Secondary Education, IMD=Index of Multiple Deprivation

Table S8. Stepwise regression conducted with all main effects and 2-way interactions

Stepwise regression ANOVA

	SumSq	DF	MeanSq	F
Virus variant	148.790	4	37.197	31.020
ED	35.821	1	35.821	29.872
Hospital admission	53.743	1	53.743	44.818
Intensive care	26.686	1	26.686	22.254
Covid illness duration	118.040	5	23.609	19.688
Error	122640	102250	1.199	

Coefficients

				95% CI	
	Estimate	**SE**	**tStat**	**Lower**	**Upper**
(Intercept)	0.116	0.053	2.182	0.012	0.220
Original virus	0.013	0.021	0.598	-0.028	0.054
Alpha (ref)	0.000	na	na	na	na
Delta	0.072	0.019	3.811	0.035	0.109
Omicron	0.135	0.017	7.829	0.102	0.168
Unknown variant	-0.101	0.053	-1.904	-0.205	0.003
No hospital	0.000	na	na	na	na
ED	-0.243	0.044	-5.466	-0.329	-0.157
Hospital admission	-0.333	0.050	-6.695	-0.431	-0.235
Intensive care	-0.351	0.074	-4.717	-0.496	-0.206
No-Covid-19 (ref)	0.000	na	na	na	na
Asymptomatic	-0.157	0.054	-2.920	-0.263	-0.051
<4 weeks	-0.212	0.051	-4.191	-0.312	-0.112
4-12 weeks	-0.241	0.055	-4.414	-0.349	-0.133
>= 12 weeks resolved	-0.224	0.059	-3.774	-0.340	-0.108
>= 12 weeks unresolved	-0.404	0.055	-7.281	-0.512	-0.296

Terms selected when using stepwise regression to identify those that explain sufficient variance in global cognitive score for analysis from amongst all main effects and 2-way interactions between (a) demographic variables, (b) proxies or mediators of severity and (c) preexisting conditions.

Table S9. Main effect on global cognitive score in SD units and 95% Confidence Intervals of duration of symptoms for each variant period relative to the reference of No-Covid-19

		Estimate	N	95% CI	
				Upper	Lower
Original virus					
	(Intercept)	0.016			
	>=12 weeks not resolved	-0.322	732	-0.249	-0.395
	>=12 weeks resolved	-0.130	604	-0.050	-0.210
	4-12 weeks	-0.146	798	-0.075	-0.217
	<4 weeks	-0.117	3579	-0.084	-0.150
	Asymptomatic	0.007	538	0.091	-0.077
Alpha					
	(Intercept)	0.013			
	>=12 weeks not resolved	-0.330	433	-0.236	-0.424
	>=12 weeks resolved	-0.126	307	-0.014	-0.238
	4-12 weeks	-0.180	520	-0.094	-0.266
	<4 weeks	-0.115	3224	-0.080	-0.150
	Asymptomatic	-0.050	328	0.058	-0.158
Delta					
	(Intercept)	0.010			
	>=12 weeks not resolved	-0.264	644	-0.186	-0.342
	>=12 weeks resolved	-0.058	271	0.062	-0.178
	4-12 weeks	-0.085	753	-0.012	-0.158
	<4 weeks	-0.036	9378	-0.014	-0.058
	Asymptomatic	-0.028	792	0.043	-0.099
Omicron					
	(Intercept)	-0.007			
	>=12 weeks not resolved	-0.161	771	-0.090	-0.232
	>=12 weeks resolved	-0.094	168	0.057	-0.245
	4-12 weeks	-0.015	1175	0.044	-0.074
	<4 weeks	0.020	29283	0.034	0.006
	Asymptomatic	0.081	1231	0.138	0.024
No-Covid-19 (ref)			46261		

Table S10. Contrasting global cognitive score (in SD units with 95% Confidence Intervals) for each cell of the variant period * illness duration factorial with No-Covid-19 after propensity score matching

Propensity score	Matched without reported cognitive symptoms				Matched including reported cognitive symptoms			
Match pre (Cohen's D')	**Original virus**	**Alpha**	**Delta**	**Omicron**	**Original virus**	**Alpha**	**Delta**	**Omicron**
Asymptomatic	-1.680	-1.653	-1.594	-1.401	-1.734	-1.657	-1.603	-1.412
>4 Weeks	1.485	1.502	1.370	1.230	1.664	1.619	1.410	1.246
4-12 Weeks	-1.681	-1.738	-1.931	-1.572	-2.384	-2.177	-2.316	-1.829
>=12 Weeks Resolved	-1.713	-1.807	-1.824	-1.574	-2.134	-2.108	-2.186	-1.900
>= 12 Weeks Unresolved	-1.796	-1.973	-1.978	-1.703	-3.010	-3.424	-2.949	-2.781
Match post (Cohen's D')								
Asymptomatic	-0.008	-0.030	-0.022	-0.003	-0.041	-0.040	-0.005	-0.010
>4 Weeks	0.000	0.001	0.000	0.000	0.001	0.003	0.001	0.000
4-12 Weeks	-0.006	-0.005	-0.011	-0.011	-0.008	-0.023	-0.009	-0.009
>=12 Weeks Resolved	-0.010	-0.029	-0.090	-0.130	-0.009	-0.043	-0.047	-0.217
>= 12 Weeks Unresolved	-0.013	-0.021	-0.003	-0.025	-0.002	-0.029	-0.010	-0.002
N per group								
Asymptomatic	538	327	792	1231	536	327	792	1231
>4 Weeks	3574	3224	8811	16793	3532	3193	8471	16791
4-12 Weeks	798	520	750	1175	786	520	750	1174
>=12 Weeks Resolved	603	307	271	168	603	307	271	168
>= 12 Weeks Unresolved	731	430	644	771	726	428	643	768

Cognitive score G								
Mean difference	**Original virus**	**Alpha**	**Delta**	**Omicron**	**Original virus**	**Alpha**	**Delta**	**Omicron**
Asymptomatic	-0.084	-0.028	-0.074	0.109	-0.022	-0.033	-0.013	0.044
>4 Weeks	-0.136	-0.097	-0.030	0.015	-0.123	-0.100	-0.024	0.028
4-12 Weeks	-0.196	-0.203	-0.138	-0.034	-0.160	-0.199	-0.063	0.011
>=12 Weeks Resolved	-0.201	-0.113	-0.002	-0.068	-0.098	0.028	-0.138	-0.075
>= 12 Weeks Unresolved	-0.318	-0.275	-0.289	-0.141	-0.361	-0.309	-0.274	-0.092
Lower 95% CI								
Asymptomatic	-0.089	-0.037	-0.077	0.106	-0.027	-0.042	-0.016	0.041
>4 Weeks	-0.137	-0.098	-0.031	0.015	-0.124	-0.101	-0.024	0.028
4-12 Weeks	-0.199	-0.208	-0.142	-0.036	-0.163	-0.205	-0.066	0.008
>=12 Weeks Resolved	-0.206	-0.122	-0.012	-0.085	-0.103	0.019	-0.148	-0.091
>= 12 Weeks Unresolved	-0.322	-0.282	-0.294	-0.145	-0.365	-0.315	-0.278	-0.096
Asymptomatic	-0.089	-0.037	-0.077	0.106	-0.027	-0.042	-0.016	0.041
FourWeeks	-0.137	-0.098	-0.031	0.015	-0.124	-0.101	-0.024	0.028
fourToTwelveWeeks	-0.199	-0.208	-0.142	-0.036	-0.163	-0.205	-0.066	0.008
TwelveWeeksResolved	-0.206	-0.122	-0.012	-0.085	-0.103	0.019	-0.148	-0.091
Upper 95% C.I								

Asymptomatic	-0.079	-0.019	-0.070	0.111	-0.016	-0.025	-0.009	0.046
FourWeeks	-0.135	-0.097	-0.030	0.015	-0.123	-0.099	-0.023	0.028
fourToTwelveWeeks	-0.192	-0.197	-0.135	-0.031	-0.156	-0.194	-0.059	0.013
TwelveWeeksResolved	-0.196	-0.104	0.008	-0.052	-0.093	0.037	-0.127	-0.058
TwelveWeeksUnresolved	-0.314	-0.268	-0.284	-0.137	-0.357	-0.302	-0.269	-0.088

Participants were propensity score matched then contrasted to the No-Covid-19 group independently for each combination of variant period and illness duration. Upper table is the contrast of propensity scores between groups. Match pre is the mean difference in propensity scores prior to matching the groups. Match post is the difference in the mean propensity scores of the groups after they have been matched. Lower table is the contrast of cognitive scores between the propensity score matched groups with 95% confidence interval (CI). Matched factors were: age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, presence of subjective cognitive concerns (poor memory or “brain fog”).

Table S11. Contrasting global cognitive score (in SD units with 95% Confidence Intervals) when propensity score matching the No-Covid-19 group, or those who did not seek medical assistance, with those who visited the emergency department or were admitted to hospital, or sought other medical assistance

Propensity score	S11a Hospital			S11b. Other medical assistance
Match pre (Cohen's D')	**ED**	**Admitted**	**Intensive Care**	
No-Covid-19	-1.557	-1.459	-1.524	-1.261
Did not seek medical assistance	-2.139	-2.31	-3.759	-0.524
Match post (Cohen's D')				
No-Covid-19	-0.013	-0.027	-0.051	0
Did not seek medical assistance	-0.017	-0.013	-0.019	-0.001
N per group				
No-Covid-19	631	499	221	10773
Did not seek medical assistance	668	525	220	14402
Cognitive score G				
Mean difference	**ED**	**Admitted**	**Intensive Care**	**Other medical assistance**
vs. No-Covid-19	-0.312	-0.347	-0.63	-0.124
vs. Did not seek medical assistance	-0.338	-0.34	-0.445	-0.115
Lower 95%CI				
No-Covid-19	-0.151	-0.43	-0.473	-0.837
Did not seek medical assistance	-0.142	-0.457	-0.469	-0.64
Upper 95% CI				
No-Covid-19	-0.097	-0.194	-0.221	-0.422
Did not seek medical assistance	-0.088	-0.22	-0.211	-0.25

a. Participants were propensity score matched from the No-Covid-19 group and the 'did not seek medical assistance' group for each hospital group independently. 'Did not seek medical assistance' comprises people who had SARS-CoV-2 infection and did not visit the hospital or seek assistance by calling NHS 111, contacting their GP or going to a walk-in medical centre. Upper table is the contrast of propensity scores between groups. Match pre is the mean difference in propensity scores prior to matching the groups. Match post is the difference in the mean propensity scores of the groups after they have been matched. Lower table is the contrast of global cognitive scores between the propensity matched groups with 95% confidence interval (CI). Matched factors were: age group, sex, ethnicity and race, education level, index of multiple-deprivation, number of preexisting conditions, variant period, vaccination status and illness-duration. b. The analysis was extended to include a further group 'Other medical assistance', comprising people who sought assistance by calling NHS 111, contacting their GP or going to a walk-in medical centre.

Table S12. Propensity score matching analysis for people who had different numbers of valid vaccine doses prior to their worst (longest duration) Covid-19 illness and whose first two doses were AstraZeneca vs Pfizer

Propensity score			
	Doses		
	1 vs. 0	**>1 vs. 0**	**AZ-Pfizer**
Match pre (Cohen's D')	-3.7187	-1.9408	-1.3411
Match post (Cohen's D')	-0.0026	-0.0034	0.0018
N per group	611	877	13539

Cognitive score G			
	Doses		
	1 vs. 0	**>1 vs. 0**	**AZ-Pfizer**
Estimate	0.0754	0.1479	-0.0694
Lower 95% CI	-0.0369	0.0483	-0.0935
Upper 95% CI	0.1877	0.2475	-0.0453

Participants who had either one or more than one vaccine doses prior to their worst illness were propensity score matched to participants who had no vaccination prior to their worst Covid-19 illness. People who had Covid-19 and who had received two or more doses of either AstraZeneca or Pfizer vaccine as their first vaccinations were also propensity score matched against each other. Factors included in the propensity score matching model were demographics, variant period and number of pre-existing conditions. Upper table is the contrast of propensity scores (SD units) between groups. Match pre is the mean difference in propensity scores prior to matching the groups. Match post is the difference in the mean propensity scores of the groups after they have been matched. Lower table is the contrast of global cognitive scores (SD units) between the propensity matched groups with 95% confidence interval (CI)

Table S13. Propensity score matching analysis for people who had one Covid-19 episode vs multiple episodes

Propensity score

	Matched for other covariates	
	No	**Yes**
Match pre (Cohen's D')	0.414	1.094
Match post (Cohen's D')	0.005	0.002
N per group	9114	8965

Cognitive score G

	Matched for other covariates	
	No	**Yes**
Estimate	-0.112	-0.024
Lower 95% CI	-0.142	-0.054
Upper 95% CI	-0.083	0.006

Participants who had either one or more than one Covid-19 episodes were propensity score matched for demographics and number of preexisting conditions, and then including other covariates - variant period, vaccination status and emergency department visit or hospital admission. Upper table is the contrast of propensity scores (SD units) between groups. Match pre is the mean difference in propensity scores prior to matching the groups. Match post is the difference in the mean propensity scores of the groups after they have been matched. Lower table is the contrast of global cognitive scores (SD units) between the propensity matched groups with 95% confidence interval (CI)

Table S14. Associations of specific task summary scores (SD units) with post-Covid covariates

a. In 102,263 participants who completed all tasks and were not within 12 weeks of infection

		Intercept	Original virus (ref)	Alpha	Delta	Omicron	No hospital (ref)	ED	Hospital admission	Intensive Care
Spatial Planning	Estimate	0.006	0	0.037	0.076	0.130	0	-0.101	-0.235	-0.334
	Upper			0.074	0.107	0.157		-0.023	-0.147	-0.201
	Lower			0.000	0.045	0.103		-0.179	-0.323	-0.467
Information Sampling	Estimate	0.007	0	0.006	0.028	0.042	0	-0.070	-0.078	-0.069
	Upper			0.043	0.059	0.069		0.010	0.010	0.064
	Lower			-0.031	-0.003	0.015		-0.150	-0.166	-0.202
2D Mental Manipulation	Estimate	-0.002	0	-0.018	0.052	0.045	0	-0.097	-0.174	-0.435
	Upper			0.019	0.083	0.072		-0.017	-0.086	-0.302
	Lower			-0.055	0.021	0.018		-0.177	-0.262	-0.568
Delayed Memory	Estimate	0.017	0	0.000	0.051	0.100	0	-0.192	-0.212	-0.211
	Upper			0.037	0.082	0.127		-0.114	-0.124	-0.078
	Lower			-0.037	0.020	0.073		-0.270	-0.300	-0.344
Immediate Memory	Estimate	0.012	0	-0.010	0.034	0.080	0	-0.188	-0.291	-0.268
	Upper			0.027	0.065	0.107		-0.110	-0.203	-0.135
	Lower			-0.047	0.003	0.053		-0.266	-0.379	-0.401
Spatial Working Memory Maximum Span	Estimate	0.008	0	0.014	0.050	0.048	0	-0.126	-0.209	-0.231
	Upper			0.051	0.081	0.075		-0.046	-0.121	-0.098
	Lower			-0.023	0.019	0.021		-0.206	-0.297	-0.364
Verbal Analogical Reasoning	Estimate	-0.002	0	-0.012	0.106	0.143	0	-0.131	-0.189	-0.319
	Upper			0.025	0.137	0.170		-0.053	-0.101	-0.186
	Lower			-0.049	0.075	0.116		-0.209	-0.277	-0.452
Word Definitions	Estimate	0.009	0	-0.009	0.092	0.173	0	-0.085	-0.146	-0.271
	Upper			0.028	0.123	0.200		-0.007	-0.058	-0.138
	Lower			-0.046	0.061	0.146		-0.163	-0.234	-0.404

a continued

		No-Covid-19 (ref)	Asymptomatic	<4 weeks	4-12 Weeks	>12 Weeks Resolved	>12 Weeks Ongoing
Spatial Planning	Estimate	0	-0.064	-0.097	-0.115	-0.127	-0.198
	Upper		-0.021	-0.070	-0.074	-0.070	-0.153
	Lower		-0.107	-0.124	-0.156	-0.184	-0.243
Information Sampling	Estimate	0	-0.044	-0.041	-0.040	-0.047	-0.068
	Upper		-0.001	-0.014	0.001	0.010	-0.023
	Lower		-0.087	-0.068	-0.081	-0.104	-0.113
2D Mental Manipulation	Estimate	0	0.042	-0.025	-0.056	-0.040	-0.106
	Upper		0.085	0.002	-0.015	0.017	-0.061
	Lower		-0.001	-0.052	-0.097	-0.097	-0.151
Delayed Memory	Estimate	0	-0.051	-0.090	-0.105	-0.094	-0.225
	Upper		-0.008	-0.063	-0.064	-0.037	-0.180
	Lower		-0.094	-0.117	-0.146	-0.151	-0.270
Immediate Memory	Estimate	0	-0.015	-0.064	-0.085	-0.068	-0.221
	Upper		0.028	-0.037	-0.044	-0.011	-0.176
	Lower		-0.058	-0.091	-0.126	-0.125	-0.266
Spatial Working Memory Maximum Span	Estimate	0	0.031	-0.048	-0.103	-0.033	-0.121
	Upper		0.074	-0.021	-0.062	0.024	-0.076
	Lower		-0.012	-0.075	-0.144	-0.090	-0.166

Verbal Analogical Reasoning	Estimate	0	-0.094	-0.087	-0.118	-0.107	-0.210
	Upper		-0.051	-0.060	-0.077	-0.050	-0.165
	Lower		-0.137	-0.114	-0.159	-0.164	-0.255
Word Definitions	Estimate	0	-0.149	-0.127	-0.120	-0.121	-0.224
	Upper		-0.106	-0.100	-0.079	-0.064	-0.179
	Lower		-0.192	-0.154	-0.161	-0.178	-0.269

b. In all 141,583 participants who completed at least one task

		Intercept	Original virus (ref)	Alpha	Delta	Omicron	No hospital (ref)	ED	Hospital admission	Intensive Care
Spatial Planning	Estimate	0.009	0	0.041	0.084	0.140	0	-0.127	-0.232	-0.352
	Upper			0.076	0.113	0.165		-0.054	-0.148	-0.227
	Lower			0.006	0.055	0.115		-0.200	-0.316	-0.477
	N	120867								
Information Sampling	Estimate	0.008	0	0.007	0.032	0.045	0	-0.063	-0.086	-0.101
	Upper			0.044	0.061	0.072		0.013	0.000	0.028
	Lower			-0.030	0.003	0.018		-0.139	-0.172	-0.230
	N	115380								
2D Mental Manipulation	Estimate	0.001	0	0.005	0.062	0.056	0	-0.129	-0.157	-0.363
	Upper			0.038	0.089	0.081		-0.060	-0.077	-0.243
	Lower			-0.028	0.035	0.031		-0.198	-0.237	-0.483
	N	136392								
Delayed Memory	Estimate	0.015	0	0.001	0.051	0.100	0	-0.203	-0.199	-0.211
	Upper			0.038	0.082	0.127		-0.127	-0.113	-0.080
	Lower			-0.036	0.020	0.073		-0.279	-0.285	-0.342
	N	112964								
Immediate Memory	Estimate	0.012	0	-0.005	0.050	0.094	0	-0.192	-0.253	-0.266
	Upper			0.028	0.077	0.118		-0.125	-0.175	-0.148
	Lower			-0.038	0.023	0.070		-0.259	-0.331	-0.384
	N	141582								
Spatial Working Memory Maximum Span	Estimate	0.007	0	0.006	0.056	0.052	0	-0.156	-0.196	-0.215
	Upper			0.041	0.083	0.077		-0.085	-0.114	-0.093
	Lower			-0.029	0.029	0.027		-0.227	-0.278	-0.337
	N	129543								
Verbal Analogical Reasoning	Estimate	-0.002	0	-0.003	0.117	0.157	0	-0.132	-0.208	-0.329
	Upper			0.032	0.146	0.182		-0.059	-0.124	-0.202
	Lower			-0.038	0.088	0.132		-0.205	-0.292	-0.456
	N	119751								
Word Definitions	Estimate	0.006	0	-0.006	0.095	0.178	0	-0.107	-0.141	-0.266
	Upper			0.029	0.124	0.205		-0.033	-0.057	-0.137
	Lower			-0.041	0.066	0.151		-0.181	-0.225	-0.395

b continued

		No-Covid-19 (ref)	Asymptomatic	<4 weeks	4-12 Weeks	>12 Weeks Resolved	>12 Weeks Ongoing	<12 weeks since infection
Spatial Planning	Estimate	0	-0.078	-0.110	-0.132	-0.113	-0.211	-0.143
	Upper		-0.037	-0.085	-0.093	-0.058	-0.168	-0.110
	Lower		-0.119	-0.135	-0.171	-0.168	-0.254	-0.176
	N							
Information Sampling	Estimate	0	-0.046	-0.044	-0.042	-0.040	-0.069	-0.061
	Upper		-0.003	-0.017	-0.001	0.017	-0.024	-0.028
	Lower		-0.089	-0.071	-0.083	-0.097	-0.114	-0.094
	N							
2D Mental Manipulation	Estimate	0	0.012	-0.039	-0.074	-0.029	-0.115	-0.067
	Upper		0.051	-0.014	-0.037	0.022	-0.074	-0.036
	Lower		-0.027	-0.064	-0.111	-0.080	-0.156	-0.098

	N							
Delayed Memory	Estimate	0	-0.052	-0.090	-0.105	-0.094	-0.225	-0.091
	Upper		-0.009	-0.063	-0.064	-0.037	-0.180	-0.056
	Lower		-0.095	-0.117	-0.146	-0.151	-0.270	-0.126
	N							
Immediate Memory	Estimate	0	-0.047	-0.079	-0.090	-0.083	-0.220	-0.089
	Upper		-0.010	-0.055	-0.053	-0.032	-0.179	-0.058
	Lower		-0.084	-0.103	-0.127	-0.134	-0.261	-0.120
	N							
Spatial Working Memory Maximum Span	Estimate	0	0.014	-0.048	-0.096	-0.037	-0.115	-0.060
	Upper		0.053	-0.023	-0.057	0.016	-0.074	-0.029
	Lower		-0.025	-0.073	-0.135	-0.090	-0.156	-0.091
	N							
Verbal Analogical Reasoning	Estimate	0	-0.119	-0.103	-0.131	-0.110	-0.220	-0.134
	Upper		-0.078	-0.078	-0.092	-0.055	-0.177	-0.101
	Lower		-0.160	-0.128	-0.170	-0.165	-0.263	-0.167
	N							
Word Definitions	Estimate	0	-0.160	-0.133	-0.129	-0.131	-0.225	-0.137
	Upper		-0.119	-0.106	-0.088	-0.076	-0.182	-0.104
	Lower		-0.201	-0.160	-0.170	-0.186	-0.268	-0.170

c. Immediate Memory
In all 26050 participants who completed the first task but did not complete the whole battery

		Intercept	Original virus (ref)	Alpha	Delta	Omicron	No hospital (ref)	ED	Hospital admission	Intensive Care
Complete	Estimate	0.012	0	-0.010	0.034	0.080	0	-0.188	-0.291	-0.268
	Upper			0.027	0.065	0.107		-0.110	-0.203	-0.135
	Lower			-0.047	0.003	0.053		-0.266	-0.379	-0.401
Not complete	Estimate	-0.1955	0	0.003	0.091	0.109	0	-0.154	-0.171	-0.214
	Upper			0.076	0.150	0.163		-0.005	0.016	0.070
	Lower			-0.069	0.031	0.056		-0.303	-0.358	-0.499

c continued

		No-Covid-19 (ref)	Asymptomatic	<4 weeks	4-12 Weeks	>12 Weeks Resolved	>12 Weeks Ongoing
Complete	Estimate	0	-0.015	-0.064	-0.085	-0.068	-0.221
	Upper		0.028	-0.037	-0.044	-0.011	-0.176
	Lower		-0.058	-0.091	-0.126	-0.125	-0.266
Not complete	Estimate	0	-0.119	-0.114	-0.098	-0.139	-0.254
	Upper		-0.038	-0.061	-0.016	-0.026	-0.157
	Lower		-0.200	-0.167	-0.180	-0.253	-0.351

Table S15. Objectively measured correlates of recent subjective memory symptoms (poor memory), mean difference in task score (SD units)

	Ongoing persistent cases			95% CI	
	N	Freq	Mean difference	Lower	Upper
Spatial Planning	2580	1216	-0.067	-0.145	0.011
Information Sampling	2580	1216	0.018	-0.060	0.096
2D Mental Manipulation	2580	1216	-0.119	-0.199	-0.039
Delayed Memory	2580	1216	-0.180	-0.258	-0.102
Immediate Memory	2580	1216	-0.206	-0.285	-0.127
Spatial Working Memory Maximum Span	2580	1216	-0.152	-0.229	-0.075
Verbal Analogical Reasoning	2580	1216	-0.196	-0.276	-0.116
Word Definitions	2580	1216	-0.124	-0.202	-0.046
Spatial Planning Respone Time	2580	1216	-0.008	-0.086	0.070
Information Sampling Response Time	2580	1216	-0.031	-0.103	0.041
2D Mental Manipulation Response Time	2576	1216	0.050	-0.031	0.131
Delayed Memory Response Time	2463	1216	0.103	0.020	0.186
Immediate Memory Response Time	2580	1216	0.205	0.128	0.282
Spatial Working Memory Response Time	2578	1216	0.071	-0.007	0.149
Verbal Analogical Reasoning Response Time	2580	1216	0.083	0.003	0.163
Word Definitions Response Time	2580	1216	0.142	0.062	0.222
Delayed Memory Precision Errors	2580	1216	0.164	0.087	0.241
Delayed Memory Binding Errors	2580	1216	0.049	-0.029	0.127
Delayed Memory Item Errors	2580	1216	0.177	0.099	0.255
Immediate Memory Precision Errors	2580	1216	0.125	0.048	0.202
Immediate Memory Binding Errors	2580	1216	0.060	-0.016	0.136
Immediate Memory Item Errors	2580	1216	0.187	0.109	0.265
Information Sampling Mean Samples	2580	1216	-0.019	-0.097	0.059
	Resolved cases			**95% CI**	
	N	**Freq**	**Mean difference**	**Lower**	**Upper**
Spatial Planning	53422	9820	-0.087	-0.109	-0.065
Information Sampling	53422	9820	-0.038	-0.060	-0.016
2D Mental Manipulation	53422	9820	-0.067	-0.089	-0.045
Delayed Memory	53422	9820	-0.114	-0.136	-0.092
Immediate Memory	53422	9820	-0.122	-0.144	-0.100
Spatial Working Memory Maximum Span	53422	9820	-0.107	-0.129	-0.085
Verbal Analogical Reasoning	53422	9820	-0.143	-0.165	-0.121
Word Definitions	53422	9820	-0.109	-0.131	-0.087
Spatial Planning Respone Time	53422	9820	-0.006	-0.028	0.016
Information Sampling Response Time	53422	9820	-0.043	-0.064	-0.022
2D Mental Manipulation Response Time	53401	9820	0.017	-0.005	0.039
Delayed Memory Response Time	51144	9820	0.037	0.015	0.059

Immediate Memory Response Time	53422	9820	0.052	0.030	0.074
Spatial Working Memory Response Time	53383	9820	0.007	-0.013	0.027
Verbal Analogical Reasoning Response Time	53413	9820	0.055	0.033	0.077
Word Definitions Response Time	53418	9820	0.108	0.086	0.130
Delayed Memory Precision Errors	53422	9820	0.094	0.073	0.115
Delayed Memory Binding Errors	53422	9820	0.027	0.006	0.048
Delayed Memory Item Errors	53422	9820	0.106	0.084	0.128
Immediate Memory Precision Errors	53422	9820	0.086	0.065	0.107
Immediate Memory Binding Errors	53422	9820	0.050	0.028	0.072
Immediate Memory Item Errors	53422	9820	0.113	0.091	0.135
Information Sampling Mean Samples	53422	9820	-0.018	-0.039	0.003

	No-Covid-19			**95% CI**	
	N	**Freq**	**Mean difference**	**Lower**	**Upper**
Spatial Planning	46261	6258	-0.013	-0.039	0.013
Information Sampling	46261	6258	-0.019	-0.046	0.008
2D Mental Manipulation	46261	6258	-0.055	-0.082	-0.028
Delayed Memory	46261	6258	-0.050	-0.076	-0.024
Immediate Memory	46261	6258	-0.062	-0.089	-0.035
Spatial Working Memory Maximum Span	46261	6258	-0.047	-0.073	-0.021
Verbal Analogical Reasoning	46261	6258	-0.041	-0.067	-0.015
Word Definitions	46261	6258	-0.062	-0.089	-0.035
Spatial Planning Respone Time	46261	6258	0.031	0.004	0.058
Information Sampling Response Time	46261	6258	-0.031	-0.058	-0.004
2D Mental Manipulation Response Time	46250	6258	0.041	0.014	0.068
Delayed Memory Response Time	44304	6258	0.043	0.016	0.070
Immediate Memory Response Time	46261	6258	0.072	0.045	0.099
Spatial Working Memory Response Time	46168	6258	0.021	-0.006	0.048
Verbal Analogical Reasoning Response Time	46257	6258	0.081	0.054	0.108
Word Definitions Response Time	46256	6258	0.074	0.048	0.100
Delayed Memory Precision Errors	46261	6258	0.023	-0.004	0.050
Delayed Memory Binding Errors	46261	6258	0.027	0.000	0.054
Delayed Memory Item Errors	46261	6258	0.050	0.023	0.077
Immediate Memory Precision Errors	46261	6258	0.030	0.003	0.057
Immediate Memory Binding Errors	46261	6258	0.021	-0.005	0.047
Immediate Memory Item Errors	46261	6258	0.057	0.030	0.084
Information Sampling Mean Samples	46261	6258	-0.007	-0.034	0.020

Mean difference in task score between contrasted groups with 95% confidence interval in SD units.

Table S16. Objectively measured correlates of subjective "brain fog", mean difference in task score (SD units)

	Ongoing persistent cases			95% CI	
	N	Freq	Mean difference	Lower	Upper
Spatial Planning	2580	1545	-0.139	-0.219	-0.059
Information Sampling	2580	1545	-0.029	-0.108	0.050
2D Mental Manipulation	2580	1545	-0.094	-0.176	-0.012
Delayed Memory	2580	1545	-0.084	-0.163	-0.005
Immediate Memory	2580	1545	-0.161	-0.241	-0.081
Spatial Working Memory Maximum Span	2580	1545	-0.187	-0.266	-0.108
Verbal Analogical Reasoning	2580	1545	-0.164	-0.246	-0.082
Word Definitions	2580	1545	-0.049	-0.129	0.031
Spatial Planning Respone Time	2580	1545	-0.019	-0.096	0.058
Information Sampling Response Time	2580	1545	-0.011	-0.084	0.062
2D Mental Manipulation Response Time	2576	1545	0.039	-0.044	0.122
Delayed Memory Response Time	2463	1545	0.032	-0.054	0.118
Immediate Memory Response Time	2580	1545	0.125	0.046	0.204
Spatial Working Memory Response Time	2578	1545	0.095	0.015	0.175
Verbal Analogical Reasoning Response Time	2580	1545	0.044	-0.037	0.125
Word Definitions Response Time	2580	1545	0.089	0.007	0.171
Delayed Memory Precision Errors	2580	1545	0.096	0.018	0.174
Delayed Memory Binding Errors	2580	1545	0.029	-0.050	0.108
Delayed Memory Item Errors	2580	1545	0.079	-0.001	0.159
Immediate Memory Precision Errors	2580	1545	0.108	0.029	0.187
Immediate Memory Binding Errors	2580	1545	0.055	-0.022	0.132
Immediate Memory Item Errors	2580	1545	0.150	0.070	0.230
Information Sampling Mean Samples	2580	1545	0.026	-0.056	0.108
	Resolved cases			**95% CI**	
	N	**Freq**	**Mean difference**	**Lower**	**Upper**
Spatial Planning	53422	12889	-0.067	-0.087	-0.047
Information Sampling	53422	12889	-0.028	-0.047	-0.009
2D Mental Manipulation	53422	12889	-0.068	-0.088	-0.048
Delayed Memory	53422	12889	-0.082	-0.102	-0.062
Immediate Memory	53422	12889	-0.088	-0.108	-0.068
Spatial Working Memory Maximum Span	53422	12889	-0.108	-0.128	-0.088
Verbal Analogical Reasoning	53422	12889	-0.094	-0.114	-0.074
Word Definitions	53422	12889	-0.060	-0.080	-0.040
Spatial Planning Respone Time	53422	12889	-0.019	-0.039	0.001
Information Sampling Response Time	53422	12889	-0.031	-0.050	-0.012

2D Mental Manipulation Response Time	53401	12889	0.015	-0.005	0.035
Delayed Memory Response Time	51144	12889	0.014	-0.007	0.035
Immediate Memory Response Time	53422	12889	0.020	0.001	0.039
Spatial Working Memory Response Time	53383	12889	-0.004	-0.026	0.018
Verbal Analogical Reasoning Response Time	53413	12889	0.015	-0.005	0.035
Word Definitions Response Time	53418	12889	0.041	0.021	0.061
Delayed Memory Precision Errors	53422	12889	0.076	0.057	0.095
Delayed Memory Binding Errors	53422	12889	0.022	0.002	0.042
Delayed Memory Item Errors	53422	12889	0.076	0.056	0.096
Immediate Memory Precision Errors	53422	12889	0.079	0.060	0.098
Immediate Memory Binding Errors	53422	12889	0.032	0.012	0.052
Immediate Memory Item Errors	53422	12889	0.080	0.060	0.100
Information Sampling Mean Samples	53422	12889	-0.010	-0.030	0.010
	No-Covid-19			**95% CI**	
	N	**Freq**	**Mean difference**	**Lower**	**Upper**
Spatial Planning	46261	7890	0.007	-0.019	0.033
Information Sampling	46261	7890	-0.015	-0.040	0.010
2D Mental Manipulation	46261	7890	-0.031	-0.055	-0.007
Delayed Memory	46261	7890	0.005	-0.021	0.031
Immediate Memory	46261	7890	-0.010	-0.033	0.013
Spatial Working Memory Maximum Span	46261	7890	-0.040	-0.064	-0.016
Verbal Analogical Reasoning	46261	7890	-0.004	-0.027	0.019
Word Definitions	46261	7890	0.001	-0.032	0.034
Spatial Planning Respone Time	46261	7890	0.024	-0.001	0.049
Information Sampling Response Time	46261	7890	-0.018	-0.043	0.007
2D Mental Manipulation Response Time	46250	7890	0.033	0.008	0.058
Delayed Memory Response Time	44304	7890	0.043	0.018	0.068
Immediate Memory Response Time	46261	7890	0.047	0.023	0.071
Spatial Working Memory Response Time	46168	7890	0.024	-0.001	0.049
Verbal Analogical Reasoning Response Time	46257	7890	0.032	0.008	0.056
Word Definitions Response Time	46256	7890	0.012	-0.012	0.036
Delayed Memory Precision Errors	46261	7890	0.005	-0.019	0.029
Delayed Memory Binding Errors	46261	7890	0.016	-0.008	0.040
Delayed Memory Item Errors	46261	7890	-0.001	-0.018	0.016
Immediate Memory Precision Errors	46261	7890	0.008	-0.016	0.032
Immediate Memory Binding Errors	46261	7890	0.005	-0.022	0.032
Immediate Memory Item Errors	46261	7890	0.011	-0.014	0.036
Information Sampling Mean Samples	46261	7890	-0.018	-0.044	0.008

Mean difference between contrasted groups with 95% confidence interval in SD units.

Table S17. Contrasting global cognitive score (SD units) for presence vs absence of individual symptoms in resolved and persistent post-Covid cases

a. Cognitive performance in relation to acute symptoms in all Covid-19 cases with recorded illness duration

	N	Mean difference	95% CI	
TOTAL	**56002**		**Lower**	**Upper**
Decrease in appetite	19713	-0.078	-0.095	-0.061
Nausea and or vomiting	6443	-0.139	-0.165	-0.113
Diarrhoea	6644	-0.155	-0.181	-0.129
Abdominal pain tummy ache	5540	-0.169	-0.197	-0.141
Runny nose	24992	0.029	0.012	0.046
Sneezing	20170	-0.011	-0.028	0.006
Blocked nose	18266	-0.008	-0.027	0.011
Sore eyes	9852	-0.085	-0.107	-0.063
Loss or change to sense of smell	16427	-0.104	-0.122	-0.086
Loss or change to sense of taste	17888	-0.111	-0.129	-0.093
Sore throat	33485	0.025	0.008	0.042
Hoarse voice	12644	-0.043	-0.063	-0.023
Headache	37381	-0.039	-0.057	-0.021
Dizziness	13803	-0.111	-0.130	-0.092
Shortness of breath	14655	-0.109	-0.128	-0.090
New persistent cough	22305	-0.030	-0.047	-0.013
Tightness in chest	11769	-0.125	-0.145	-0.105
Chest pain	4656	-0.243	-0.273	-0.213
Fever (feeling too hot)	24754	-0.039	-0.056	-0.022
Chills (feeling too cold)	19254	-0.060	-0.077	-0.043
Difficulty sleeping	16010	-0.107	-0.125	-0.089
Felt more tired than normal	39150	0.015	-0.003	0.033
Severe fatigue	15427	-0.127	-0.146	-0.108
Numbness or tingling	3261	-0.262	-0.297	-0.227
Feeling of heaviness in arms or legs	11583	-0.081	-0.101	-0.061
Achy muscles	30415	-0.064	-0.081	-0.047
Raised red itchy areas on the skin	1403	-0.222	-0.275	-0.169
Sudden swelling of the face or lips	211	-0.429	-0.564	-0.294
Red purple sores or blisters on your feet	332	-0.257	-0.365	-0.149
Leg swelling (Thrombosis)	358	-0.305	-0.409	-0.201

b. Cognitive performance in relation to recent symptoms (past 2 weeks) in all ongoing persistent cases

	N	Mean difference	95% CI	
TOTAL	**2580**		**Lower**	**Upper**
Fever	158	-0.303	-0.463	-0.143
Persistent cough	498	-0.043	-0.140	0.054
Shortness of breath	893	-0.169	-0.250	-0.088
Chest pain tightness	514	-0.223	-0.319	-0.127
Headache	1322	-0.109	-0.186	-0.032
Dizziness	739	-0.247	-0.332	-0.162
Mild fatigue	1804	0.044	-0.041	0.129
Severe fatigue	377	-0.325	-0.433	-0.217
Loss of appetite	430	-0.222	-0.325	-0.119
Joint pain Aches	1468	-0.154	-0.231	-0.077
Muscle pain Aches	1303	-0.123	-0.200	-0.046
Brain fog	1545	-0.153	-0.231	-0.075
Heart problems	716	-0.172	-0.258	-0.086
Leg swelling	200	-0.048	-0.192	0.096
Swelling of face or lips	30	-0.363	-0.722	-0.004
Red or purples sores blisters on feet	42	-0.179	-0.482	0.124
Numbness or tingling	723	-0.230	-0.315	-0.145
Skin issues (itchy scaly redness rash)	696	-0.083	-0.169	0.003
Itchy eyes	707	-0.032	-0.119	0.055
Loss or change to sense of taste	515	-0.161	-0.257	-0.065
Loss or change to send of smell	591	-0.104	-0.195	-0.013
Vision issues	463	-0.148	-0.248	-0.048
Ringing in the ears (tinnitus)	763	-0.052	-0.137	0.033
Hair loss	298	-0.191	-0.311	-0.071
Difficulty sleeping	1339	-0.111	-0.188	-0.034
Poor memory	1216	-0.223	-0.300	-0.146
Mood swings	682	-0.210	-0.297	-0.123

Anxiety	1042	-0.184	-0.262	-0.106
Low mood	1021	-0.118	-0.197	-0.039

Mean difference in global cognitive score between contrasted groups in SD units with 95% confidence interval.

Table S18. Associations with global cognitive score (SD units) after excluding people who were vaccinated prior to their worst (longest duration) Covid-19 illness

	Estimate	95% CI Upper	Lower
(Intercept)	0.120	0.024	0.216
Original virus	0.005	-0.034	0.043
Alpha (ref)	0.000		
Delta	0.058	0.016	0.100
Omicron	0.146	0.111	0.181
Unknown variant	-0.106	-0.201	-0.011
ED	-0.235	-0.327	-0.142
Hospital admission	-0.302	-0.403	-0.200
Intensive care	-0.274	-0.423	-0.125
No-Covid-19 (ref)	0.000		
Asymptomatic	-0.150	-0.251	-0.048
<4 weeks	-0.201	-0.292	-0.110
4-12 weeks	-0.234	-0.336	-0.131
>= 12 weeks resolved	-0.209	-0.320	-0.099
>= 12 weeks unresolved	-0.400	-0.504	-0.296

Sensitivity analysis rerunning the regression analysis with terms identified in the stepwise regression for people who were unvaccinated only produced similar parameter estimates to the main analysis.

Table S19. Associations with global cognitive score (SD units) after excluding the No-Covid-19 group

	Estimate	95% CI Lower	Upper
(Intercept)	-0.082	-0.116	-0.048
Original virus	0.012	-0.026	0.049
Alpha (ref)	0.000		
Delta	0.066	0.032	0.099
Omicron	0.118	0.088	0.149
Unknown variant	-0.100	-0.195	-0.006
ED	-0.244	-0.321	-0.167
Hospital admission	-0.296	-0.382	-0.209
Intensive care	-0.339	-0.470	-0.208
Asymptomatic(ref)	0.000		
<4 weeks	-0.003	-0.022	0.017
4-12 weeks	-0.030	-0.070	0.009
>= 12 weeks resolved	-0.018	-0.076	0.040
>= 12 weeks unresolved	-0.182	-0.226	-0.139

Sensitivity analysis rerunning the regression analysis with terms identified in the stepwise regression without the No-Covid-19 group produced similar parameter estimates to the main analysis.

Table S20. Analysis of associations with global cognitive score (SD units) when including either people who did or did not report recent (in the past two weeks) cognitive symptoms (poor memory or "brain fog")

	Reporting cognitive symptoms?					
	TRUE			FALSE		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Intercept	0.042	-0.115	0.198	0.138	-0.019	0.259
Original virus	0.011	-0.052	0.075	0.014	-0.050	0.061
Alpha (ref)	0.000			0.000		
Delta	0.047	-0.012	0.106	0.074	0.015	0.115
Omicron	0.125	0.070	0.179	0.119	0.065	0.157
ED	-0.313	-0.425	-0.200	-0.101	-0.214	0.013
Admitted	-0.340	-0.460	-0.220	-0.220	-0.340	-0.083
Intensive Care	-0.407	-0.579	-0.234	-0.145	-0.317	0.071
No-Covid-19	0.000			0.000		
Asymptomatic	-0.134	-0.301	0.034	-0.164	-0.332	-0.043
<4 wks resolved	-0.190	-0.338	-0.042	-0.201	-0.349	-0.085
4-12 weeks	-0.232	-0.391	-0.073	-0.201	-0.360	-0.076
>=12 resolved	-0.212	-0.386	-0.038	-0.194	-0.368	-0.059
>=12 not resolved	-0.352	-0.509	-0.195	-0.306	-0.464	-0.173

Sensitivity analysis rerunning the regression analysis with terms identified in the stepwise regression including either only those people who did report cognitive symptoms (poor memory or "brain fog") in the past two weeks and only those people who did not.

Table S21. Associations with global cognitive score (SD units) when excluding people where education level was unknown

	Estimate	95%CI Lower	Upper
(Intercept)	0.135	0.009	0.262
Original virus	0.013	-0.036	0.062
Alpha (ref)	0		
Delta	0.015	-0.063	0.092
Omicron	0.049	-0.030	0.127
Unknown variant	-0.113	-0.239	0.013
ED	-0.193	-0.290	-0.095
Hospital admission	-0.258	-0.366	-0.149
Intensive care	-0.403	-0.570	-0.235
1 Dose	-0.025	-0.112	0.062
2 Doses	0.070	-0.004	0.143
No-Covid-19 (ref)	0.000		
Asymptomatic	-0.176	-0.304	-0.049
<4 weeks	-0.233	-0.353	-0.112
4-12 weeks	-0.247	-0.376	-0.118
>= 12 weeks resolved	-0.273	-0.412	-0.133
>= 12 weeks unresolved	-0.397	-0.528	-0.265

Sensitivity analysis excluding participants (N=38,437) where education level was unknown in case this biased the normative model, produced marginally larger parameter estimates.

Table S22. Associations with global cognitive score (SD units) when including suspected but unconfirmed Covid-19 as a separate group

	Estimate	95%CI	
		Lower	Upper
(Intercept)	0.115	0.020	0.210
Original virus	0.011	-0.027	0.048
Alpha (ref)	0		
Delta	0.066	0.032	0.100
Omicron	0.124	0.094	0.155
ED	-0.228	-0.307	-0.148
Hospital admission	-0.308	-0.397	-0.220
Intensive care	-0.330	-0.463	-0.198
No-Covid-19(ref)	0		
Suspected	-0.018	-0.044	0.008
Asymptomatic	-0.154	-0.250	-0.057
<4 weeks	-0.204	-0.294	-0.113
4-12 weeks	-0.230	-0.327	-0.132
>= 12 weeks resolved	-0.216	-0.322	-0.110
>= 12 weeks unresolved	-0.381	-0.481	-0.282

Sensitivity analysis dividing the No-Covid-19 group into those participants (N=6,643) who suspected they might have had Covid-19 but this was not confirmed with a test, and the remainder who did not suspect that they had Covid-19.

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