

Table S1: Sources of Data for Table S4

Table S4 Field	Source in HES
Month	Date of Admission (ADMIDATE)
Region	Government office region of treatment (GORTREAT)
ADMISSION SOURCE Group	Source of admission(ADMISORC) with the following mappings: Text Codes Usual of Residence 19 Care home / hospice 54,65,66,85 Hospital 49,51,52,53 Temp place of residence. 29 Other all other codes
Age Band	Age on admission (ADMIMAGE) into the following age bands (years) 19 to 44 55 to 64 65 to 74 75 to 120
Deprivation Decile	IMD Index of Multiple Deprivation (IMD04) mapped on to deciles against English population. This index is the standard index used for UK data. It is based on 39 indicators in seven domains (income, employment, health deprivation and disability, education/skill training, crime, barriers to housing and services and living environment), drawn from government data. The measure is based on small areas (neighborhoods), with an average population of 1,500 each.
Ethnicity Group	Ethnic category (ETHNOS) mapped according to: Text Ethnicity Group Unknown Unknown British White Irish White Any other White background White White and Black Caribbean Mixed White and Black African Mixed White and Asian Mixed Any other mixed background Mixed Indian Asian or Asian British Pakistani Asian or Asian British Bangladeshi Asian or Asian British Any other Asian background Asian or Asian British Caribbean Black or Black British African Black or Black British Any other Black background Black or Black British Chinese Other Ethnic Groups Any other ethnic group Other Ethnic Groups Not Stated Patient Declined
Sex	Sex of patient
All comorbidity fields	Derived from diagnosis -4 characters (DIAG_4_NN) according to the Elixhauser comorbidity measure rules (1).

Table S2: Selected additional characteristics by Month

Month	Number of COVID admissions	Length of stay		Patients with a Critical episode	Deaths	In Hospital Deaths	Estimated Bed occupancy as % of all available beds
		Median	IQR				
March	27,957	9.0	(4 - 18)	3758 (13.4%)	9,339	9070 (97.1%)	104.4
April	49,455	6.0	(3 - 13)	5141 (10.4%)	15,716	14201 (90.4%)	70.5
May	16,678	7.0	(2 - 14)	1130 (6.8%)	4,258	3830 (89.9%)	62.3
June	6,010	6.0	(2 - 13)	461 (7.7%)	1,202	1059 (88.1%)	73.0
July	2,510	5.0	(2 - 11)	202 (8.0%)	389	344 (88.4%)	77.0

Table S2 shows that the median length of stay has reduced from 9 days in March to 5.0 days in July. The next column was obtained from the HES Adult Critical Care (2) data set and shows percentage of patients receiving critical care has reduced from 13.4% to 8.0%. Likewise, the percentage of patients who died in hospital dropped from 97.1% to 88.4%. The last column shows an estimate of the percentage occupancy of NHS beds. The number of occupied beds was obtained by summing the all stays in that month from HES. The number of available beds was obtained by an NHS form report (KH03), which give the average number of each beds available for overnight stay each quarter (3). As the number of available beds can be flexed within the quarter, this estimate should be treated with caution. Nevertheless, March was very likely the period with both the highest mortality and highest % occupancy.

Table S3: 10 most common causes of death for patients admitted with COVID 19 between March and July 2020.

Code	Text	March	April	May	June	July
U07	Emergency use of U07	8162 (87.4%)	13150 (83.7%)	2867 (67.3%)	730 (60.7%)	189 (48.6%)
F03	Unspecified dementia	115 (1.2%)	130 (0.8%)	86 (2.0%)	39 (3.2%)	16 (4.1%)
J44	Other chronic obstructive pulmonary disease	78 (0.8%)	105 (0.7%)	58 (1.4%)	31 (2.6%)	16 (4.1%)
J18	Pneumonia, unspecified organism	43 (0.5%)	125 (0.8%)	55 (1.3%)	23 (1.9%)	13 (3.3%)
C34	Malignant neoplasm of bronchus and lung	42 (0.4%)	71 (0.5%)	45 (1.1%)	27 (2.2%)	11 (2.8%)
I25	Chronic ischemic heart disease	40 (0.4%)	93 (0.6%)	33 (0.8%)	13 (1.1%)	<10
I64	Stroke, not specified as haemorrhage or infarction	42 (0.4%)	80 (0.5%)	39 (0.9%)	12 (1.0%)	7 (1.8%)
G30	Alzheimer's disease	32 (0.3%)	76 (0.5%)	29 (0.7%)	12 (1.0%)	<10
I21	Acute myocardial infarction	28 (0.3%)	45 (0.3%)	26 (0.6%)	<10	<10
F01	Mental disorders due to known physiological conditions	13 (0.1%)	46 (0.3%)	19 (0.4%)	<10	<10
	All other codes	744 (7.3%)	1795 (11.4%)	1001 (24.1%)	298 (26.0%)	120 (34.5%)
	All deaths	9339	15716	4258	1202	389

Note: Small numbers have been suppressed in line with ONS Governance requirements. Codes are ICD-10 not ICD-10-CM. Cause of death is usually obtained from the medical certificate of cause of death (MCCD), completed by a medical practitioner when the death is certified. This is coded using automatic cause coding software (IRIS 3.5). Specific text terms from the death certificate are converted to International Classification of Diseases (ICD) codes, and then selection and modification rules are used to assign the underlying cause of death. The underlying cause of death is defined by WHO as the disease or injury that initiated the train of events directly leading to death or the circumstances of the accident or violence that produced the fatal injury (4).

Table S4: Zou's Modified Poisson Regression to predict death with 28 days of admission

Month	N (%)	RR	95% CI	p
March	27957 ( 27.2%)		Reference	
April	49455 ( 48.2%)	0.95	(0.89 - 1.00)	0.059
May	16678 ( 16.3%)	0.73	(0.66 - 0.80)	<.001
June	6010 ( 5.9%)	0.61	(0.49 - 0.76)	<.001
July	2510 ( 2.4%)	0.52	(0.34 - 0.80)	0.003
<b>Region</b>				
London	20990 ( 20.5%)		Reference	
East of England	11516 ( 11.2%)	1.10	(1.00 - 1.22)	0.059
Midlands	20593 ( 20.1%)	1.01	(0.92 - 1.12)	0.804
North East and Yorkshire	14660 ( 14.3%)	1.01	(0.91 - 1.12)	0.860
North West	16455 ( 16%)	0.98	(0.88 - 1.08)	0.651
South East	13545 ( 13.2%)	1.00	(0.89 - 1.12)	0.948
South West	4851 ( 4.7%)	0.91	(0.77 - 1.08)	0.296
<b>Admission Source</b>				
Usual place of residence	92241 ( 89.9%)		Reference	
Care home / hospice	2361 ( 2.3%)	1.25	(1.16 - 1.35)	<.001
Hospital	7576 ( 7.4%)	0.87	(0.76 - 1.00)	0.048
Other	151 ( 0.1%)	1.26	(0.67 - 2.36)	0.471
Temp place of residence	281 ( 0.3%)	1.03	(0.59 - 1.79)	0.924
<b>Age Band</b>				
19-44	11007 ( 10.7%)		Reference	
65-54	10707 ( 10.4%)	2.41	(0.24 - 24.25)	0.454
55-64	14740 ( 14.4%)	4.69	(0.49 - 45.31)	0.182
65-74	17931 ( 17.5%)	7.43	(0.76 - 72.12)	0.084
75-120	48225 ( 47%)	11.16	(1.16 - 107.15)	0.037
<b>DEPRIVATION DECILE</b>				
1 (Most Deprived)	13709 ( 13.4%)		Reference	
2	13101 ( 12.8%)	0.98	(0.87 - 1.11)	0.776
3	12300 ( 12%)	0.98	(0.87 - 1.11)	0.765
4	10964 ( 10.7%)	0.99	(0.88 - 1.11)	0.835
5	9917 ( 9.7%)	0.96	(0.85 - 1.08)	0.518
6	9713 ( 9.5%)	0.96	(0.85 - 1.08)	0.464
7	9029 ( 8.8%)	0.94	(0.83 - 1.06)	0.309
8	8536 ( 8.3%)	0.94	(0.84 - 1.07)	0.352
9	8377 ( 8.2%)	0.93	(0.82 - 1.05)	0.248
10 (Least Deprived)	6964 ( 6.8%)	0.91	(0.80 - 1.03)	0.133
<b>Ethnicity Group</b>				

White	73978 ( 72.1%)		Reference	
Asian or Asian British	8105 ( 7.9%)	1.14	(0.99 - 1.32)	0.067
Black or Black British	5008 ( 4.9%)	0.99	(0.81 - 1.21)	0.941
Mixed	817 ( 0.8%)	1.08	(0.60 - 1.96)	0.794
Patient Declined	8019 ( 7.8%)	1.03	(0.91 - 1.17)	0.632
Other Ethnic Groups	3494 ( 3.4%)	1.00	(0.76 - 1.30)	0.979
Unknown	3189 ( 3.1%)	1.06	(0.91 - 1.24)	0.427
SEX = Female	46262 ( 45.1%)	0.82	(0.77 - 0.88)	<.001
Congestive Heart Failure	988 ( 1%)	1.19	(0.95 - 1.50)	0.130
Cardiac Arrhythmia	26521 ( 25.8%)	1.09	(1.04 - 1.14)	<.001
Valvular Disease	7623 ( 7.4%)	0.97	(0.90 - 1.05)	0.427
Pulmonary Circulation Disorder	4822 ( 4.7%)	1.05	(0.91 - 1.21)	0.505
Peripheral Vascular Disease	5834 ( 5.7%)	1.08	(1.00 - 1.16)	0.045
Hypertension	49245 ( 48%)	0.96	(0.92 - 1.01)	0.151
Paralysis	2754 ( 2.7%)	1.08	(0.93 - 1.26)	0.296
Other Neurological Disorders	10125 ( 9.9%)	1.13	(1.02 - 1.26)	0.020
Chronic Pulmonary Disease	27942 ( 27.2%)	1.04	(0.98 - 1.10)	0.176
Diabetes without Chronic Complications	26063 ( 25.4%)	1.05	(0.99 - 1.11)	0.081
Diabetes with Chronic Complications	3785 ( 3.7%)	1.05	(0.93 - 1.17)	0.428
Hypothyroidism	8372 ( 8.2%)	0.99	(0.90 - 1.08)	0.785
Renal Failure	19599 ( 19.1%)	1.17	(1.13 - 1.22)	<.001
Liver Disease	4697 ( 4.6%)	1.18	(0.96 - 1.45)	0.124
Peptic Ulcer Disease	688 ( 0.7%)	0.96	(0.70 - 1.32)	0.804
Lymphoma	1357 ( 1.3%)	1.26	(1.09 - 1.47)	0.002
Metastatic Cancer	3312 ( 3.2%)	1.41	(1.25 - 1.59)	<.001
Solid Tumor without Metastasis	6865 ( 6.7%)	1.09	(1.01 - 1.17)	0.021
Rheumatoid Arthritis	4871 ( 4.7%)	1.01	(0.91 - 1.13)	0.821
Coagulopathy	2449 ( 2.4%)	1.22	(1.04 - 1.44)	0.016
Obesity	9427 ( 9.2%)	1.15	(0.96 - 1.36)	0.124
Weight Loss	1647 ( 1.6%)	0.96	(0.75 - 1.24)	0.773
Fluid and Electrolyte Disorders	28214 ( 27.5%)	1.30	(1.22 - 1.38)	<.001
Blood Loss Anemia	205 ( 0.2%)	1.02	(0.52 - 2.04)	0.944
Anemia Deficiency	5055 ( 4.9%)	0.85	(0.74 - 0.98)	0.020
Alcohol Abuse	3848 ( 3.8%)	0.99	(0.75 - 1.31)	0.937
Drug Abuse	655 ( 0.6%)	0.91	(0.06 - 14.24)	0.947
Psychoses	2149 ( 2.1%)	1.06	(0.82 - 1.37)	0.666
Depression	8723 ( 8.5%)	0.95	(0.83 - 1.09)	0.486

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We undertook the following three sensitivity analysis:

- Lab Confirmed: Restricted the data to only laboratory-confirmed cases (U07.1),
- LOS  $\geq 3$  days: Included only patients with a length of stay  $\geq 3$  days,
- Respiratory: Restrict admissions to cases where either a respiratory illness or COVID-19 were included as a primary diagnosis. See Appendix 1.

### Appendix 1: Codes used to define principal diagnosis of COVID-19, sepsis, or respiratory disease

U07	COVID-19
J00-J99	Diseases of the respiratory system
R05	Cough
R060	Dyspnoea

### Bibliography

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2. **NHS Digital** . HES Data Dictionary: Adult Critical Care. [Online] 2017. [Cited: 01 15, 2021.] [https://digital.nhs.uk/binaries/content/assets/legacy/pdf/7/9/hes\\_data\\_dictionary\\_-\\_adult\\_critical\\_care.pdf](https://digital.nhs.uk/binaries/content/assets/legacy/pdf/7/9/hes_data_dictionary_-_adult_critical_care.pdf).
3. **NHS England.** Bed Availability and Occupancy. [Online] 2020. [Cited: 01 15, 2021.] <https://www.england.nhs.uk/statistics/statistical-work-areas/bed-availability-and-occupancy/>.
4. **Office for National Statistics.** User guide to mortality statistics. [Online] 2020. [Cited: 01 15, 2021.] <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/methodologies/userguidetomortalitystatisticsjuly2017#cause-of-death-coding>.

Figure S1: Sensitivity Analysis

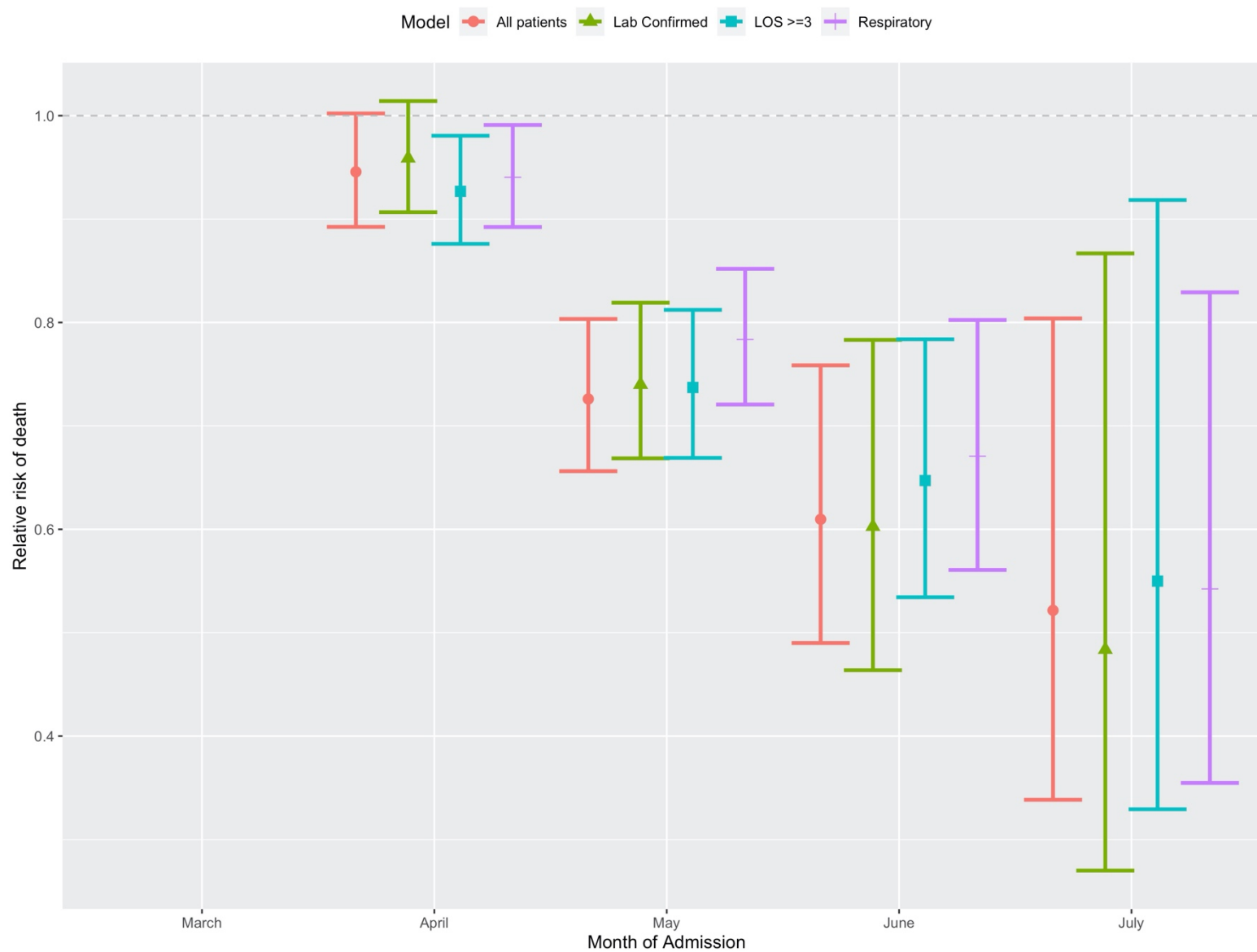


Figure S2: Crude Mortality by Age Group and Month

