Dynamic CO-CIN report to SAGE and NERVTAG (Recent cases)
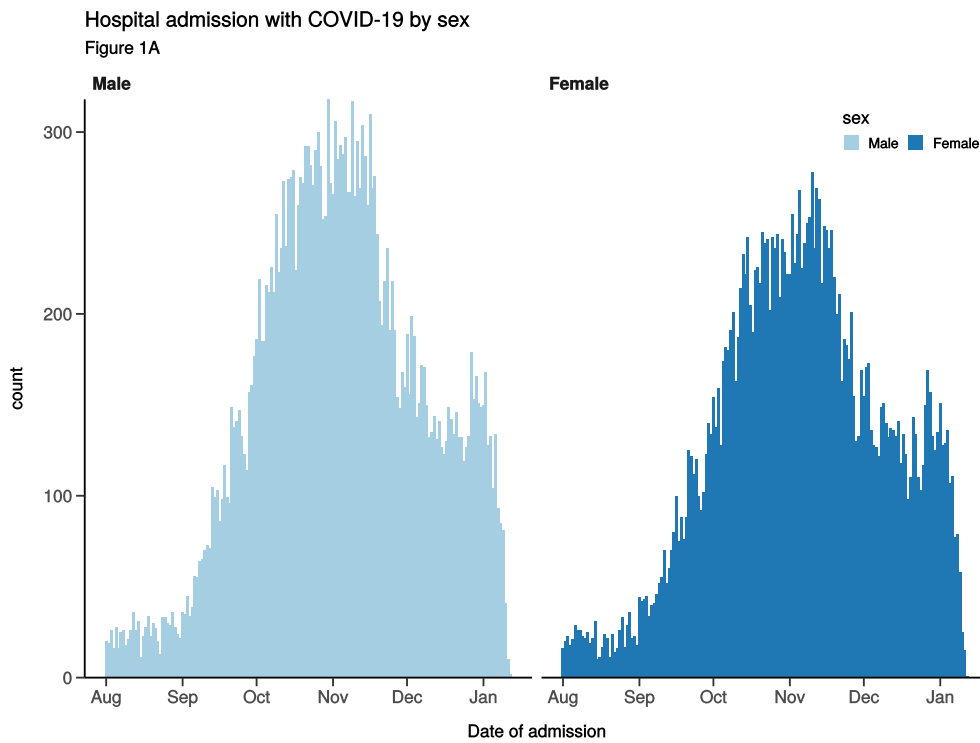
Executive summary

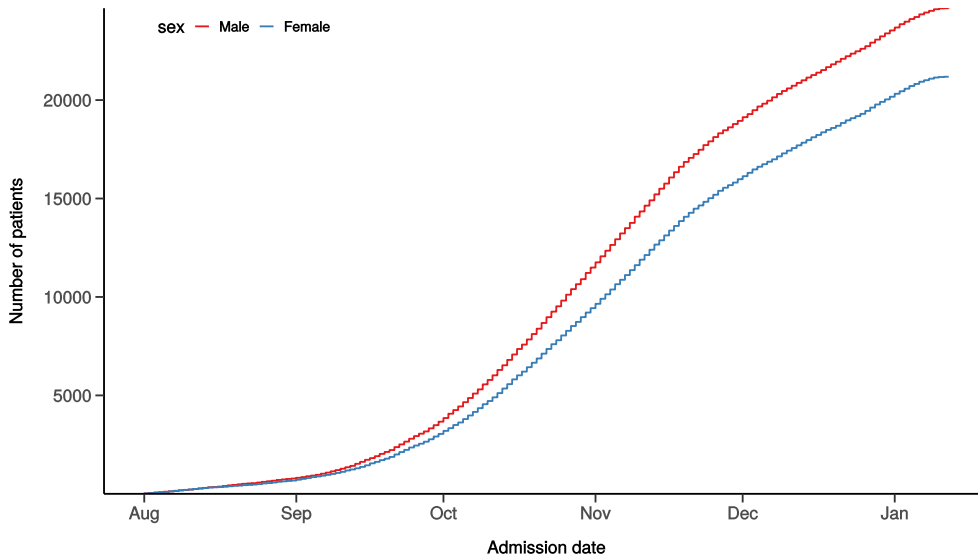### Includes patients admitted after 01 August 2020

There are 46037 patients included in CO-CIN. Of these, 7469 patient(s) have died and 7850 required ICU. 24735 have been discharged home.
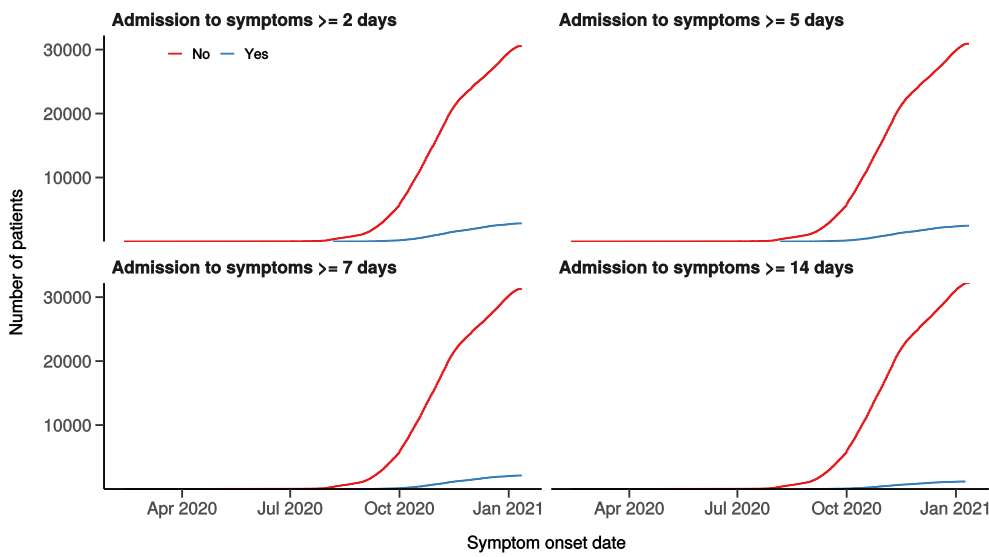
Admission

Figure 1

Hospital admission with COVID-19 by sex
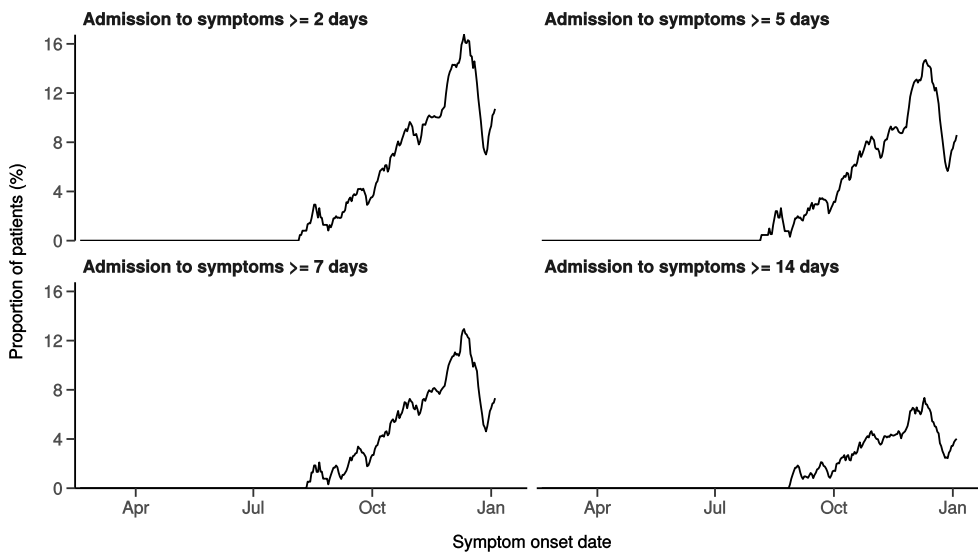Figure 1A

Hospital admission with COVID-19 by sex
Figure 1B

Number with symptom onset occuring after admission to hospital
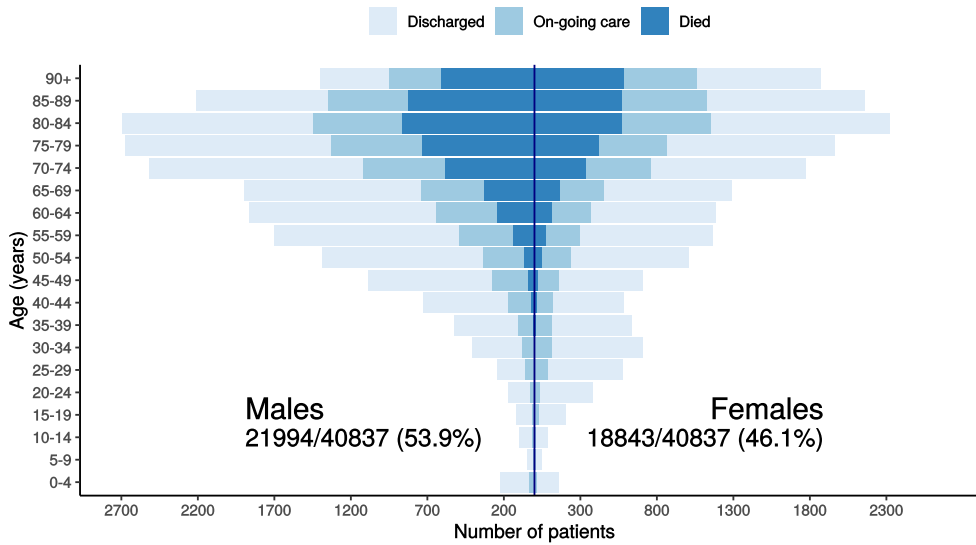Figure 1C

Proportion with symptom onset occuring after hospital admission
Figure 1D - 7-day rolling percentage. n = 33377

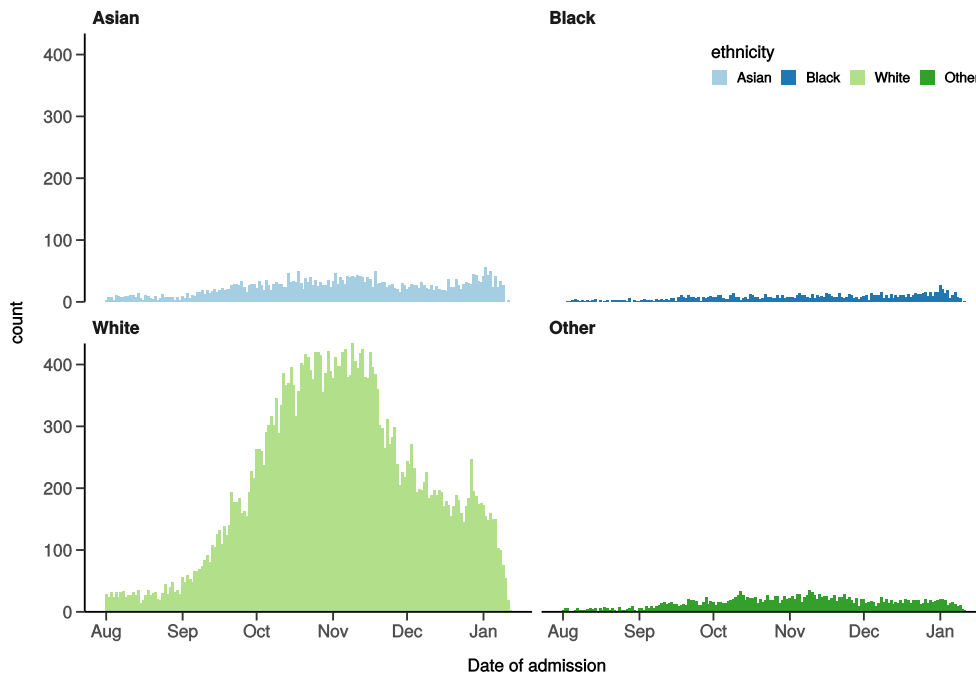## Patients with outcome stratified by age, and sex
Figure 1E

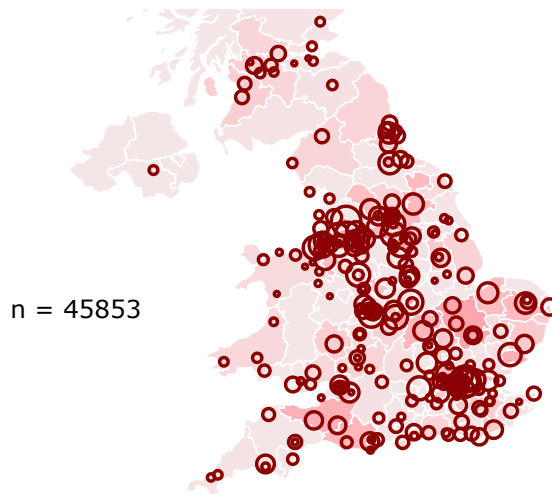
Hospital admission with COVID-19 by ethnicity
Figure 1F

Location by CCG / Healthboard

Figure 2

Click and drag on map to zoom into area. Reset via toolbar at top of map.

n = 45853

Symptoms and comorbidity

Figure 3A

Symptoms on presentation to hospital
% patients, n = 42183

YES NO Unknown

Shortness of breath (Dyspnea)	
Cough	
History of fever	
Fatigue / Malaise	
Asymptomatic	
Altered consciousness / confusion	
Vomiting / Nausea	
Diarrhoea	
Chest pain	
Muscle aches (Myalgia)	
Abdominal pain	
Headache	
Wheezing	
Joint pain (Arthralgia)	
Sore throat	
Bleeding (Haemorrhage)	
Runny nose (Rhinorrhoea)	
Skin ulcers	
Skin rash	
Lower chest wall indrawing	
Lymphadenopathy	
Ear pain	
Conjunctivitis	

Proportion of patients with symptom (%)

Comorbidity
% patients, n = 46037

YES NO Unknown

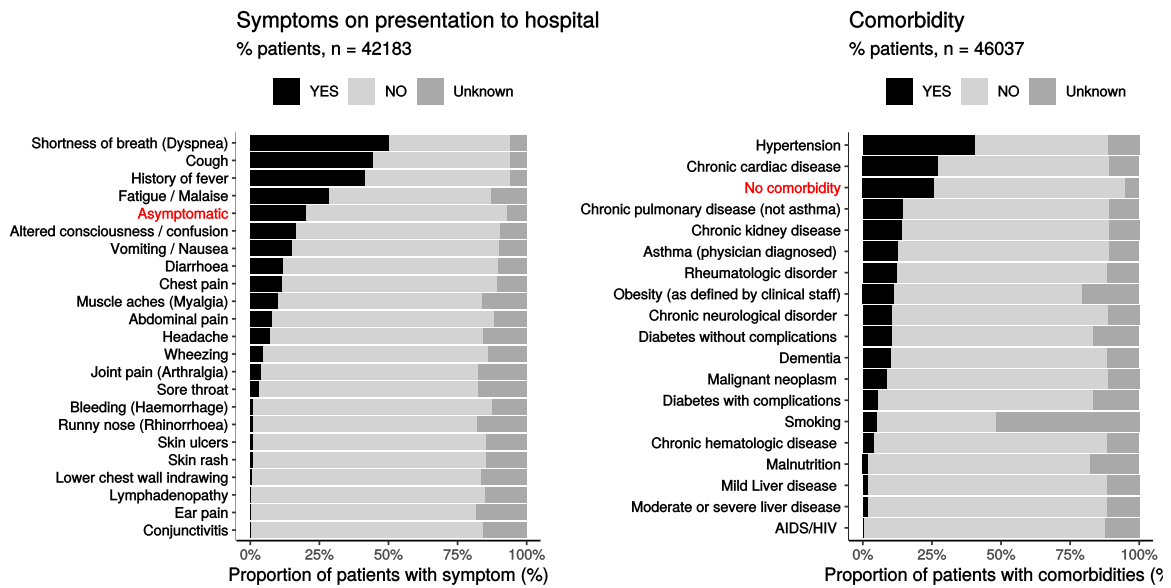|	
Hypertension	
Chronic cardiac disease	
No comorbidity	
Chronic pulmonary disease (not asthma)	
Chronic kidney disease	
Asthma (physician diagnosed)	
Rheumatologic disorder	
Obesity (as defined by clinical staff)	
Chronic neurological disorder	
Diabetes without complications	
Dementia	
Malignant neoplasm	
Diabetes with complications	
Smoking	
Chronic hematologic disease	
Malnutrition	
Mild Liver disease	
Moderate or severe liver disease	
AIDS/HIV	

Proportion of patients with comorbidities (%

Figure 3B - Symptoms by Age

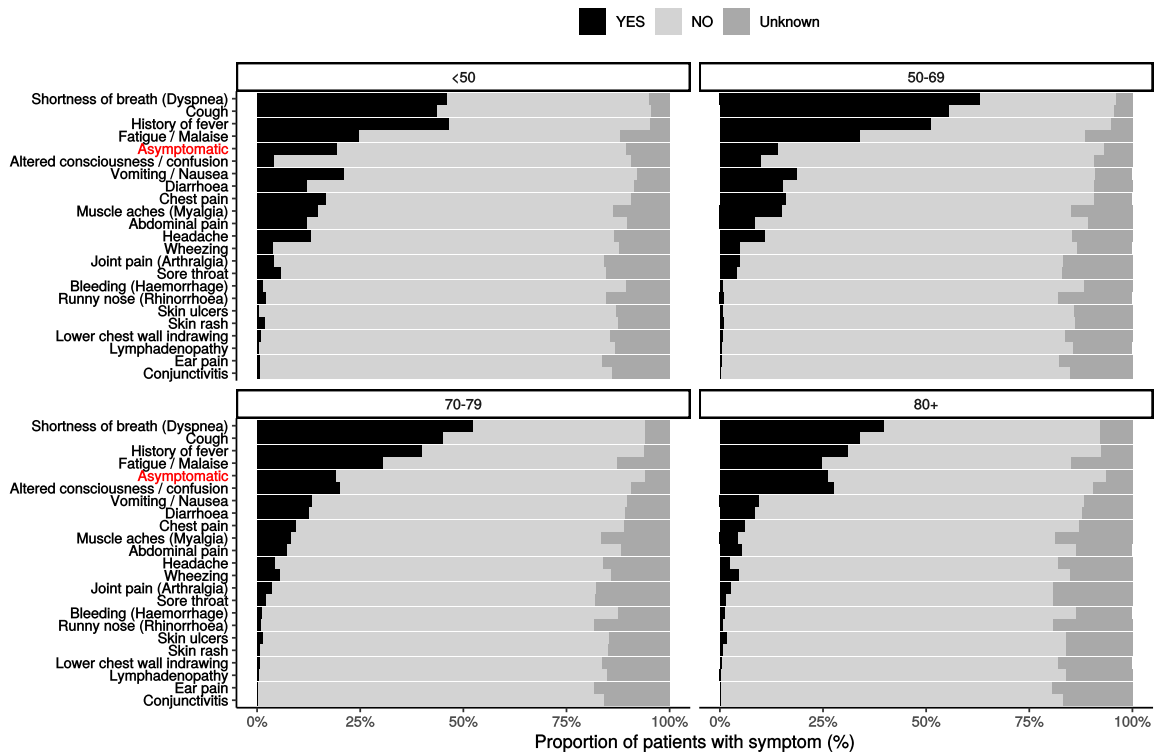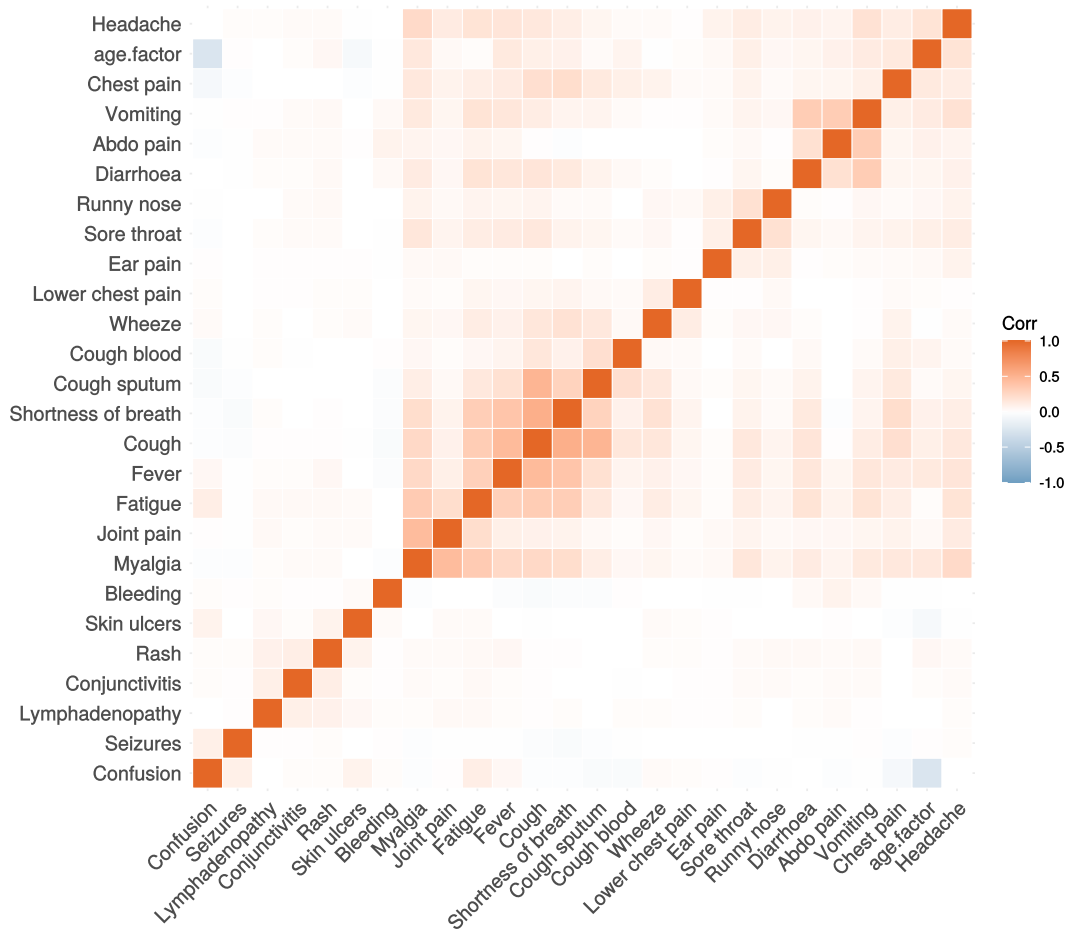Symptoms on presentation to hospital
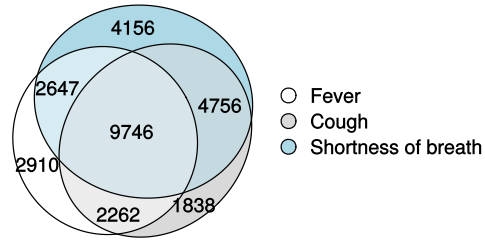Stratifed by age

Figure 3C

Correlation of symptoms in all pages. Note clusters, top right to bottom left, flu-like, coryzal, abdominal, respiratory, neurocutaneous.

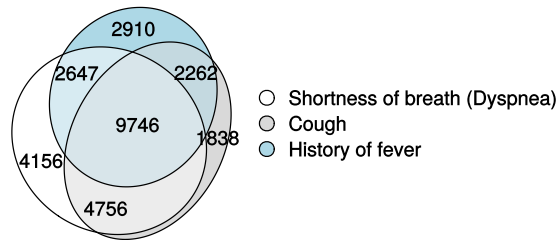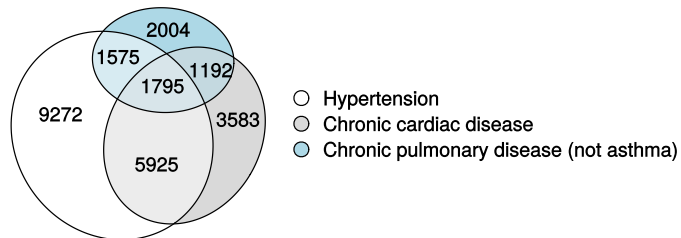## Symptoms (diagnostic criteria)

Figure 4A

n = 42183

	Fever
	Cough
	Shortness of breath

4156, 2647, 4756, 9746, 2910, 2262, 1838

Symptoms (most common)

Figure 4B

n = 42183

	Shortness of breath (Dyspnea)
	Cough
	History of fever

2910, 2647, 2262, 9746, 1838, 4156, 4756

Comorbidity (most common)

Figure 4C

n = 46037

	Hypertension
	Chronic cardiac disease
	Chronic pulmonary disease (not asthma)

2004, 1575, 1192, 1795, 9272, 3583, 5925

Medication prior to illness
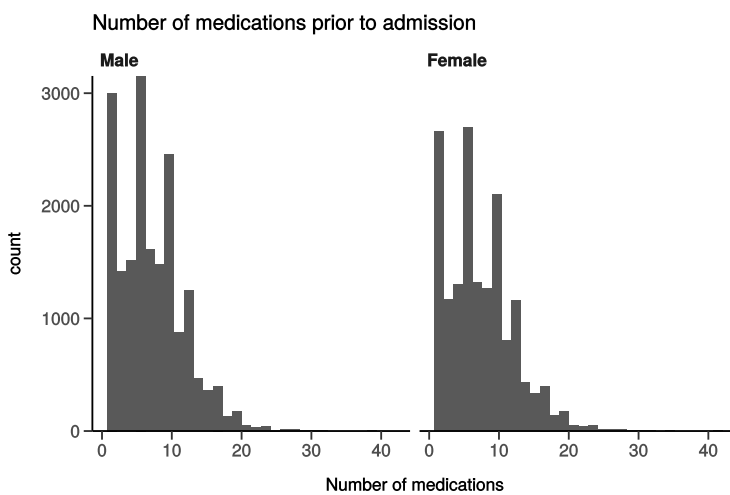
Figure 5

Number of medications prior to admission
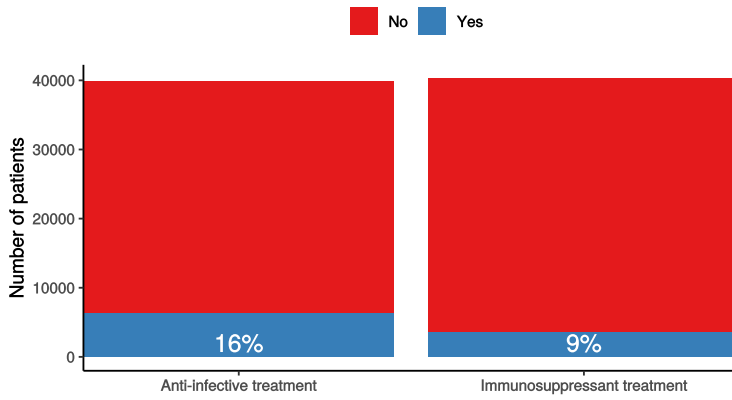
Preadmission treatment

Figure 6

Pre-admission treatment

Anti-infectives for illness episode (left) immunosuppressants including oral (not

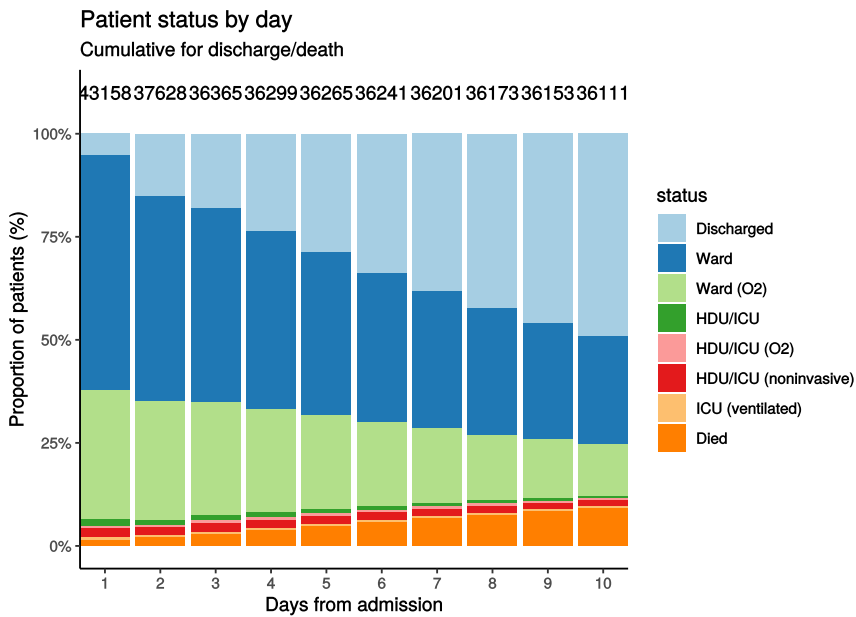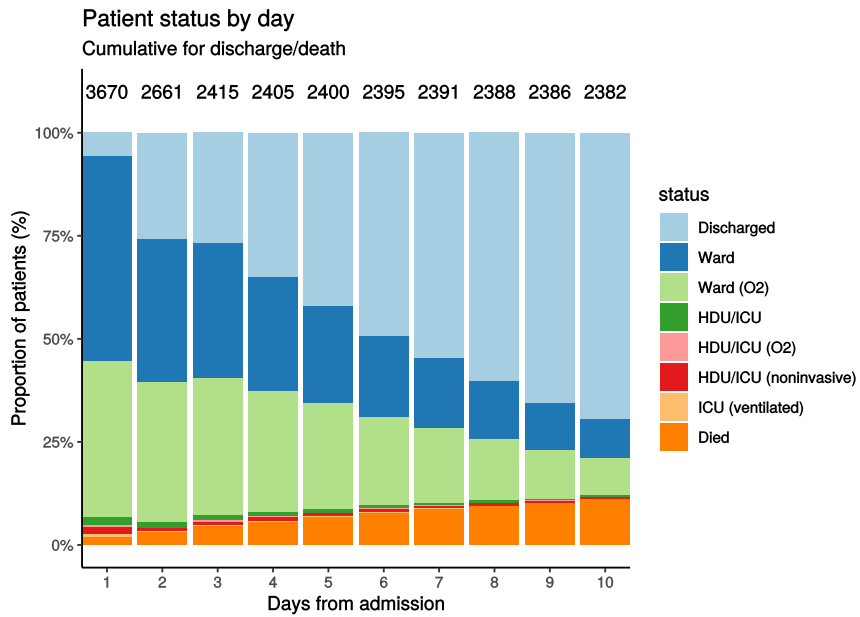# Patient flow

Figure 7A - All patients

N = 43158

Figure 7B - Patients admitted >=14 days and <=28 days ago

N = 3670

Patient status by day
Cumulative for discharge/death

3670 2661 2415 2405 2400 2395 2391 2388 2386 2382

status
- Discharged
- Ward
- Ward (O2)
- HDU/ICU
- HDU/ICU (O2)
- HDU/ICU (noninvasive)
- ICU (ventilated)
- Died

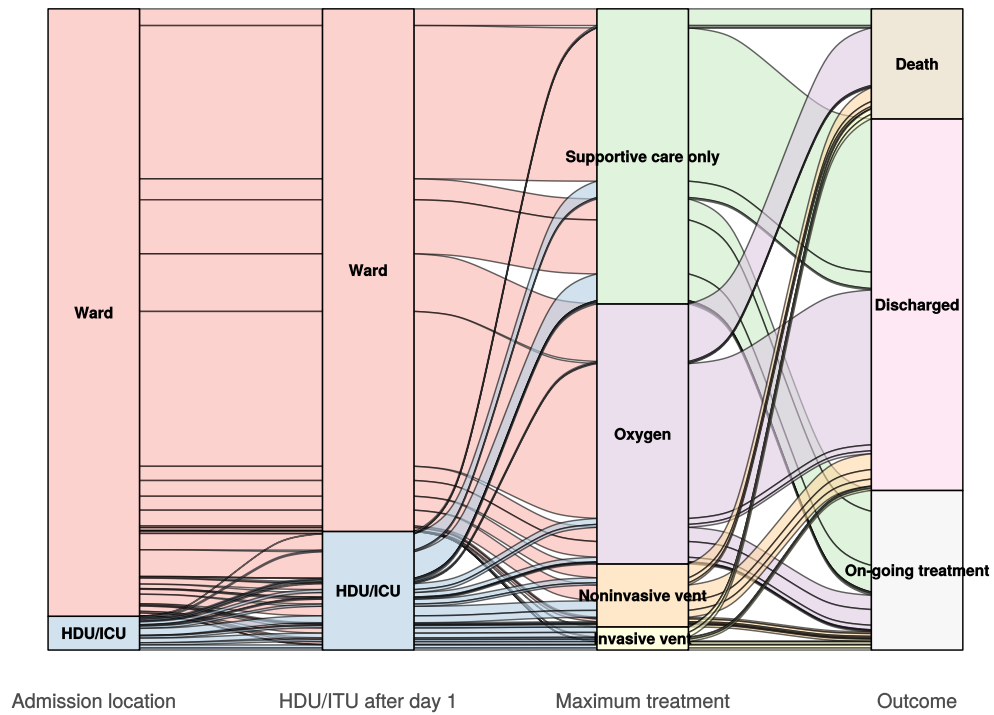# Oxygen requirement

Figure 8A - All patients

N = 41057

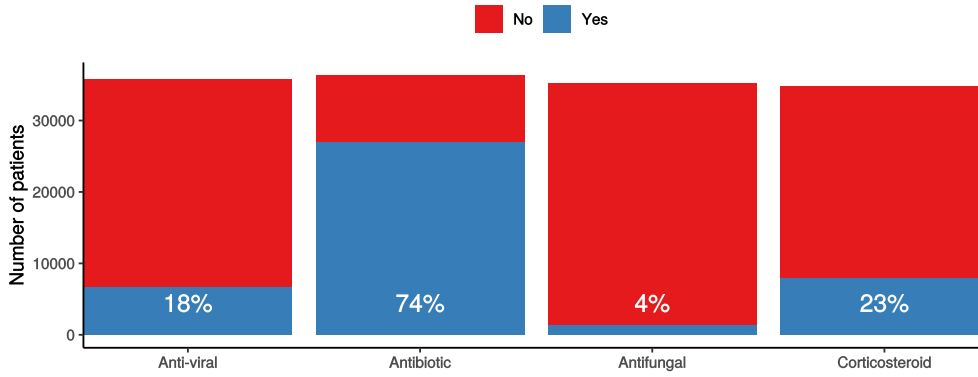## Figure 8B - Patients admitted >=14 days and <=28 days ago

N = 3434

In-hospital medical treatment

Figure 9

In-hospital treatment

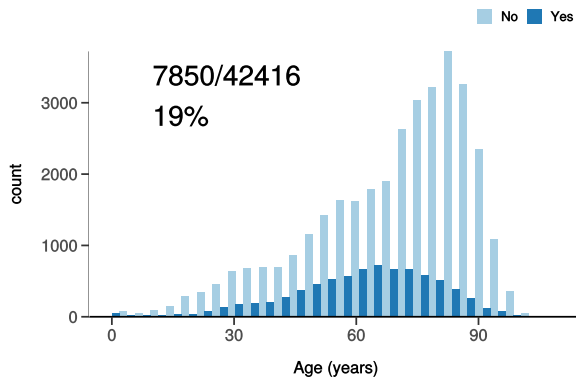Anti-virals, antibiotics, corticosteroids,
and anti-fungals for patients who have completed journey.

Treatment

Figure 10

ICU/HDU admission
Figure 10A

7850/42416
19%

High flow oxygen
Figure 10B

26131/41576
63%

Noninvasive ventilation
Figure 10C

5196/41264
13%
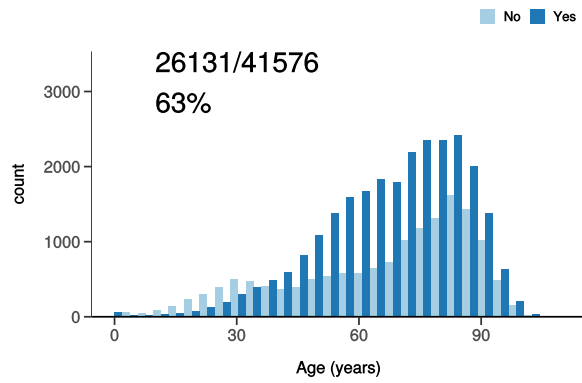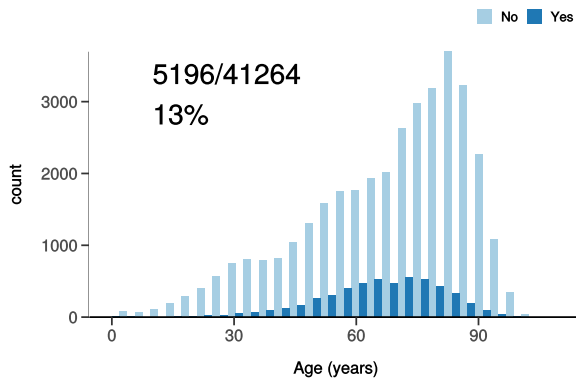
Invasive ventilation
Figure 10D

1525/41345
4%
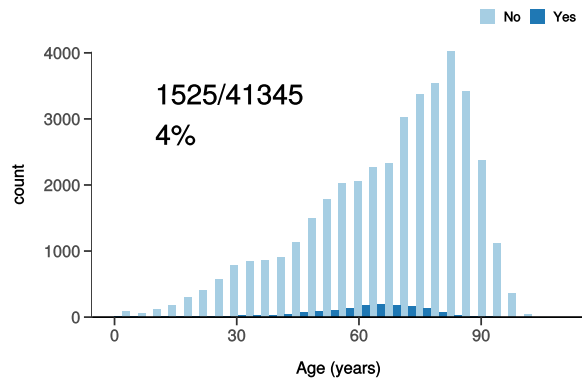
Status in patients admitted >=14 days from today

Figure 11

All: status in patients admitted >=14 days ago
Figure 11A

Died
7389/39233
19%

On-going care
7523/39233
19%

Discharged alive
24256/39233
62%
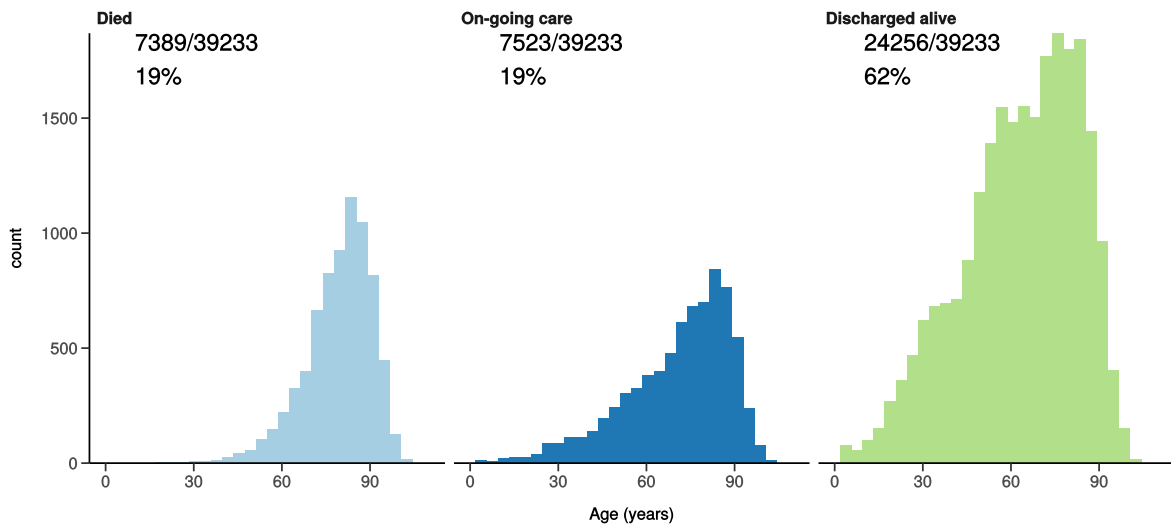
ICU/HDU admissions: status in patients admitted >=14 days ago
Figure 11B

Died
1393/6499
21%

On-going care
2258/6499
35%

Discharged alive
2845/6499
44%
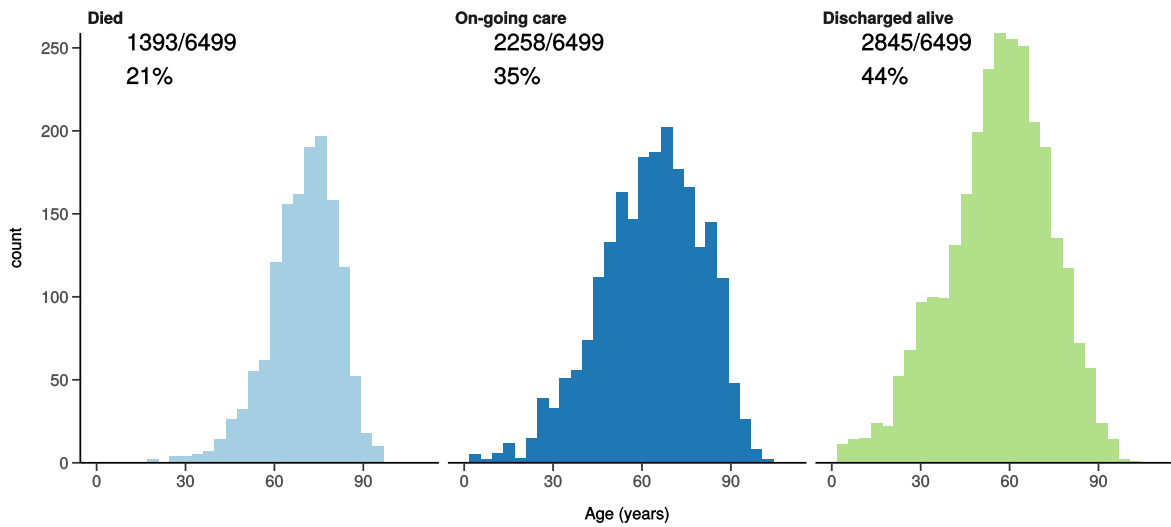
Invasive ventilation: status in patients admitted >=14 days ago
Figure 11c

Died
651/1438
45%

On-going care
499/1438
35%

Discharged alive
287/1438
20%
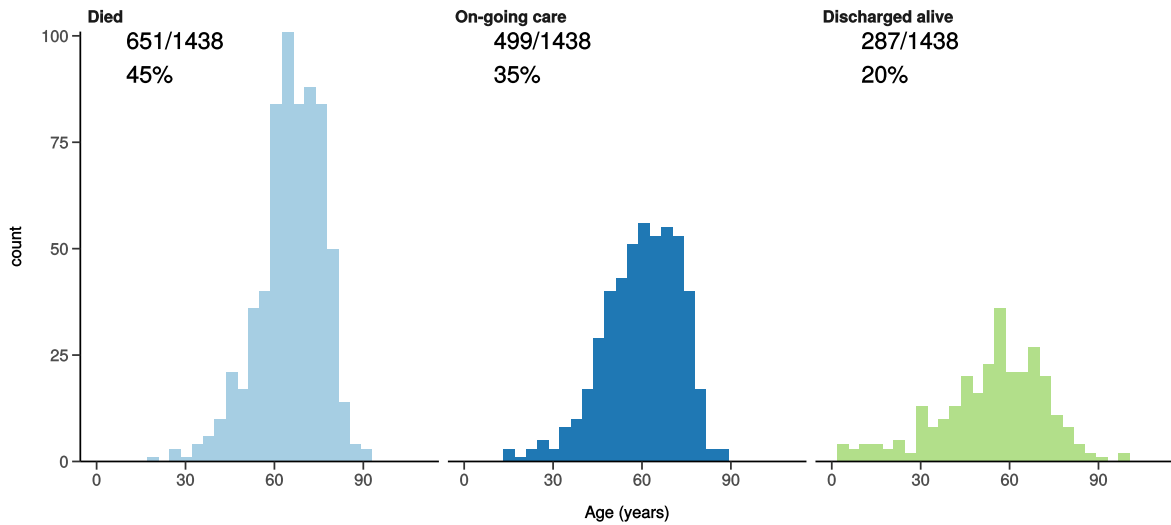
Length of stay stratified by age
Figure 12

Length of stay stratified by age and mortality
Proportion who reach outcome by day 14 shown
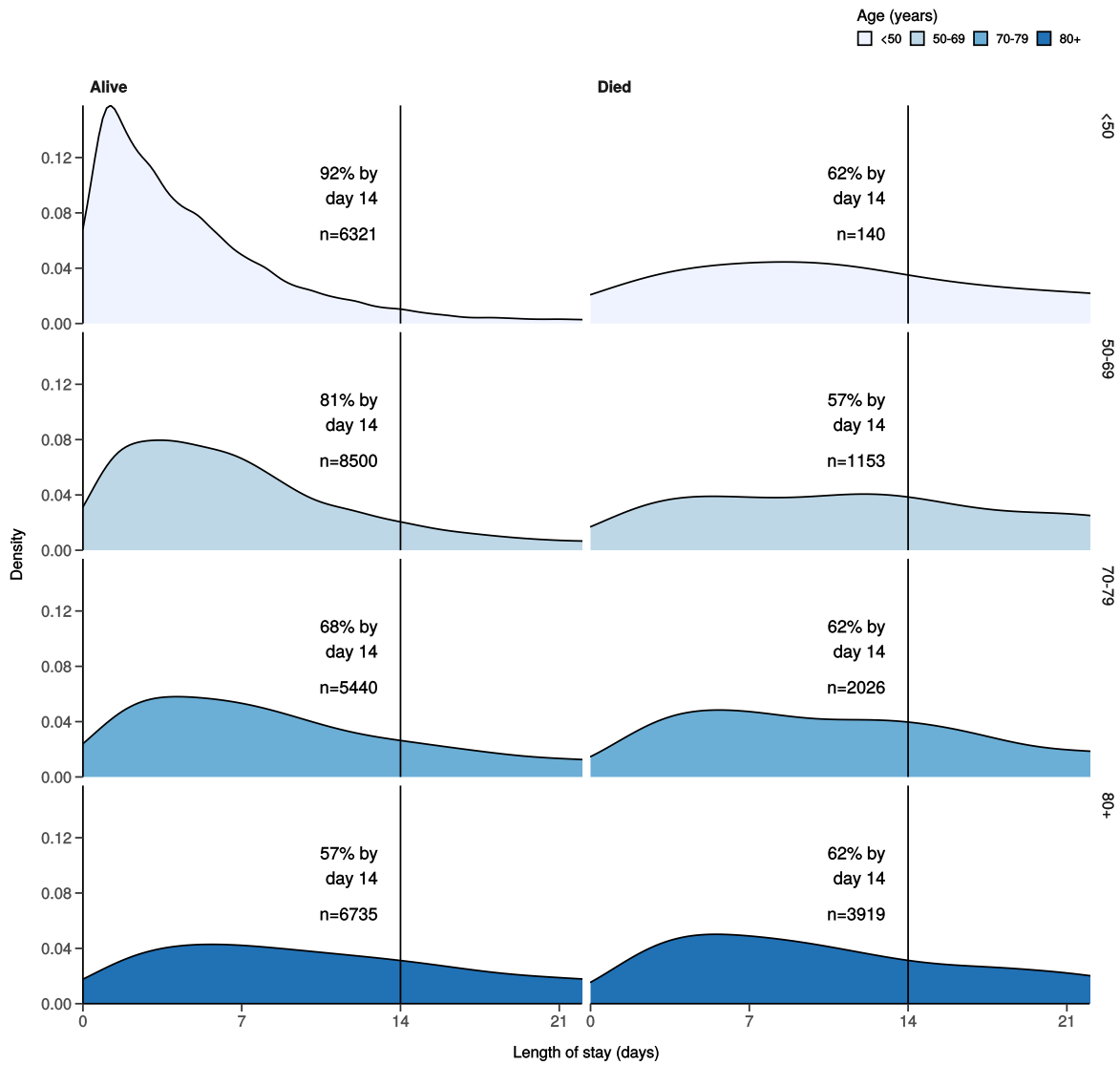
Predictors of death: logistic regression multivariable model

Logistic regression model only includes patients admitted >14 days ago from today.

Dependent: death		No	Yes	OR (univariable)	OR (multivariable)
Age on admission (years)	<50	6661 (97.9)	146 (2.1)	•	•
	50-69	8893 (88.3)	1180 (11.7)	6.05 (5.10-7.24, p<0.001)	5.14 (4.25-6.28, p<0.001)
	70-79	5821 (73.9)	2053 (26.1)	16.09 (13.61-19.18, p<0.001)	11.94 (9.88-14.57, p<0.001)
	80+	7181 (64.3)	3988 (35.7)	25.34 (21.49-30.11, p<0.001)	18.23 (15.10-22.21, p<0.001)
Sex at Birth	Male	14886 (77.0)	4452 (23.0)	•	•
	Female	13680 (82.4)	2920 (17.6)	0.71 (0.68-0.75, p<0.001)	0.66 (0.62-0.71, p<0.001)
	Not specified	0 (NaN)	0 (NaN)	•	•
Chronic cardiac disease	NO	19908 (84.4)	3667 (15.6)	•	•

Dependent: death		No	Yes	OR (univariable)	OR (multivariable)
	YES	7070 (68.8)	3207 (31.2)	2.46 (2.33-2.60, p<0.001)	1.22 (1.14-1.31, p<0.001)
Chronic pulmonary disease (not asthma)	NO	23354 (82.0)	5123 (18.0)	•	•
	YES	3637 (67.3)	1771 (32.7)	2.22 (2.08-2.37, p<0.001)	1.54 (1.43-1.67, p<0.001)
Chronic neurological disorder	NO	24058 (80.6)	5804 (19.4)	•	•
	YES	2818 (73.4)	1019 (26.6)	1.50 (1.39-1.62, p<0.001)	1.05 (0.95-1.15, p=0.322)
Chronic hematologic disease	NO	25722 (80.0)	6423 (20.0)	•	•
	YES	1104 (73.7)	393 (26.3)	1.43 (1.27-1.60, p<0.001)	0.92 (0.79-1.05, p=0.224)
Chronic kidney disease	NO	23478 (82.2)	5085 (17.8)	•	•
	YES	3466 (66.1)	1780 (33.9)	2.37 (2.22-2.53, p<0.001)	1.34 (1.24-1.46, p<0.001)
Dementia	NO	24474 (81.9)	5422 (18.1)	•	•
	YES	2370 (64.0)	1335 (36.0)	2.54 (2.36-2.74, p<0.001)	1.37 (1.25-1.50, p<0.001)
Obesity (as defined by clinical staff)	NO	20567 (79.6)	5266 (20.4)	•	•
	YES	3653 (83.8)	704 (16.2)	0.75 (0.69-0.82, p<0.001)	1.02 (0.93-1.13, p=0.643)
Malignant neoplasm	NO	24723 (81.3)	5691 (18.7)	•	•
	YES	2134 (65.1)	1144 (34.9)	2.33 (2.15-2.52, p<0.001)	1.64 (1.50-1.80, p<0.001)

Number in dataframe = 43421, Number in model = 28952, Missing = 14469, AIC = 24493.7, C-statistic = 0.758, H&L = Chi-sq(8) 52.53 (p<0.001)

Figure 13 - Adjusted odds ratio plot

| Death			
Age on admission (years)	<50	-	
	50-69	5.14 (4.25-6.28, p<0.001)	
	70-79	11.94 (9.88-14.57, p<0.001)	
	80+	18.23 (15.10-22.21, p<0.001)	
Sex at Birth	Male	-	
	Female	0.66 (0.62-0.71, p<0.001)	
	Not specified	-	
Chronic cardiac disease	YES	1.22 (1.14-1.31, p<0.001)	
Chronic pulmonary disease (not asthma)	YES	1.54 (1.43-1.67, p<0.001)	
Chronic neurological disorder	YES	1.05 (0.95-1.15, p=0.322)	
Chronic hematologic disease	YES	0.92 (0.79-1.05, p=0.224)	
Chronic kidney disease	YES	1.34 (1.24-1.46, p<0.001)	
Dementia	YES	1.37 (1.25-1.50, p<0.001)	
Obesity (as defined by clinical staff)	YES	1.02 (0.93-1.13, p=0.643)	
Malignant neoplasm	YES	1.64 (1.50-1.80, p<0.001)	

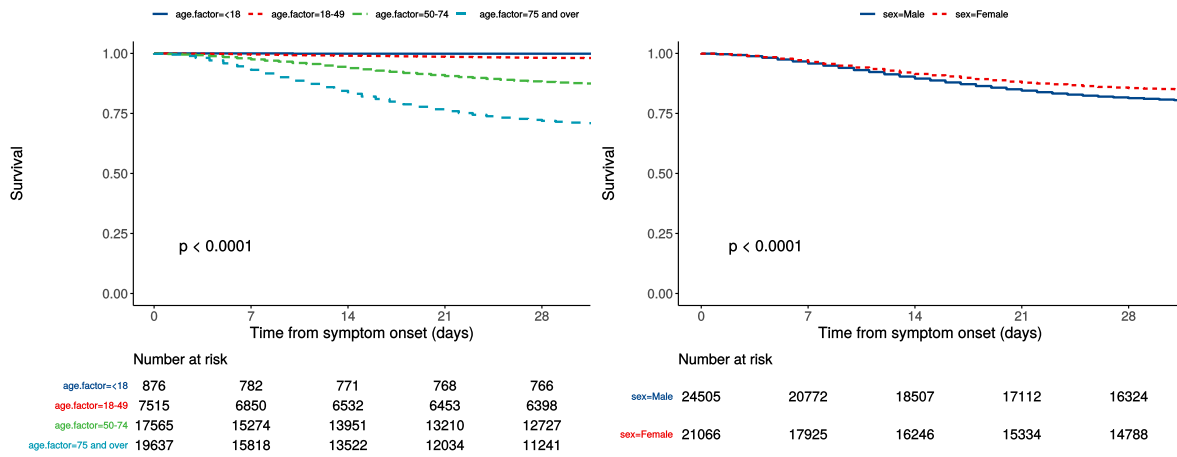Odds ratio (95% CI, log scale)
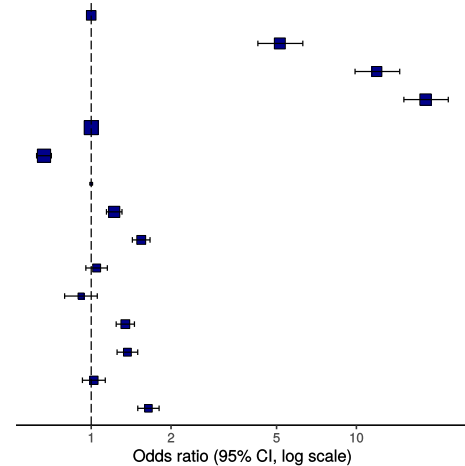
Figure 14 - ROC
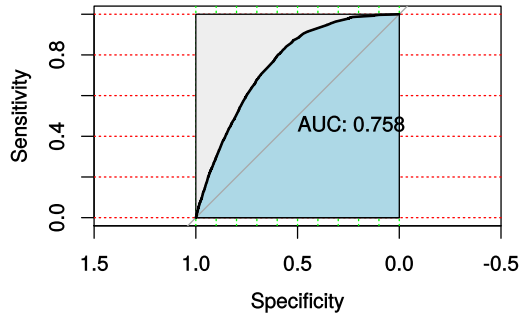
Survival models

Kaplan-Meier plots for survival from symptom onset stratified by age (left) and sex (right)

Figure 15

P-value is log-rank test.

Cox proportional hazards model

The methodology for this is now up and running, but models are still being explored. **What is presented here is not a final model, but to demonstrate methodology**. The results are correct, but important variables have not yet been included.

Time from symptom onset.

Dependent: Surv(time, status)		all	HR (univariable)	HR (multivariable)
Age on admission (years)	<50	8403 (18.4)	•	•
	50-69	12755 (28.0)	5.78 (4.87-6.87, p<0.001)	4.78 (3.90-5.86, p<0.001)
	70-79	10103 (22.1)	14.26 (12.06-16.87, p<0.001)	11.39 (9.33-13.91, p<0.001)
	80+	14352 (31.5)	21.17 (17.95-24.97, p<0.001)	16.82 (13.78-20.53, p<0.001)
Sex at Birth	Male	24517 (53.8)	•	•
	Female	21066 (46.2)	0.74 (0.71-0.78, p<0.001)	0.73 (0.69-0.77, p<0.001)
qSOFA score on admission	0	19196 (51.9)	•	•
	1	15307 (41.4)	1.69 (1.60-1.78, p<0.001)	1.86 (1.75-1.98, p<0.001)
	2	2330 (6.3)	3.42 (3.16-3.70, p<0.001)	3.13 (2.86-3.42, p<0.001)
	3	139 (0.4)	5.99 (4.73-7.58, p<0.001)	5.42 (4.16-7.06, p<0.001)
Symptomatic at presentation	No symptoms	7968 (18.8)	•	•

Dependent: Surv(time, status)		all	HR (univariable)	HR (multivariable)
	Symptoms	34435 (81.2)	1.64 (1.53-1.76, p<0.001)	•
Chronic cardiac disease	NO	28446 (69.6)	•	•
	YES	12421 (30.4)	2.24 (2.14-2.35, p<0.001)	1.21 (1.14-1.28, p<0.001)
Chronic kidney disease	NO	34473 (84.5)	•	•
	YES	6344 (15.5)	2.14 (2.03-2.26, p<0.001)	1.27 (1.19-1.36, p<0.001)
Moderate or severe liver disease	NO	39727 (98.1)	•	•
	YES	786 (1.9)	1.60 (1.39-1.84, p<0.001)	1.62 (1.36-1.92, p<0.001)
Chronic neurological disorder	NO	35928 (88.4)	•	•
	YES	4734 (11.6)	1.41 (1.32-1.50, p<0.001)	•
Malignant neoplasm	NO	36726 (90.3)	•	•
	YES	3926 (9.7)	2.09 (1.97-2.23, p<0.001)	1.52 (1.41-1.64, p<0.001)
Chronic hematologic disease	NO	38760 (95.5)	•	•
	YES	1806 (4.5)	1.34 (1.21-1.48, p<0.001)	•
Obesity (as defined by clinical staff)	NO	31219 (85.8)	•	•
	YES	5159 (14.2)	0.78 (0.72-0.84, p<0.001)	1.02 (0.94-1.12, p=0.614)
Diabetes without complications	NO	33504 (87.6)	•	•
	YES	4739 (12.4)	1.18 (1.10-1.27, p<0.001)	•
Rheumatologic disorder	NO	34971 (86.2)	•	•
	YES	5578 (13.8)	1.17 (1.10-1.25, p<0.001)	•
Dementia	NO	36055 (88.8)	•	•
	YES	4532 (11.2)	2.30 (2.17-2.44, p<0.001)	1.19 (1.11-1.29, p<0.001)
Malnutrition	NO	36823 (97.7)	•	•
	YES	873 (2.3)	1.88 (1.66-2.14, p<0.001)	•
smoking_mhyn_2levels	NO	19678 (46.5)	•	•
	YES	2321 (5.5)	0.91 (0.82-1.02, p=0.114)	•
	N/K	20318 (48.0)	1.18 (1.13-1.24, p<0.001)	•

Number in dataframe = 45761, Number in model = 30420, Missing = 15341, Number of events = 5114, Concordance = 0.758 (SE = 0.003), R-squared = 0.136(Max possible = 0.967), Likelihood ratio test = 4429.636 (df = 13, p = 0.000)

Figure 16a - Multivariable Cox proportional hazards model

Survival: HR (95% CI, p-value)

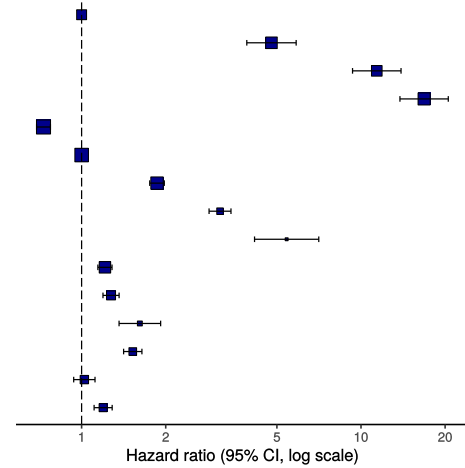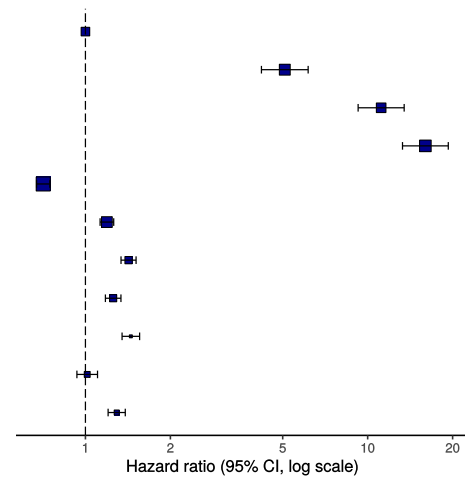|		HR (95% CI, p-value)
Age on admission (years)	<50	-
	50-69	4.78 (3.90-5.86, p<0.001)
	70-79	11.39 (9.33-13.91, p<0.001)
	80+	16.82 (13.78-20.53, p<0.001)
Sex at Birth	Female	0.73 (0.69-0.77, p<0.001)
qSOFA score on admission	0	-
	1	1.86 (1.75-1.98, p<0.001)
	2	3.13 (2.86-3.42, p<0.001)
	3	5.42 (4.16-7.06, p<0.001)
Chronic cardiac disease	YES	1.21 (1.14-1.28, p<0.001)
Chronic kidney disease	YES	1.27 (1.19-1.36, p<0.001)
Moderate or severe liver disease	YES	1.62 (1.36-1.92, p<0.001)
Malignant neoplasm	YES	1.52 (1.41-1.64, p<0.001)
Obesity (as defined by clinical staff)	YES	1.02 (0.94-1.12, p=0.614)
Dementia	YES	1.19 (1.11-1.29, p<0.001)

Hazard ratio (95% CI, log scale)

Figure 16b - Multivariable Cox proportional hazards model (age, sex, comorbidities only)

Survival: HR (95% CI, p-value)

		HR (95% CI, p-value)
Age on admission (years)	<50	-
	50-69	5.09 (4.20-6.15, p<0.001)
	70-79	11.16 (9.25-13.47, p<0.001)
	80+	16.02 (13.29-19.30, p<0.001)
Sex at Birth	Female	0.71 (0.67-0.75, p<0.001)
Chronic cardiac disease	YES	1.19 (1.13-1.26, p<0.001)
Chronic pulmonary disease (not asthma)	YES	1.42 (1.34-1.51, p<0.001)
Chronic kidney disease	YES	1.25 (1.18-1.34, p<0.001)
Malignant neoplasm	YES	1.45 (1.35-1.56, p<0.001)
Obesity (as defined by clinical staff)	YES	1.01 (0.93-1.10, p=0.734)
Dementia	YES	1.29 (1.20-1.38, p<0.001)

Hazard ratio (95% CI, log scale)

ROC = 0.7595874

Figure 17 - Predictions calibration plot

Black: observed Gray: ideal
Blue : optimism corrected

Predicted 7 Day Survival $_{B=40}$ based on observed-predicted
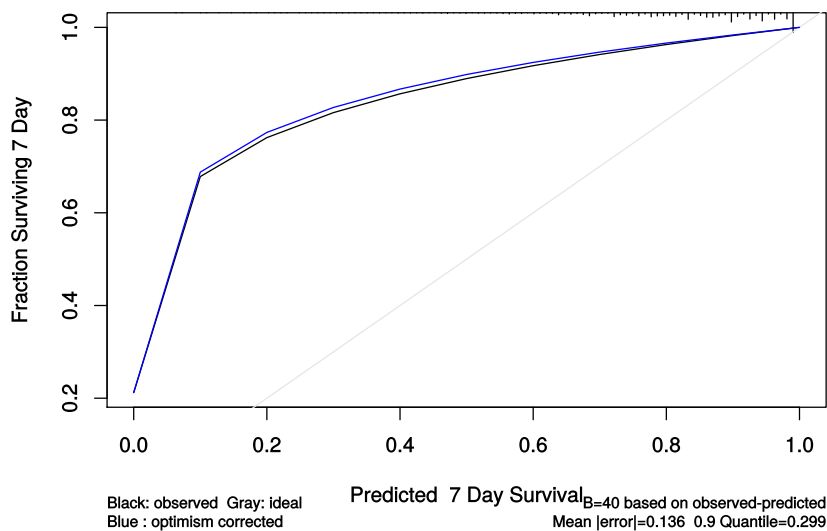Mean |error|=0.136 0.9 Quantile=0.299

Figure 18 - Prognostic model predictions

Again, for demonstration of methods.

Prognostic model for survival 7 days after onset

qSOFA score on admission

Adjusted to:sex=Male chrincard=NO chronicpul_mhyn=NO malignantneo_mhyn=NO obesity_mhyn=NO dementia_mhyn=NO
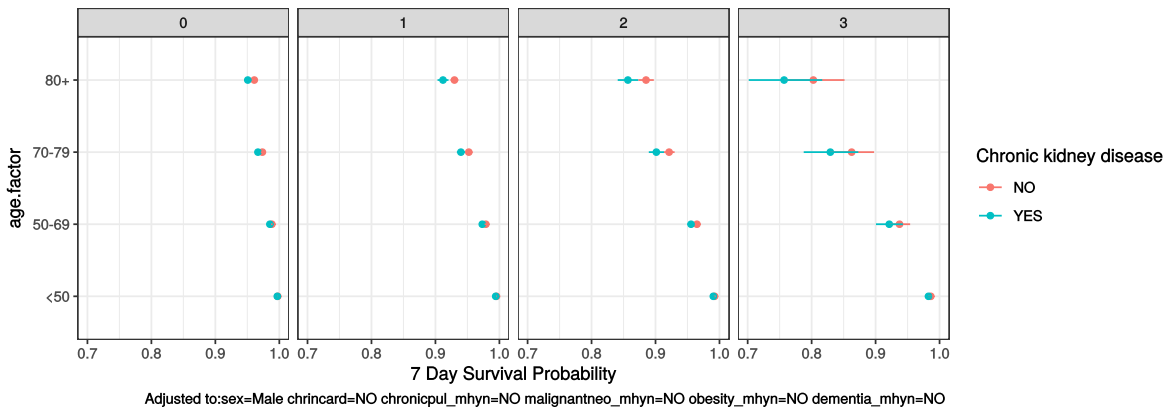
Figure 19 - Death by severity (NEWS) on admission

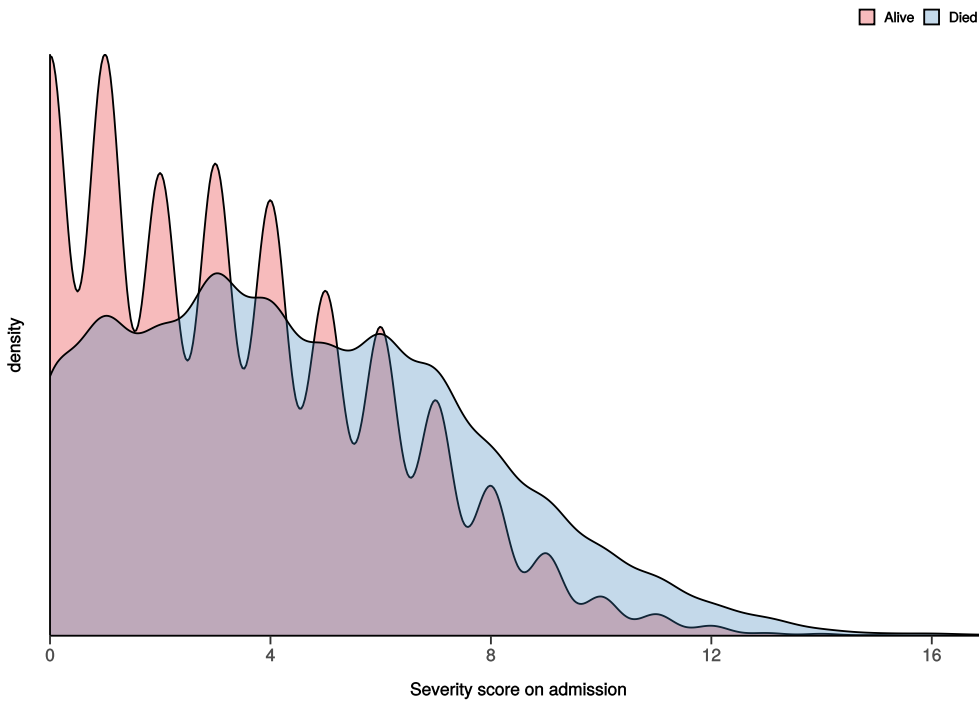Number of deaths by NEWS score at admission

Figure 20 - Death by severity (NEWS) on admission stratified by age

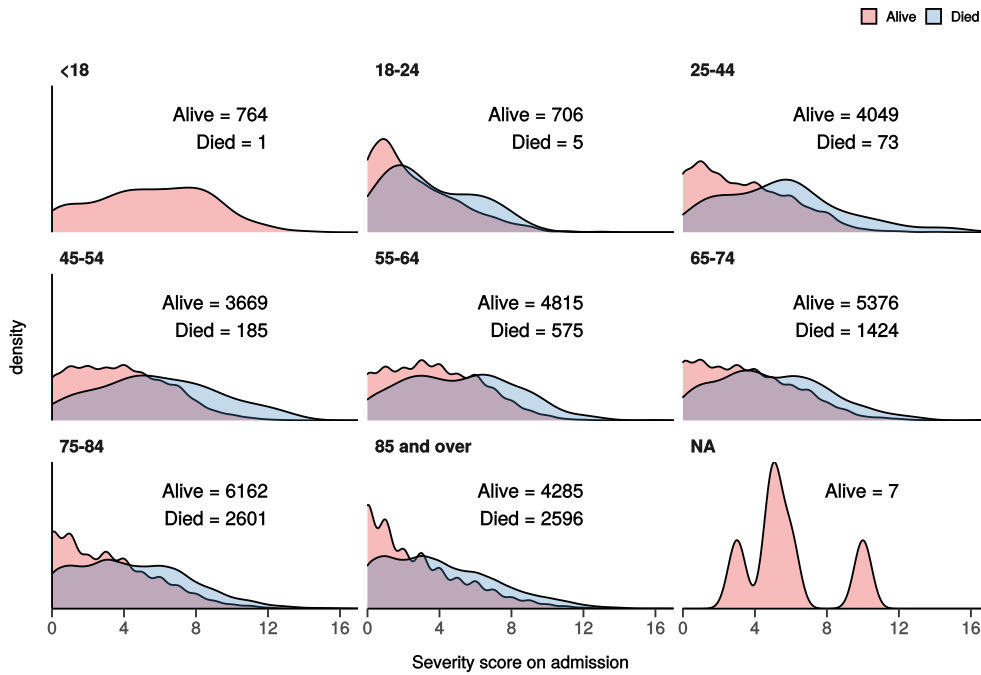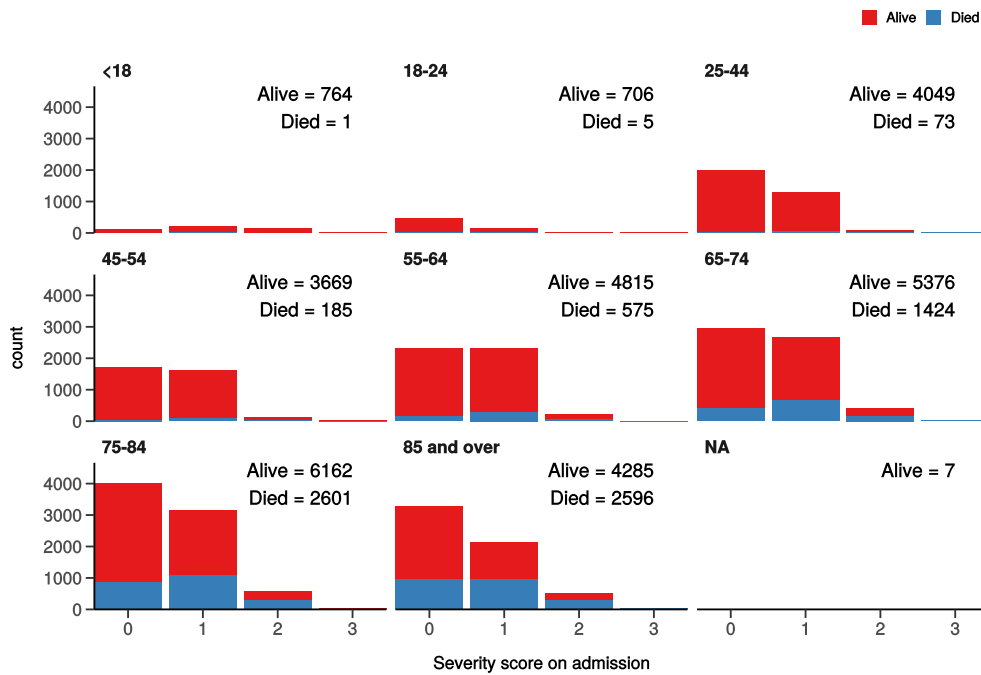Number of deaths by NEWS score at admission
Stratified by age

Figure 21 - Death by severity (qSOFA) on admission stratified by age

Number of deaths by qSOFA score at admission
Stratified by age

Healthcare workers

Employed as a healthcare worker?		NO	YES	p
Total N (%)		35591 (97.6)	880 (2.4)	
NEWS score on admission	Median (IQR)	3.0 (4.0)	3.0 (5.0)	0.002
Death	No	22193 (76.9)	720 (95.7)	<0.001
	Yes	6678 (23.1)	32 (4.3)	