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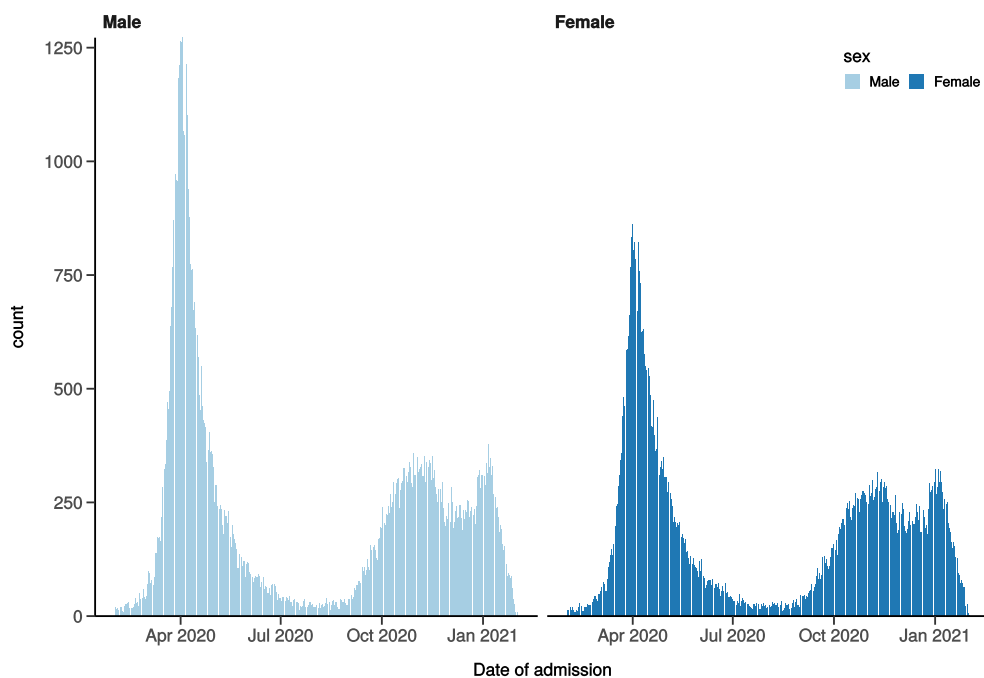
Executive summary

Includes all patients

There are 174128 patients included in CO-CIN. Of these, 35549 patient(s) have died and 22016 required ICU. 81582 have been discharged home.
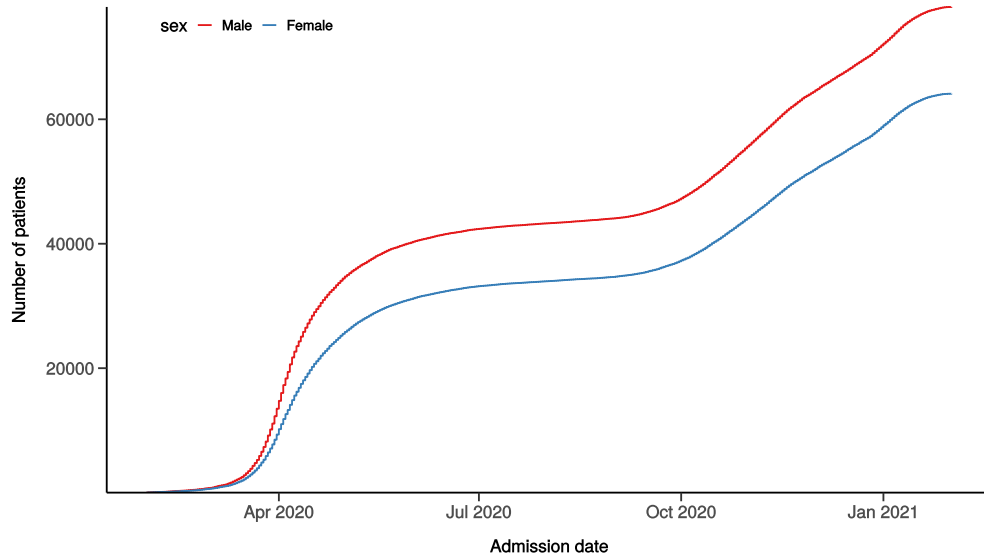
Admission

Figure 1
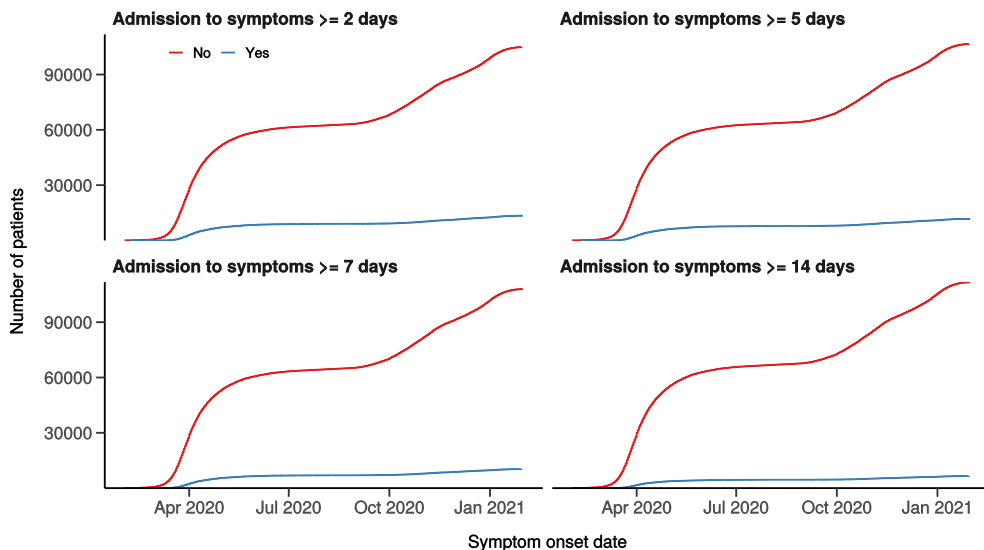
Hospital admission with COVID-19 by sex
Figure 1A

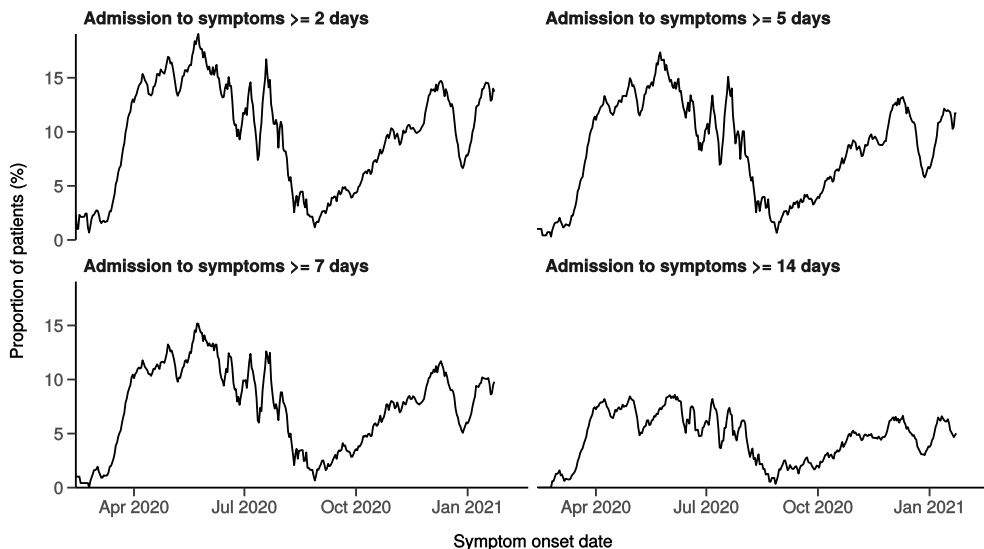Hospital admission with COVID-19 by sex
Figure 1B

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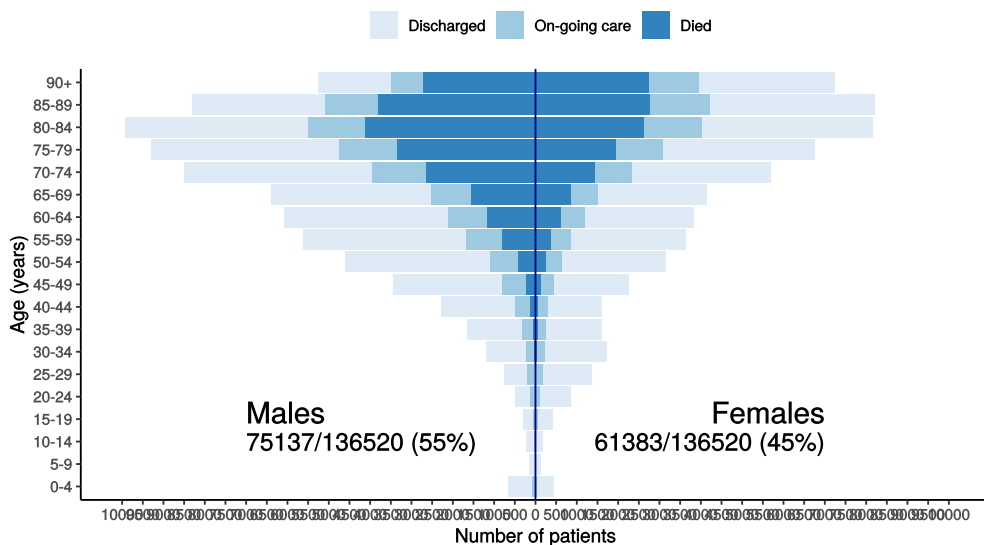Figure 1C

Admission to symptoms >= 2 days

— No — Yes

Admission to symptoms >= 5 days

Admission to symptoms >= 7 days

Admission to symptoms >= 14 days

Number of patients

Symptom onset date

Proportion with symptom onset occuring after hospital admission
Figure 1D - 7-day rolling percentage. n = 118342

Admission to symptoms >= 2 days

Admission to symptoms >= 5 days

Admission to symptoms >= 7 days

Admission to symptoms >= 14 days

Proportion of patients (%)

Symptom onset date

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

Discharged   On-going care   Died

Age (years)

Males
75137/136520 (55%)

Females
61383/136520 (45%)

Number of patients

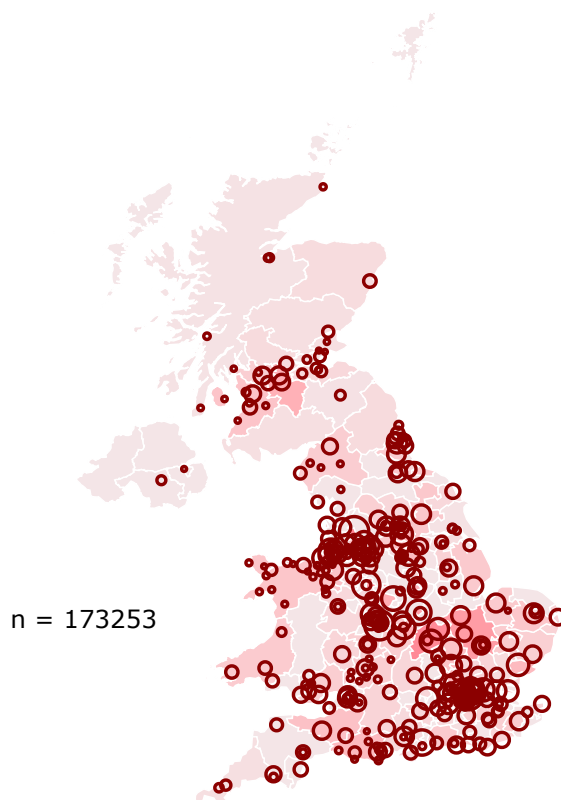Hospital admission with COVID-19 by ethnicity

Figure 1F
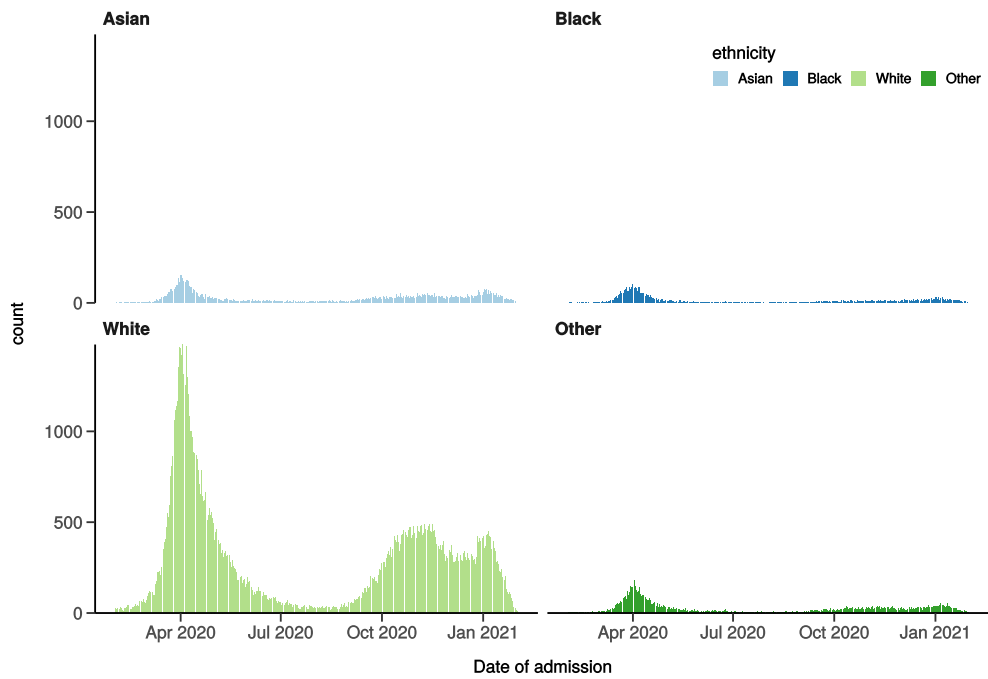
Location by CCG / Healthboard

Figure 2

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

Symptoms and comorbidity

Figure 3A

Symptoms on presentation to hospital
% patients, n = 136000

Comorbidity
% patients, n = 174128
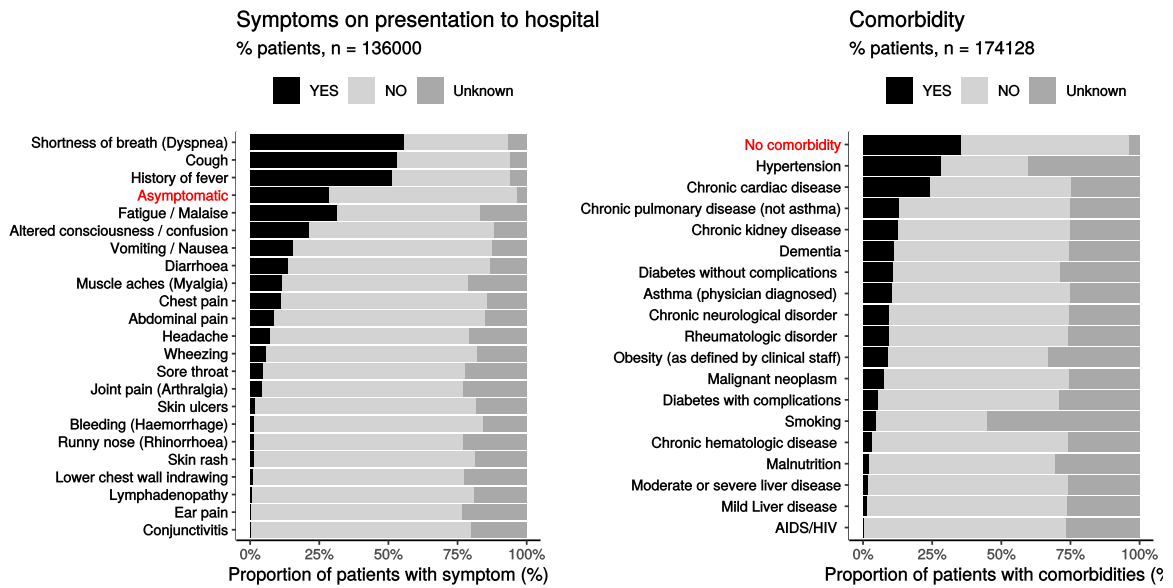
Figure 3B - Symptoms by Age

Symptoms on presentation to hospital
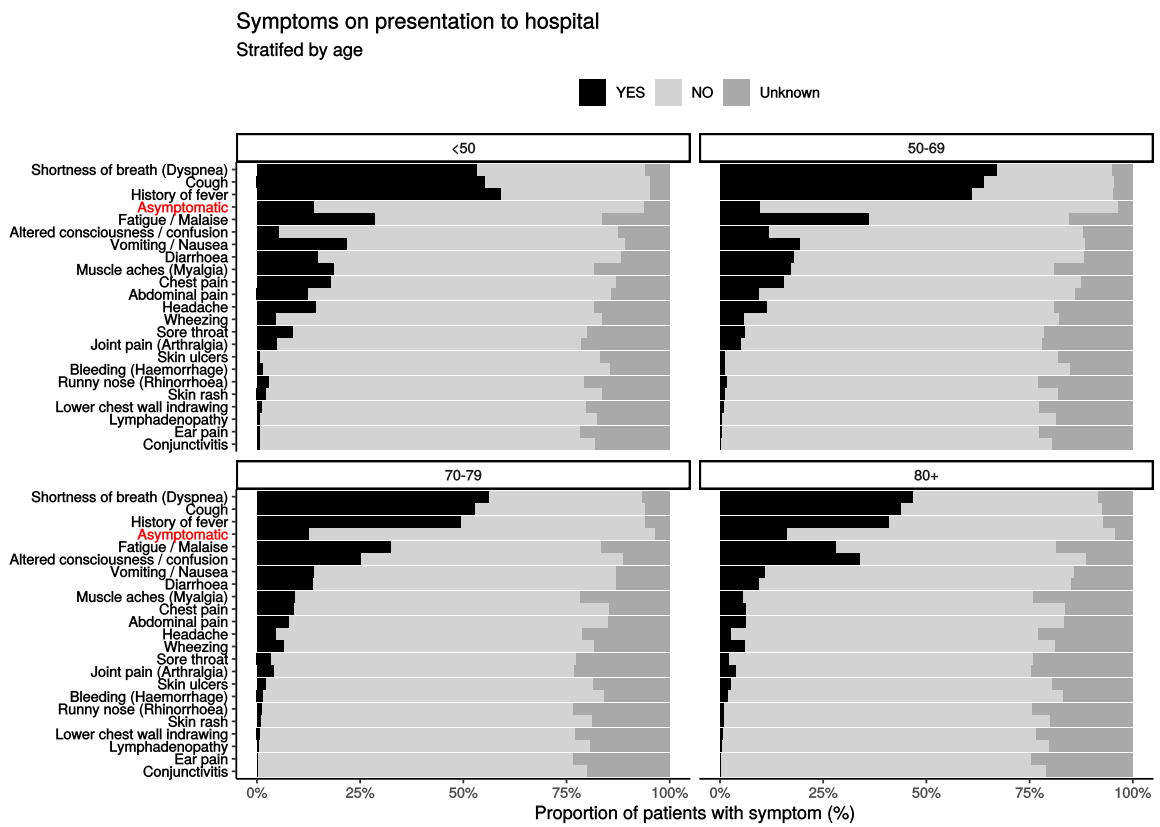Stratifed by age

Figure 3C

Correlation of symtpoms in all pages. Note clusters, top right to bottom left, flu-like, coryzal, abdominal, respiratory, neurocutaneous.
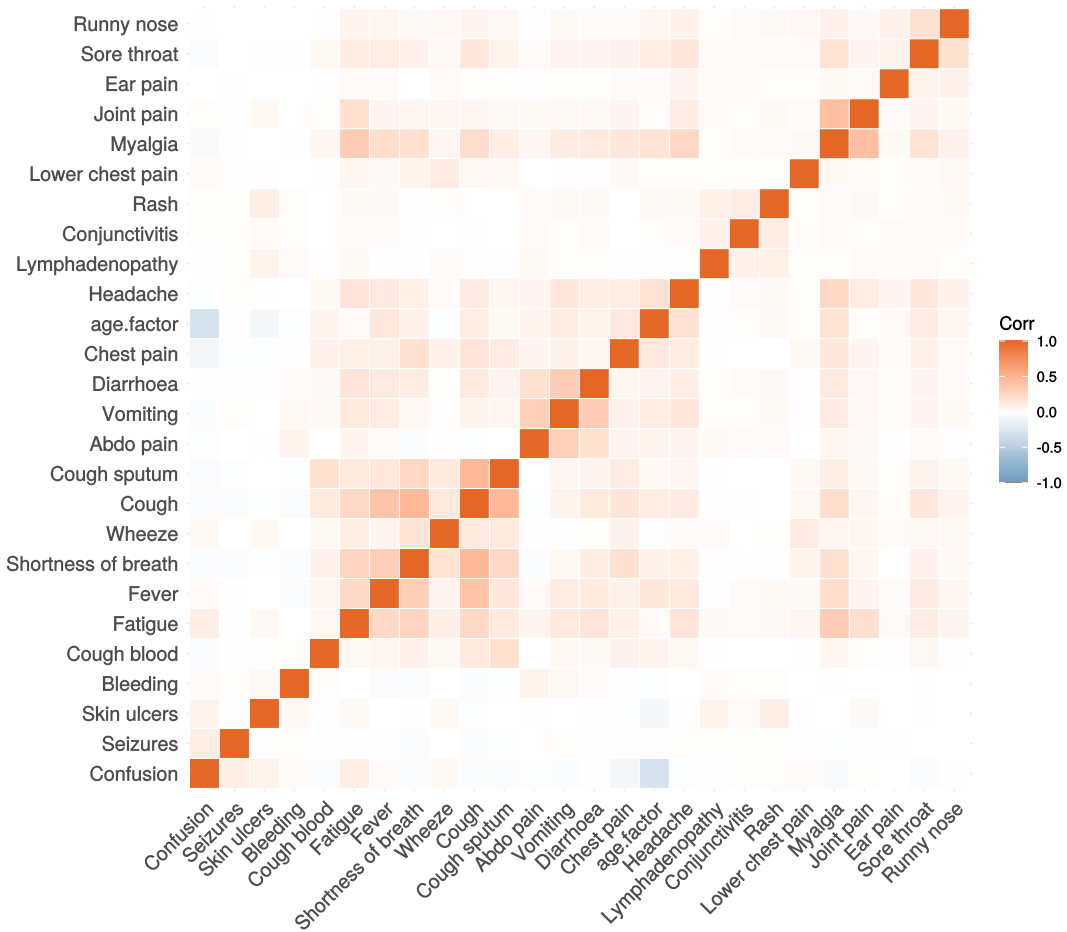
Symptoms (diagnostic criteria)

Figure 4A

n = 136000

Fever
Cough
Shortness of breath
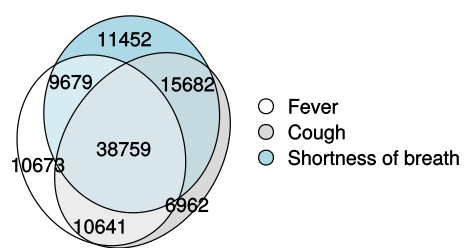
Symptoms (most common)

Figure 4B

n = 136000

Shortness of breath (Dyspnea)
Cough
History of fever
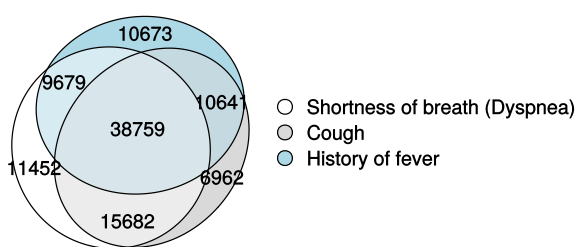
Comorbidity (most common)

Figure 4C

n = 174128

Hypertension
Chronic cardiac disease
Chronic pulmonary disease (not asthma)
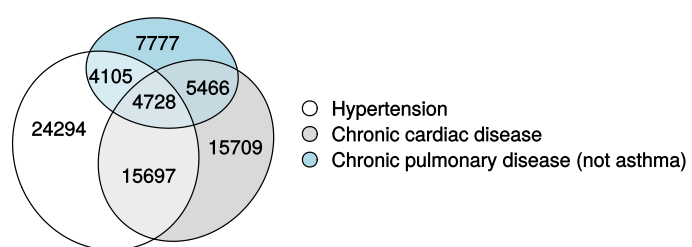
Medication prior to illness

Figure 5

Number of medications prior to admission
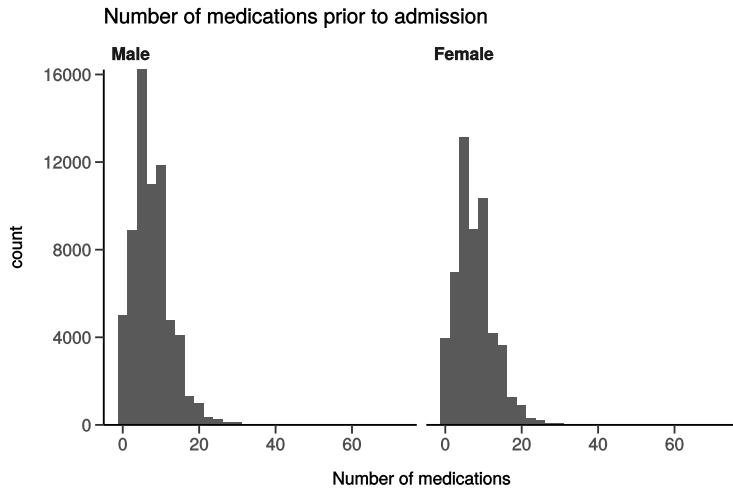
Preadmission treatment

Figure 6

Pre-admission treatment

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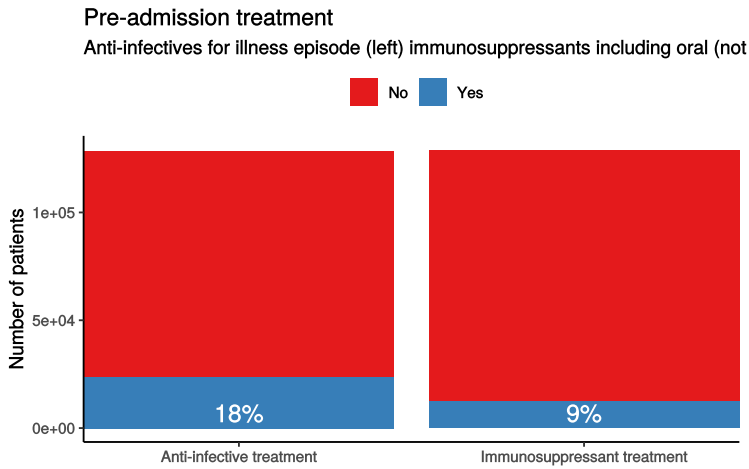
Patient flow

Figure 7A - All patients

N = 140197

Patient status by day

Cumulative for discharge/death
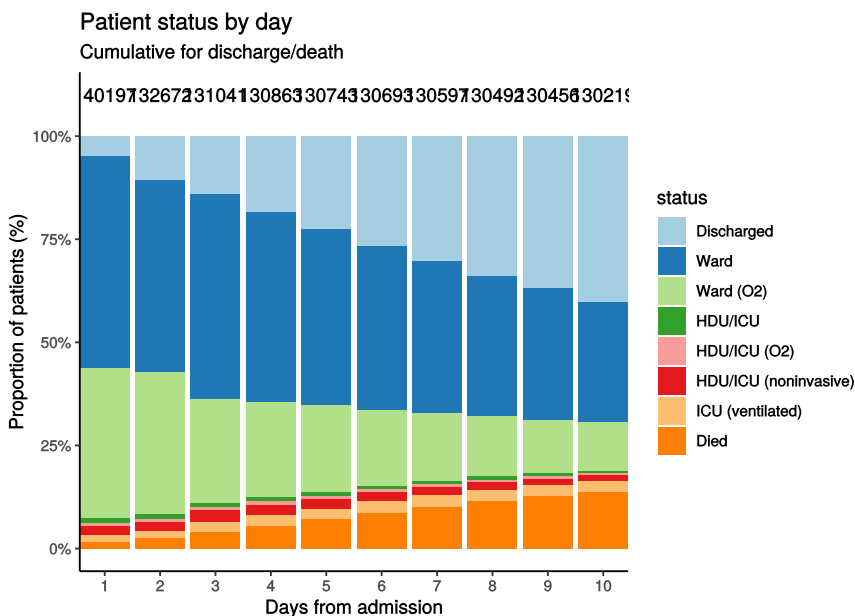
Figure 7B - Patients admitted >=14 days and <=28 days ago

N = 5794

Patient status by day
Cumulative for discharge/death
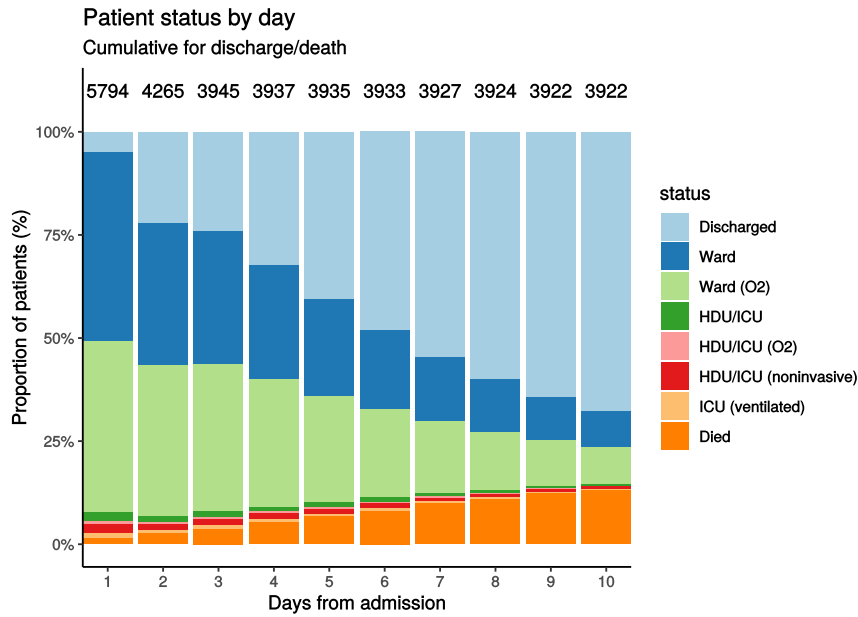
Oxygen requirement

Figure 8A - All patients

N = 132575
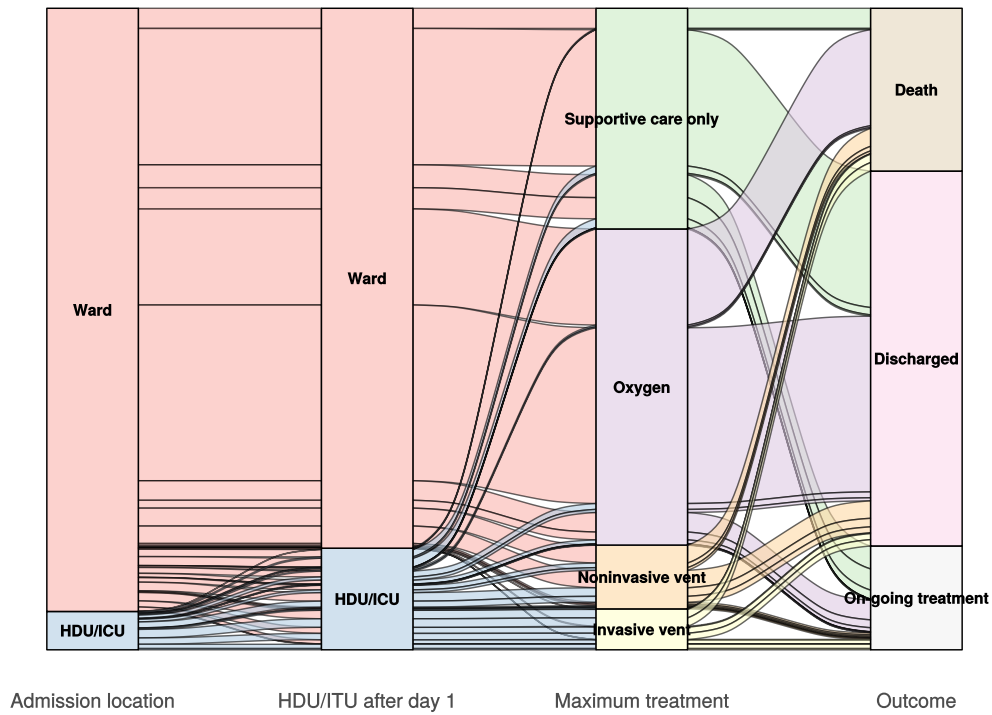
Figure 8B - Patients admitted >=14 days and <=28 days ago

N = 5496

In-hospital medical treatment

Figure 9

In-hospital treatment

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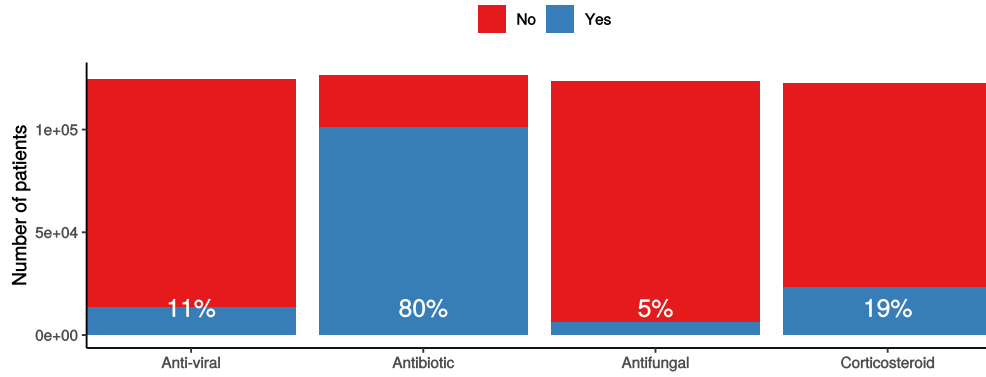
Treatment

Figure 10

ICU/HDU admission
Figure 10A
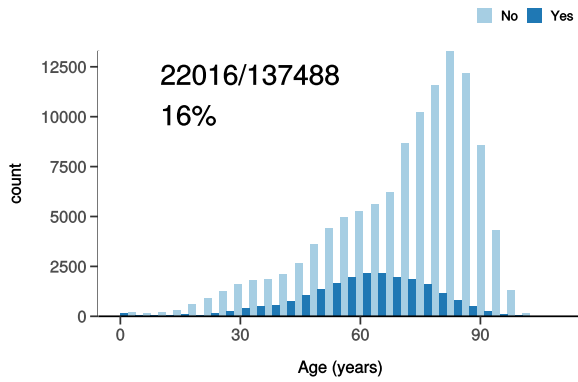
High flow oxygen
Figure 10B
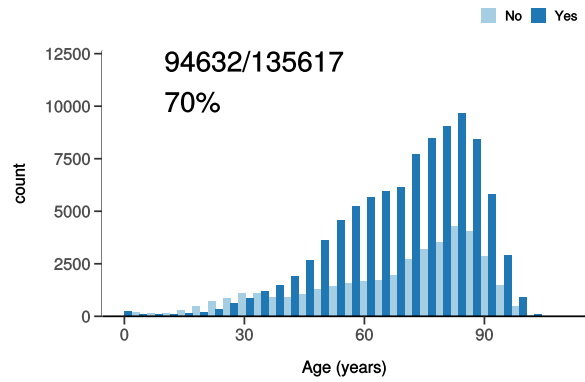
Noninvasive ventilation
Figure 10C
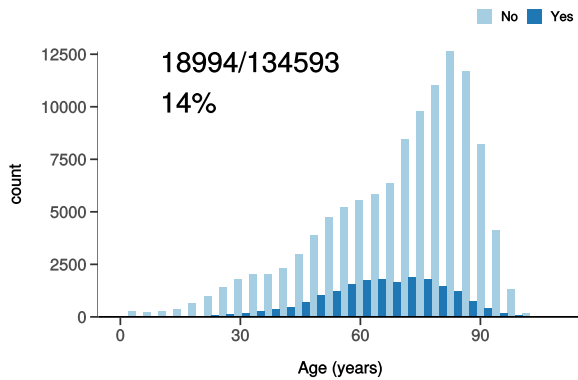
Invasive ventilation
Figure 10D
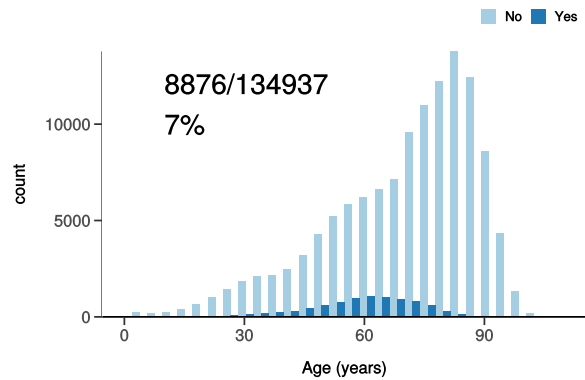
Status in patients admitted >=14 days from today

Figure 11

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

Died
35182/136060
26%

On-going care
20154/136060
15%

Discharged alive
80493/136060
59%
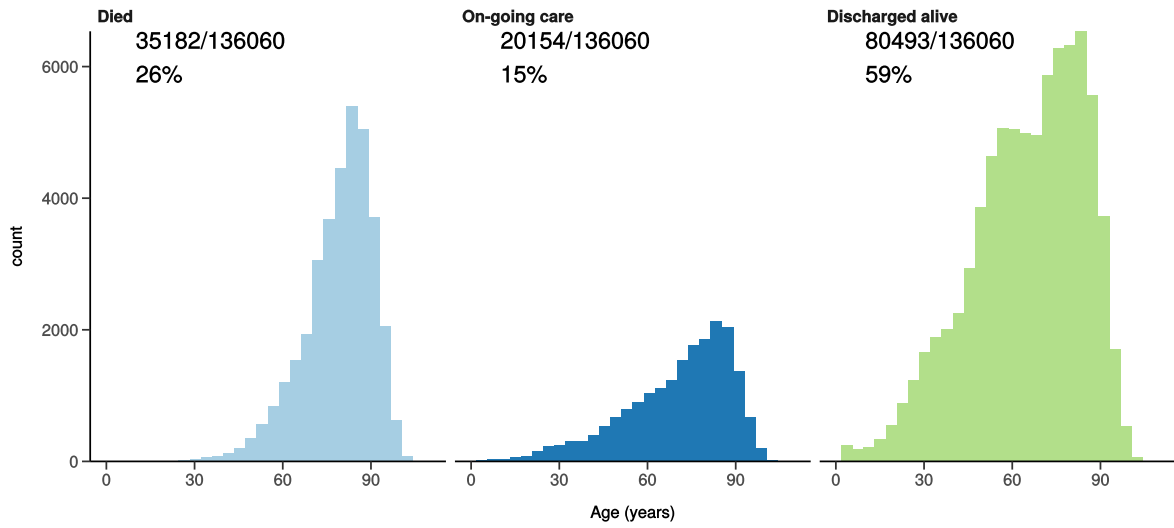
ICU/HDU admissions: status in patients admitted >=14 days ago
Figure 11B

Died
6035/20880
29%

On-going care
5455/20880
26%

Discharged alive
9366/20880
45%
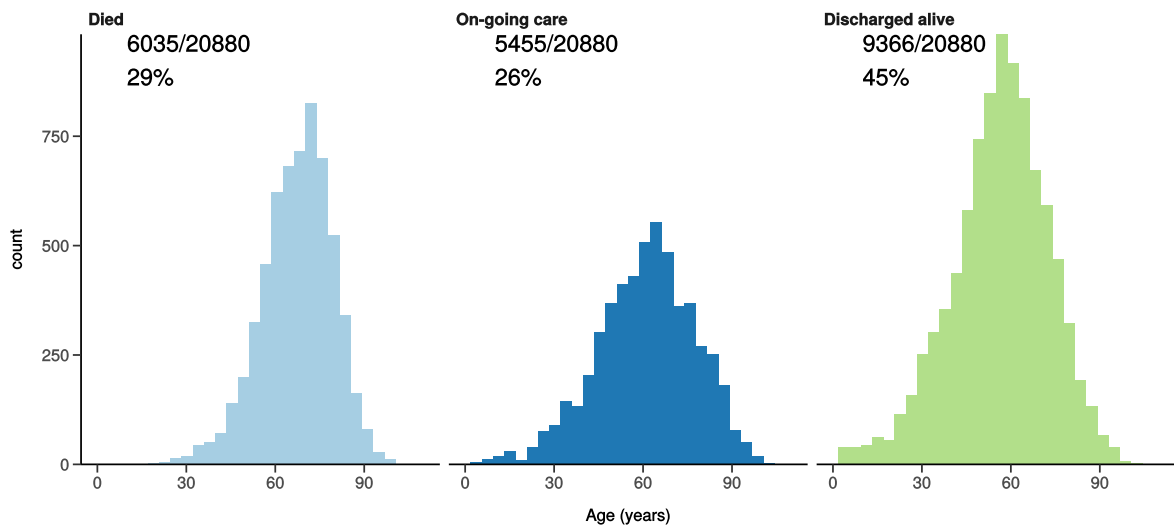
Invasive ventilation: status in patients admitted >=14 days ago
Figure 11c

Died
3740/8607
43%

On-going care
2054/8607
24%

Discharged alive
2805/8607
33%
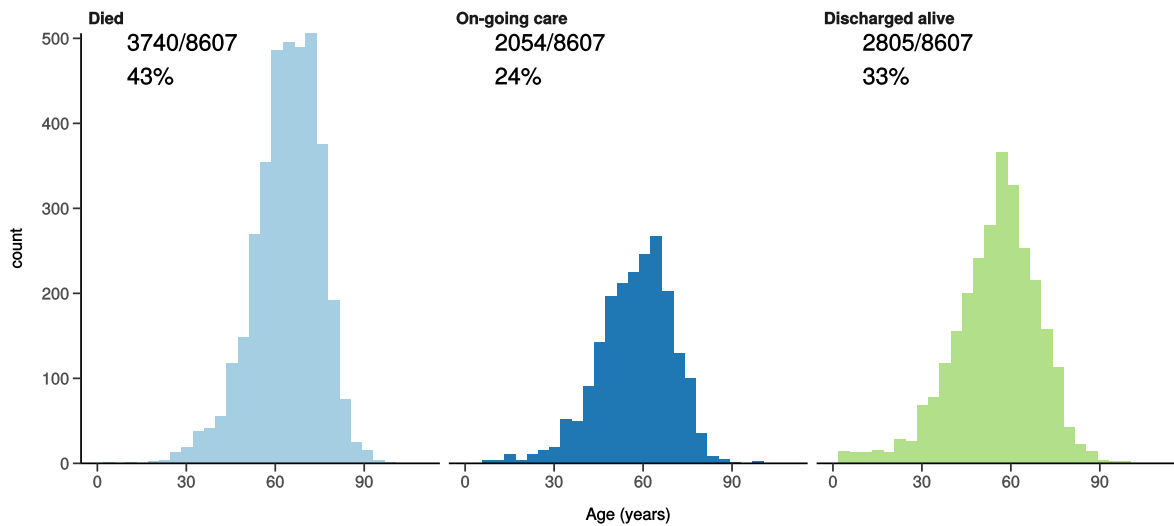
Length of stay stratified by age
Figure 12

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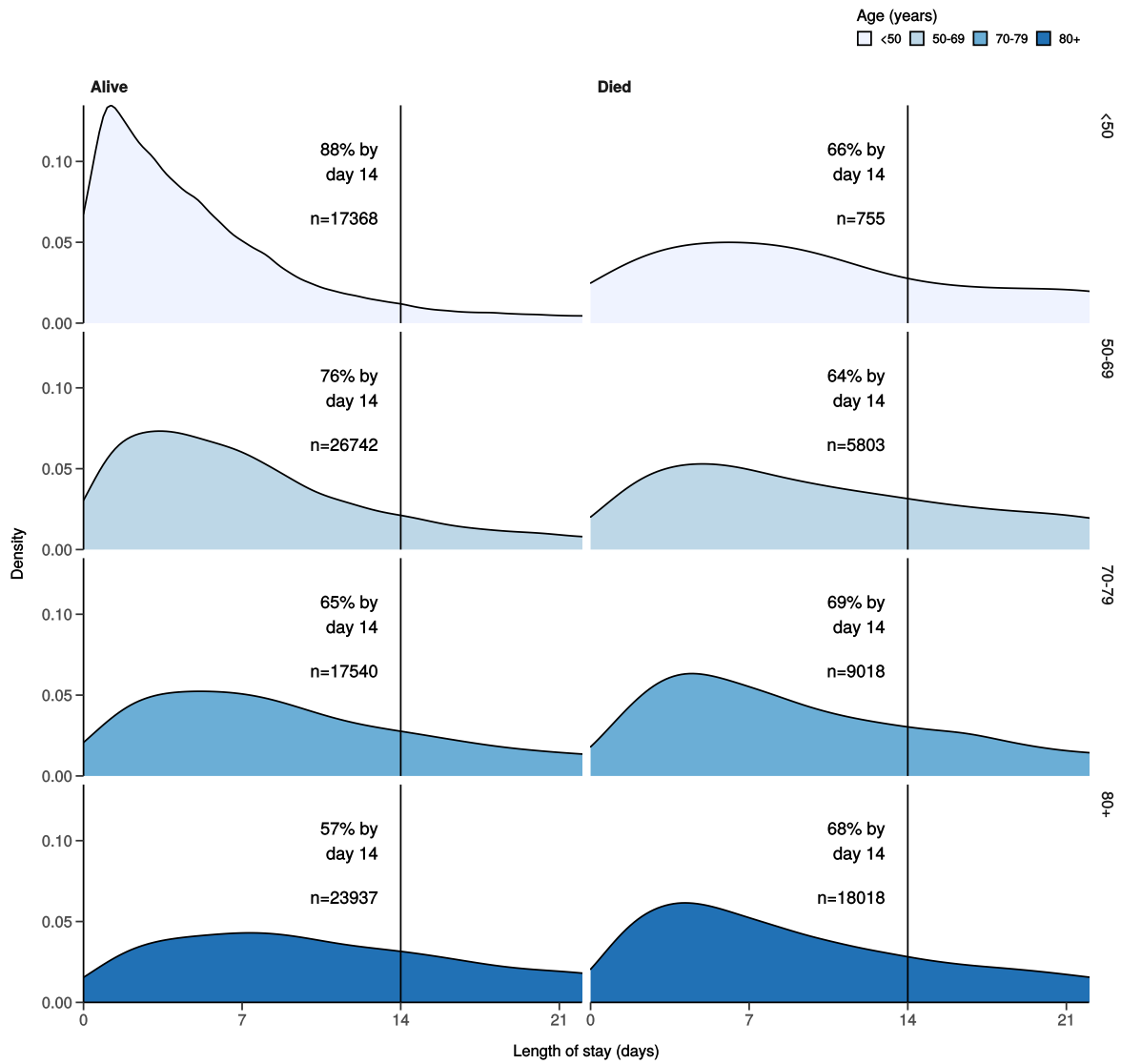
Predictors of death: logistic regression multivariable model

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	19756 (96.1)	803 (3.9)	•	•
	50-69	29346 (82.9)	6061 (17.1)	5.08 (4.71-5.49, p<0.001)	4.62 (4.25-5.03, p<0.001)
	70-79	19314 (67.3)	9386 (32.7)	11.96 (11.10-12.89, p<0.001)	9.68 (8.90-10.55, p<0.001)
	80+	26207 (58.2)	18825 (41.8)	17.67 (16.44-19.02, p<0.001)	14.11 (12.97-15.37, p<0.001)
Sex at Birth	Male	50277 (70.4)	21135 (29.6)	•	•
	Female	44407 (76.1)	13966 (23.9)	0.75 (0.73-0.77, p<0.001)	0.69 (0.67-0.71, p<0.001)
	Not specified	0 (NaN)	0 (NaN)	•	•
Chronic cardiac disease	NO	64552 (78.0)	18252 (22.0)	•	•
	YES	24315 (62.5)	14569 (37.5)	2.12 (2.06-2.18, p<0.001)	1.16 (1.12-1.20, p<0.001)

Dependent: death		No	Yes	OR (univariable)	OR (multivariable)
Chronic pulmonary disease (not asthma)	NO	75979 (75.4)	24849 (24.6)	•	•
	YES	12794 (62.2)	7791 (37.8)	1.86 (1.80-1.92, p<0.001)	1.35 (1.30-1.40, p<0.001)
Chronic neurological disorder	NO	78151 (74.2)	27224 (25.8)	•	•
	YES	10099 (66.3)	5130 (33.7)	1.46 (1.41-1.51, p<0.001)	1.11 (1.06-1.16, p<0.001)
Chronic hematologic disease	NO	84476 (73.5)	30424 (26.5)	•	•
	YES	3551 (66.2)	1815 (33.8)	1.42 (1.34-1.50, p<0.001)	1.03 (0.96-1.11, p=0.339)
Chronic kidney disease	NO	76176 (75.8)	24322 (24.2)	•	•
	YES	12364 (60.1)	8225 (39.9)	2.08 (2.02-2.15, p<0.001)	1.31 (1.26-1.36, p<0.001)
Dementia	NO	78067 (76.0)	24647 (24.0)	•	•
	YES	10147 (56.9)	7677 (43.1)	2.40 (2.32-2.48, p<0.001)	1.39 (1.34-1.45, p<0.001)
Obesity (as defined by clinical staff)	NO	68829 (73.1)	25355 (26.9)	•	•
	YES	10951 (77.4)	3190 (22.6)	0.79 (0.76-0.82, p<0.001)	1.17 (1.11-1.23, p<0.001)
Malignant neoplasm	NO	80821 (74.7)	27346 (25.3)	•	•
	YES	7279 (59.5)	4951 (40.5)	2.01 (1.93-2.09, p<0.001)	1.50 (1.43-1.57, p<0.001)

Number in dataframe = 142021, Number in model = 103266, Missing = 38755, AIC = 104408.4, C-statistic = 0.729, H&L = Chi-sq(8) 191.90 (p<0.001)

Figure 13 - Adjusted odds ratio plot

Death

Age on admission (years)	<50	-	
	50-69	4.62 (4.25-5.03, p<0.001)	
	70-79	9.68 (8.90-10.55, p<0.001)	
	80+	14.11 (12.97-15.37, p<0.001)	
Sex at Birth	Male	-	
	Female	0.69 (0.67-0.71, p<0.001)	
	Not specified	-	
Chronic cardiac disease	YES	1.16 (1.12-1.20, p<0.001)	
Chronic pulmonary disease (not asthma)	YES	1.35 (1.30-1.40, p<0.001)	
Chronic neurological disorder	YES	1.11 (1.06-1.16, p<0.001)	
Chronic hematologic disease	YES	1.03 (0.96-1.11, p=0.339)	
Chronic kidney disease	YES	1.31 (1.26-1.36, p<0.001)	
Dementia	YES	1.39 (1.34-1.45, p<0.001)	
Obesity (as defined by clinical staff)	YES	1.17 (1.11-1.23, p<0.001)	
Malignant neoplasm	YES	1.50 (1.43-1.57, p<0.001)	

Odds ratio (95% CI, log scale)
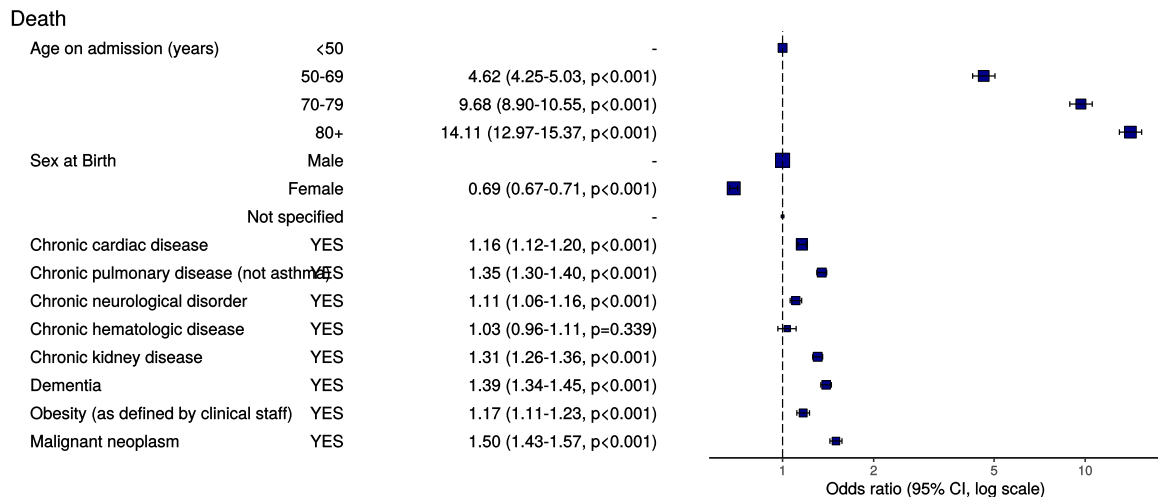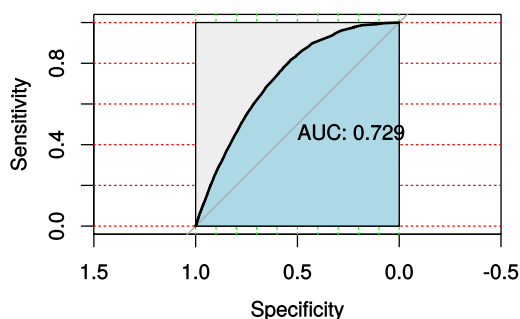
Figure 14 - ROC
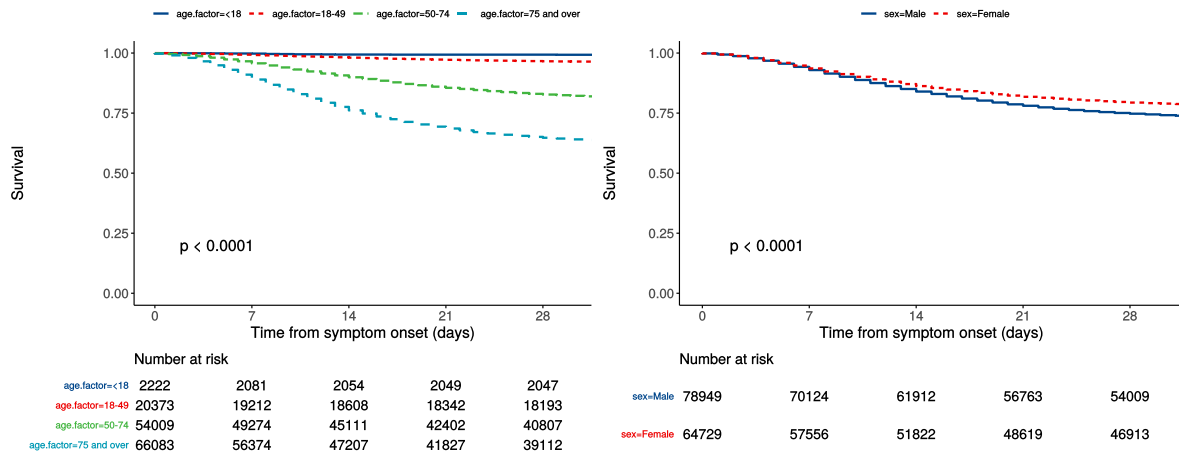
AUC: 0.729

Sensitivity

Specificity

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	22595 (15.8)	•	•
	50-69	39141 (27.4)	4.66 (4.33-5.02, p<0.001)	4.26 (3.90-4.66, p<0.001)
	70-79	31731 (22.2)	9.94 (9.24-10.68, p<0.001)	8.77 (8.04-9.58, p<0.001)
	80+	49234 (34.5)	13.81 (12.87-14.82, p<0.001)	11.97 (10.97-13.07, p<0.001)
Sex at Birth	Male	78949 (54.9)	•	•
	Female	64729 (45.1)	0.79 (0.77-0.80, p<0.001)	0.77 (0.75-0.79, p<0.001)
qSOFA score on admission	0	55436 (46.6)	•	•
	1	51558 (43.3)	1.65 (1.61-1.69, p<0.001)	1.79 (1.74-1.84, p<0.001)
	2	10953 (9.2)	3.29 (3.18-3.40, p<0.001)	3.06 (2.94-3.18, p<0.001)
	3	1085 (0.9)	5.62 (5.20-6.08, p<0.001)	5.03 (4.60-5.49, p<0.001)
Symptomatic at presentation	No symptoms	14869 (10.9)	•	•
	Symptoms	121302 (89.1)	1.87 (1.79-1.95, p<0.001)	•
Chronic cardiac disease	NO	88820 (68.2)	•	•
	YES	41391 (31.8)	1.90 (1.86-1.95, p<0.001)	1.15 (1.12-1.18, p<0.001)
Chronic kidney disease	NO	107694 (83.1)	•	•
	YES	21858 (16.9)	1.86 (1.81-1.91, p<0.001)	1.24 (1.20-1.27, p<0.001)
Moderate or severe liver disease	NO	125894 (98.0)	•	•
	YES	2530 (2.0)	1.36 (1.27-1.46, p<0.001)	1.47 (1.35-1.60, p<0.001)
Chronic neurological disorder	NO	112843 (87.5)	•	•
	YES	16191 (12.5)	1.39 (1.35-1.43, p<0.001)	•

Dependent: Surv(time, status)		all	HR (univariable)	HR (multivariable)
Malignant neoplasm	NO	115871 (89.9)	•	•
	YES	12957 (10.1)	1.77 (1.72-1.82, p<0.001)	1.38 (1.33-1.43, p<0.001)
Chronic hematologic disease	NO	122997 (95.6)	•	•
	YES	5641 (4.4)	1.34 (1.28-1.41, p<0.001)	•
Obesity (as defined by clinical staff)	NO	100689 (86.9)	•	•
	YES	15147 (13.1)	0.81 (0.78-0.84, p<0.001)	1.10 (1.06-1.15, p<0.001)
Diabetes without complications	NO	104973 (85.2)	•	•
	YES	18214 (14.8)	1.26 (1.22-1.30, p<0.001)	•
Rheumatologic disorder	NO	112353 (87.5)	•	•
	YES	16031 (12.5)	1.16 (1.13-1.20, p<0.001)	•
Dementia	NO	110142 (85.4)	•	•
	YES	18820 (14.6)	2.12 (2.07-2.18, p<0.001)	1.18 (1.15-1.22, p<0.001)
Malnutrition	NO	117308 (97.4)	•	•
	YES	3128 (2.6)	1.52 (1.43-1.62, p<0.001)	•
smoking_mhyn_2levels	NO	69765 (52.3)	•	•
	YES	7542 (5.7)	0.85 (0.81-0.90, p<0.001)	•
	N/K	56095 (42.0)	1.13 (1.11-1.16, p<0.001)	•

Number in dataframe = 144240, Number in model = 97203, Missing = 47037, Number of events = 23992, Concordance = 0.732 (SE = 0.001), R-squared = 0.155(Max possible = 0.996), Likelihood ratio test = 16392.017 (df = 13, p = 0.000)

Figure 16a - Multivariable Cox proportional hazards model

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

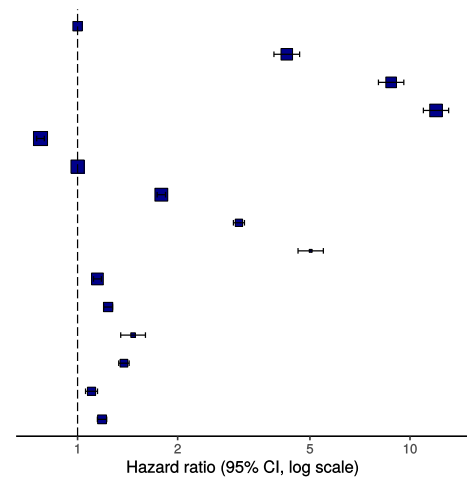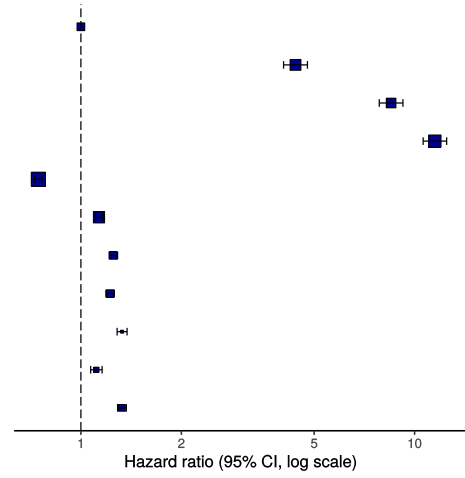| Age on admission (years) | <50 | - |
	50-69	4.26 (3.90-4.66, p<0.001)
	70-79	8.77 (8.04-9.58, p<0.001)
	80+	11.97 (10.97-13.07, p<0.001)
Sex at Birth	Female	0.77 (0.75-0.79, p<0.001)
qSOFA score on admission	0	-
	1	1.79 (1.74-1.84, p<0.001)
	2	3.06 (2.94-3.18, p<0.001)
	3	5.03 (4.60-5.49, p<0.001)
Chronic cardiac disease	YES	1.15 (1.12-1.18, p<0.001)
Chronic kidney disease	YES	1.24 (1.20-1.27, p<0.001)
Moderate or severe liver disease	YES	1.47 (1.35-1.60, p<0.001)
Malignant neoplasm	YES	1.38 (1.33-1.43, p<0.001)
Obesity (as defined by clinical staff)	YES	1.10 (1.06-1.15, p<0.001)
Dementia	YES	1.18 (1.15-1.22, 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)

Age on admission (years)	<50	-	
	50-69	4.40 (4.05-4.77, p<0.001)	
	70-79	8.50 (7.84-9.23, p<0.001)	
	80+	11.50 (10.61-12.48, p<0.001)	
Sex at Birth	Female	0.75 (0.73-0.76, p<0.001)	
Chronic cardiac disease	YES	1.13 (1.10-1.16, p<0.001)	
Chronic pulmonary disease (not asthma)	YES	1.25 (1.22-1.29, p<0.001)	
Chronic kidney disease	YES	1.22 (1.19-1.26, p<0.001)	
Malignant neoplasm	YES	1.33 (1.28-1.38, p<0.001)	
Obesity (as defined by clinical staff)	YES	1.11 (1.07-1.16, p<0.001)	
Dementia	YES	1.33 (1.29-1.37, p<0.001)	

Hazard ratio (95% CI, log scale)

ROC = 0.7325113

Figure 17 - Predictions calibration plot

Black: observed Gray: ideal
Blue : optimism corrected

Predicted 7 Day Survival
B=40 based on observed-predicted
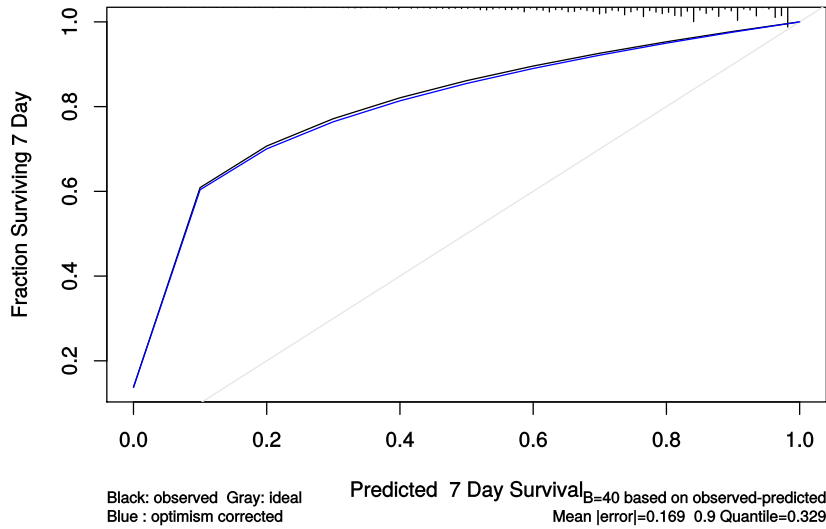Mean |error|=0.169 0.9 Quantile=0.329

Figure 18 - Prognostic model predictions

Again, for demonstration of methods.

Prognostic model for survival 7 days after onset
qSOFA score on admission

7 Day Survival Probability

Chronic kidney disease
NO
YES

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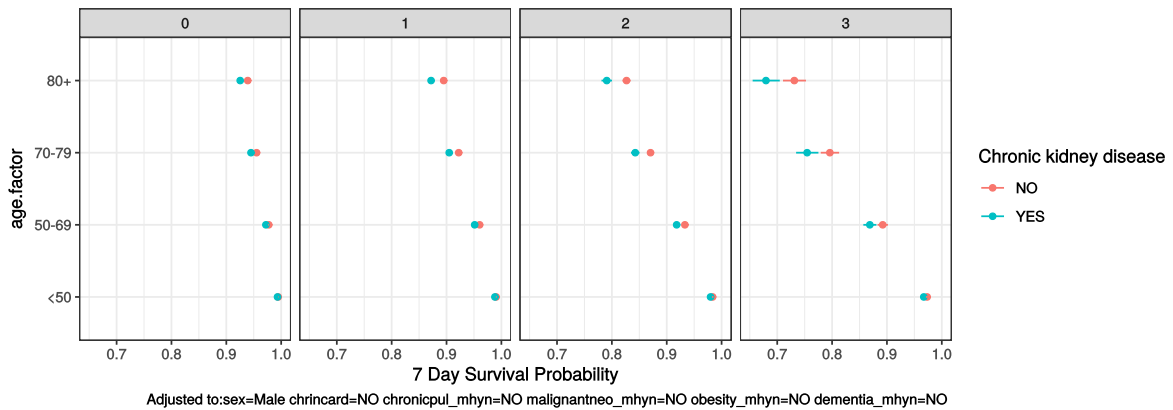
Figure 19 - Death by severity (NEWS) on admission
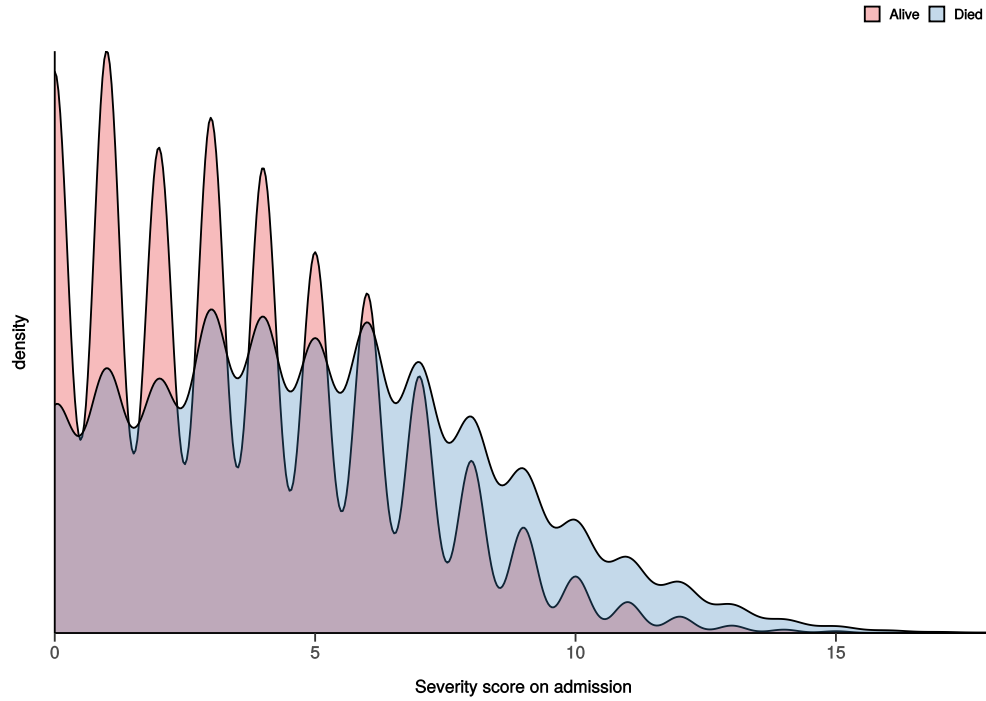
Number of deaths by NEWS score at admission

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

Number of deaths by NEWS score at admission
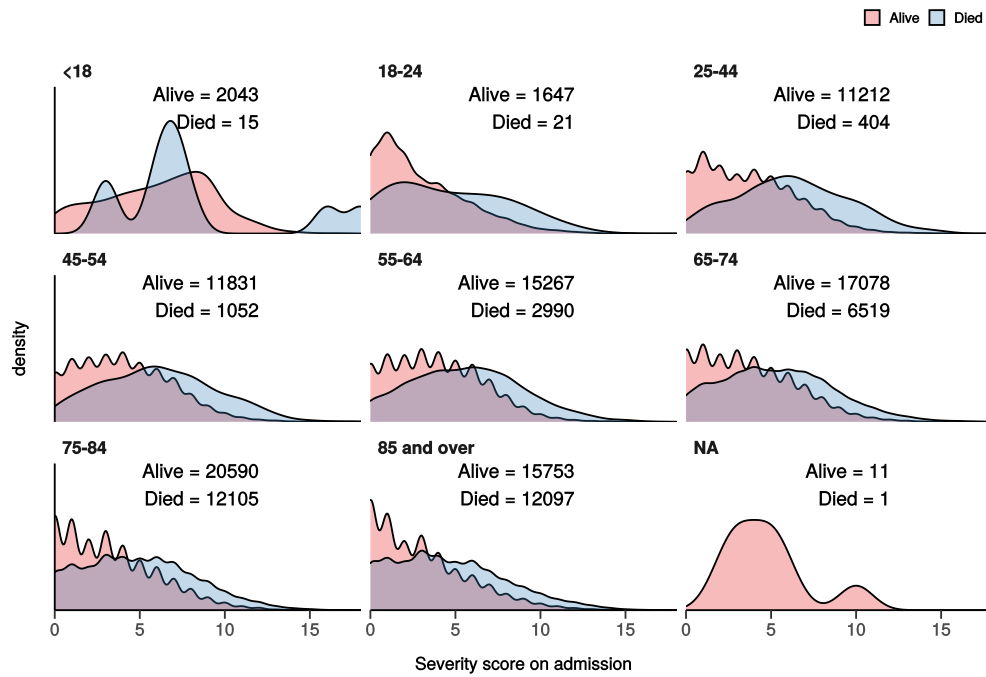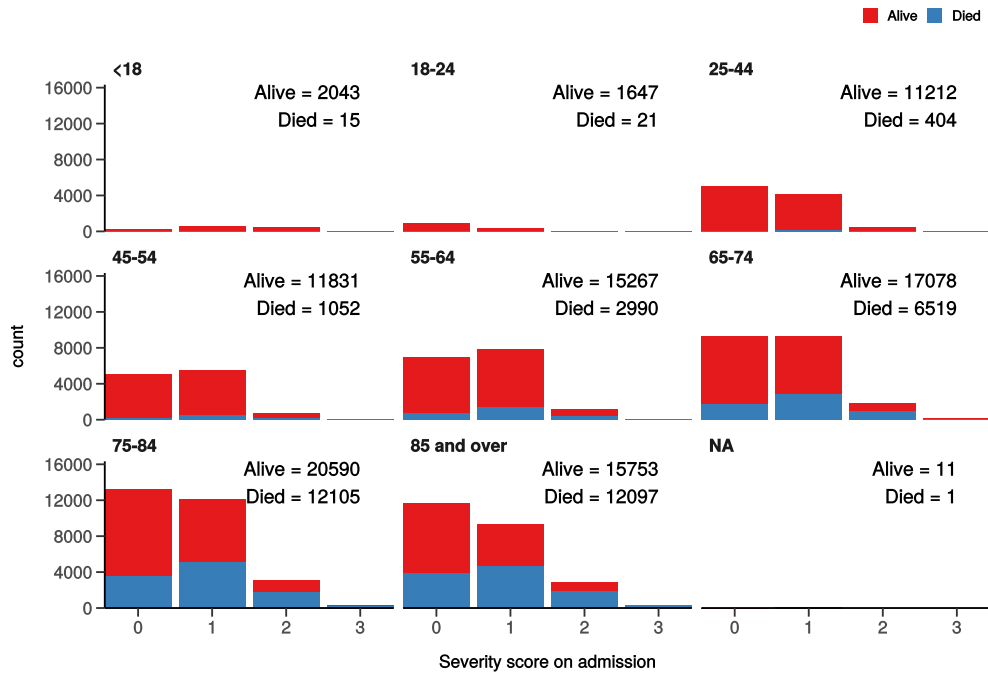Stratified by age

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 (%)		120926 (96.2)	4735 (3.8)	
NEWS score on admission	Median (IQR)	3.0 (5.0)	4.0 (4.0)	<0.001
Death	No	75861 (70.4)	4137 (92.9)	<0.001
	Yes	31921 (29.6)	318 (7.1)	