International Severe Acute Respiratory and Emerging Infections Consortium (ISARIC)

A global federation of clinical research networks, providing a proficient, coordinated, and agile research response to outbreak-prone infectious diseases

COVID-19 Report (ICU admitted with confirmed COVID 19)

Summary

The results in this report have been produced using data from Ireland using the ISARIC COVID-19 database. For information, or to contribute to the collaboration, please contact sprintsari@ucd.ie.

Please note the following caveats. Information is incomplete for the many patients who are still being treated. Furthermore, it is likely that we received more cases of severely ill individuals than those with relatively less severe illness; outcomes from these data, such as the proportion dying, must therefore not be used to infer outcomes for the entire population of people who might become infected. Some patients may be participants in clinical trials of experimental interventions. Additional caveats are provided in the in the 'Caveats' section below.

The analysis detailed in this report only includes individuals for whom data collection commenced on or before **09 November 2020**.

The cohort comprises **156** individuals, including 107 males and 48 females – sex is unreported for 1 case. SARS-COV-2 infection has been **confirmed by laboratory testing in 156 of these individuals**.

The median age (calculated based on reported ages) is 61.5 years. The minimum and maximum observed ages are 17 and 88 years respectively.

Outcomes have been recorded for 123 patients, consisting of 93 recoveries and 30 deaths. Follow-up is ongoing for 11 patients. Outcome records are unavailable for 22 patient(s).

The observed mean number of days from (first) symptom onset to hospital admission was 9.1, with a SD of 8.7 days and a median of 6 days.

A total of 135 cases had complete information on length of hospital stay. Of these, the observed mean number of days from hospital admission to outcome (death or discharge) was 32.4, with a standard deviation (SD) of 34.6 days and a median of 22 days.

The symptoms on admission represent the policy for hospital admission and containment at this site. The four most common symptoms at admission were fatigue and malaise alongside cough, history of fever and shortness of breath.

87 patients received non-invasive mechanical ventilation (NIV). The mean and median durations from ad-mission to receiving NIV were 6.4 days and 2 days respectively (SD: 11.3 days) – estimated from records on cases with complete records on dates of hospital admission and NIV onset (N = 72).

The mean and median durations for NIV were 3.7 days and 1 days respectively (SD: 5.9 days) – estimated based on only those cases which have complete NIV duration records (N = 46).

156 patients were admitted at some point into an intensive care unit (ICU) or high dependency unit (HDU). The observed mean and median durations (in days) from hospital admission to ICU/HDU admission were 5.5 and 1 respectively (SD: 9) – estimated from records on cases with complete date records on hospital admission and ICU/HDU entry (N = 155).

The duration of stay in ICU/HDU has a mean of 16 days and a median of 11 (SD: 17 days) – estimated on only those cases with complete records for ICU/HDU duration or ICU/HDU start/end dates (N = 143). Of these 156 patients who were admitted into ICU/HDU, 30 died, 11 are still in hospital and 93 have recovered and been discharged. Outcome records are unavailable for 22 cases.

104 patients received invasive mechanical ventilation (IMV). The mean and median durations (in days) from admission to receiving IMV were 6.8 and 1 respectively (SD: 12.9 days) – estimated from records on cases with complete information on dates of hospital admission and IMV onset (N = 101).

The mean, median and SD for the duration (in days) of IMV – estimated based on all 92 cases with complete records on IMV stays – were 17.3, 12 and 17.2 respectively.

Of 122 patients with a recorded outcome and details of treatments received, 95.9% received an antibiotic and 55.7% received antivirals. These treatment categories are not mutually exclusive since some patients received multiple treatments. 98.4% of patients received some degree of oxygen supplementation: of these, 59.2% received NIV and 63.3% IMV.

Of 122 patients admitted into ICU/HDU with a recorded outcome and details of treatments, 95.9% received antibiotics and 55.7% antivirals; and 98.4% received some degree of oxygen supplementation, of which 59.2% was NIV and 63.3% IMV.

Patient Characteristics

Figure 1: Age and sex distribution of patients. Bar fills are outcome (death/discharge/ongoing care) at the time of report.

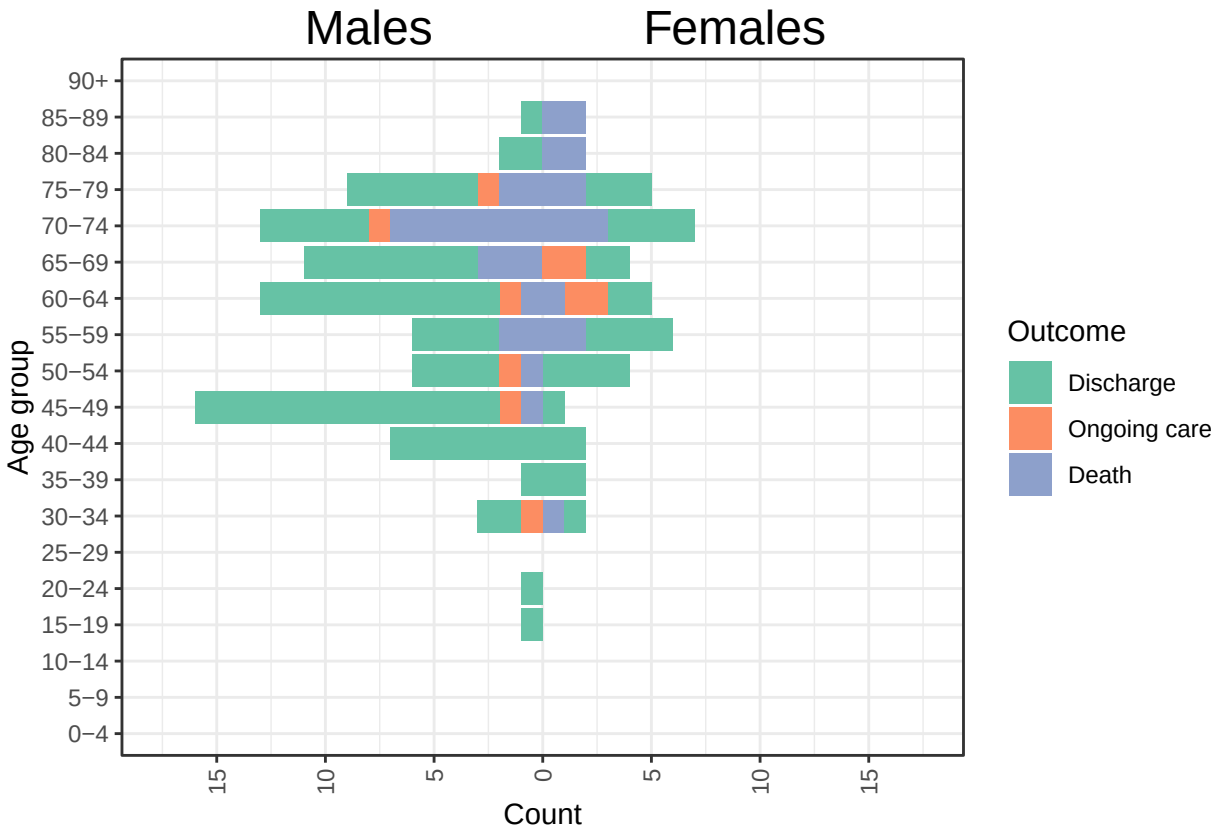
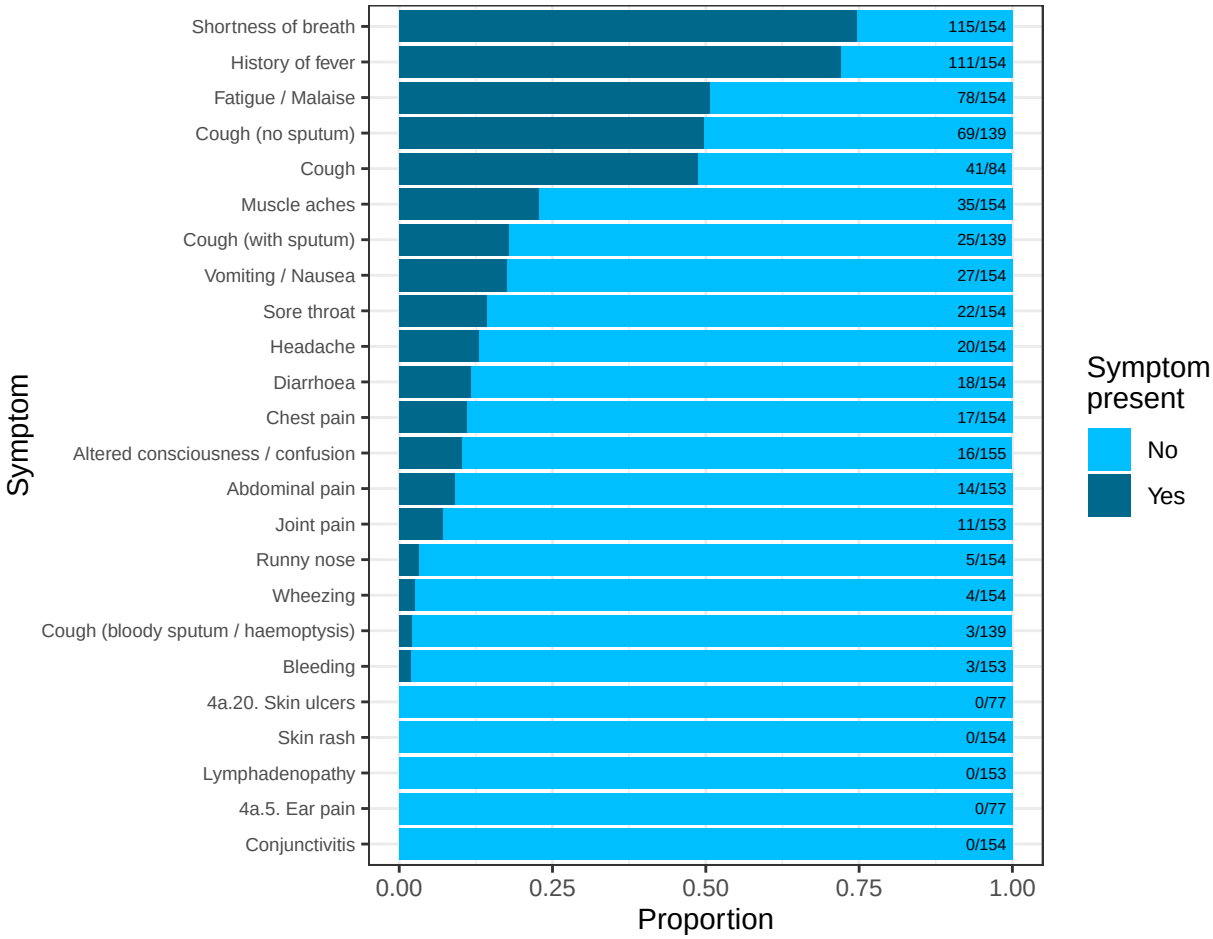
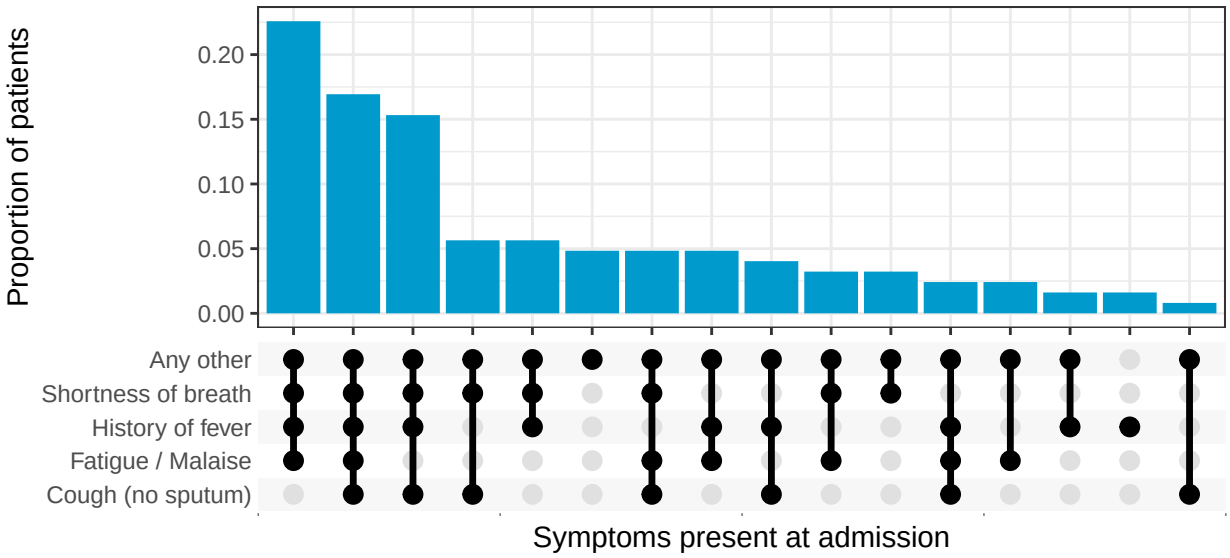


Figure 2: Top: Frequency of symptoms seen at admission amongst COVID-19 patients. Bars are annotated with a fraction representing the number of patients presenting with this symptom over the number of patients for whom presence or absence of this symptom was recorded. Middle: The distribution of combinations of the four most common symptoms, amongst all patients for whom these data were recorded. Filled and empty circles below the x-axis indicate the presence or absence of each comorbidity. The "Any other" category contains all remaining symptoms in the top plot. Bottom: Heatmap for prevalance of pairwise combinations of symptoms. Fill colour reflects the proportion of patients reporting presence of both symptoms amongst those with recorded presence or absence of both.




Proportion of patients
0.20
0.15
0.10
0.05
0.00
Any other
Shortness of breath
History of fever
Fatigue / Malaise
Cough (no sputum)
Symptoms present at admission

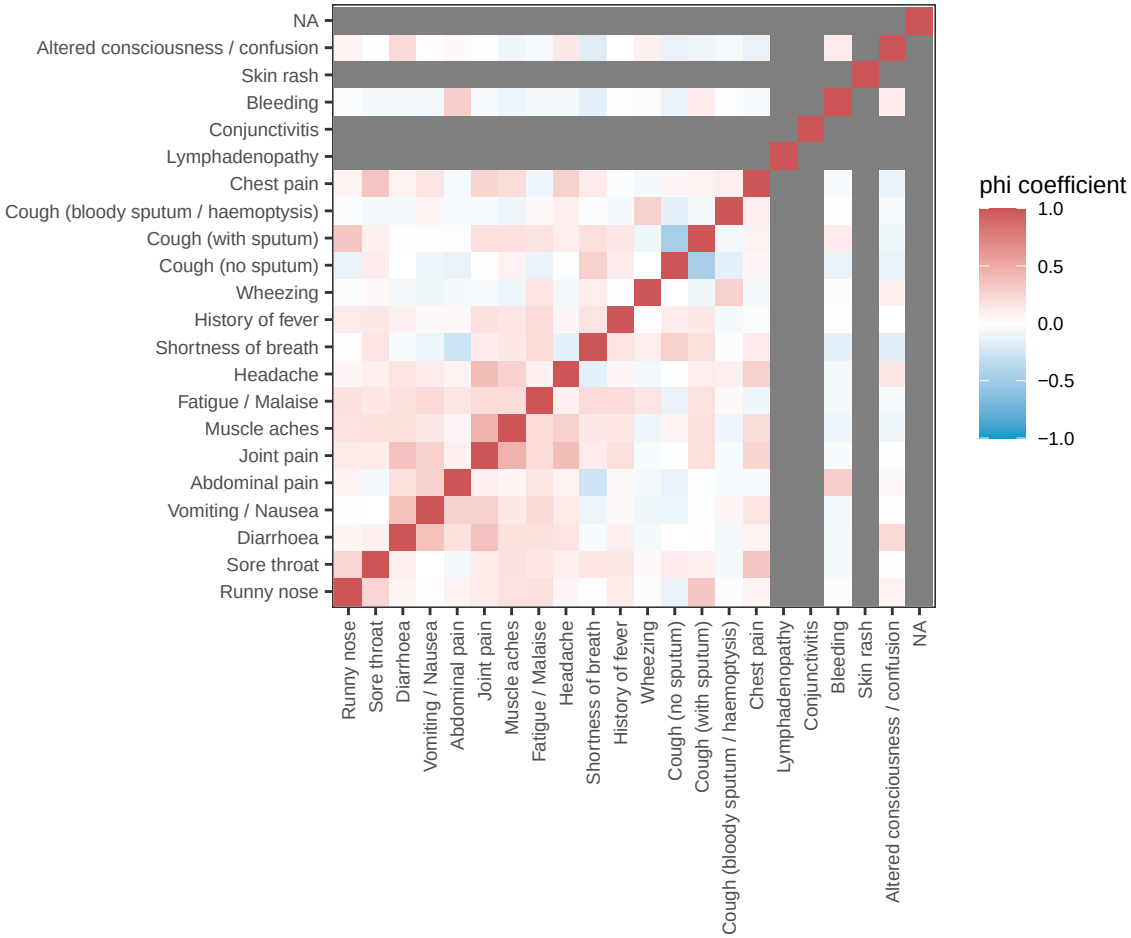
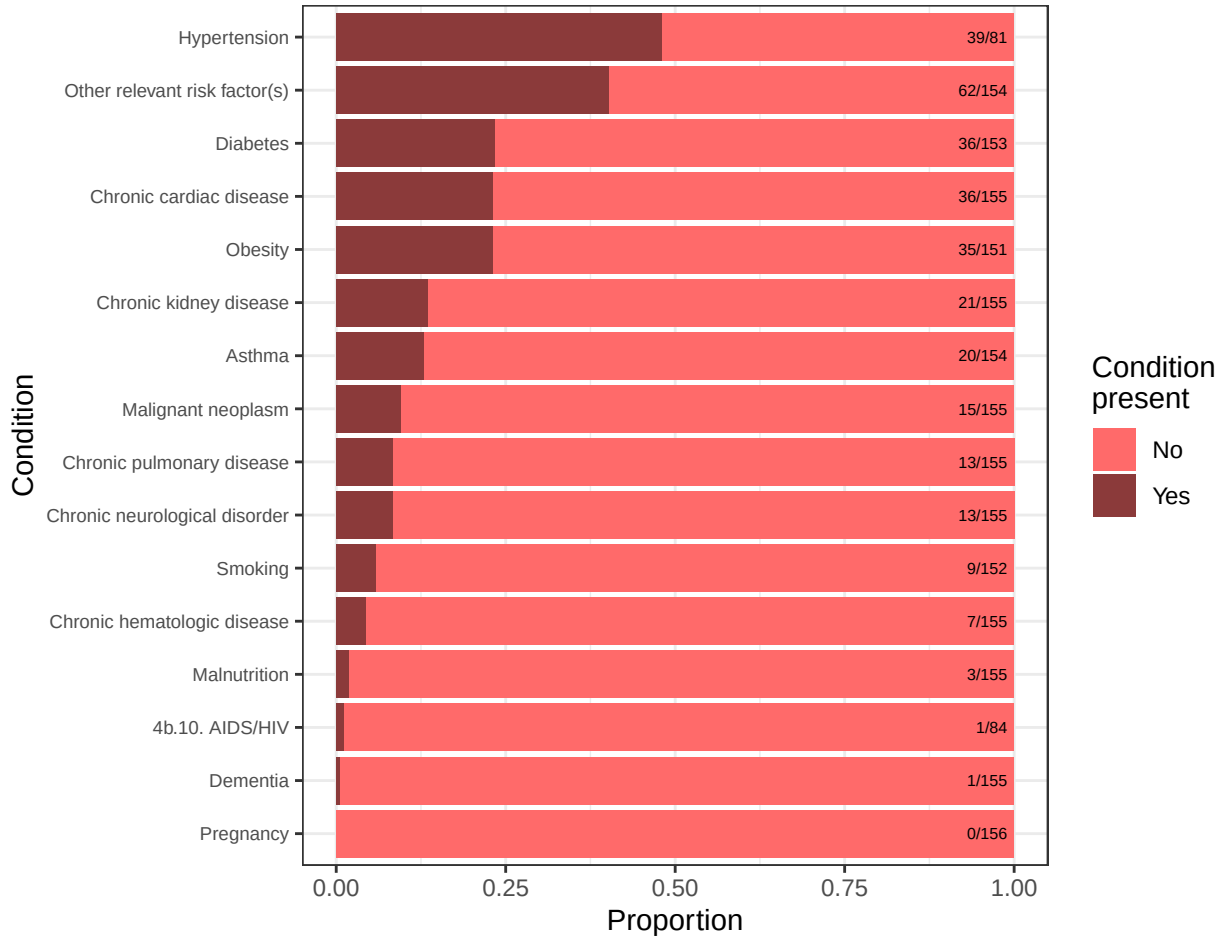
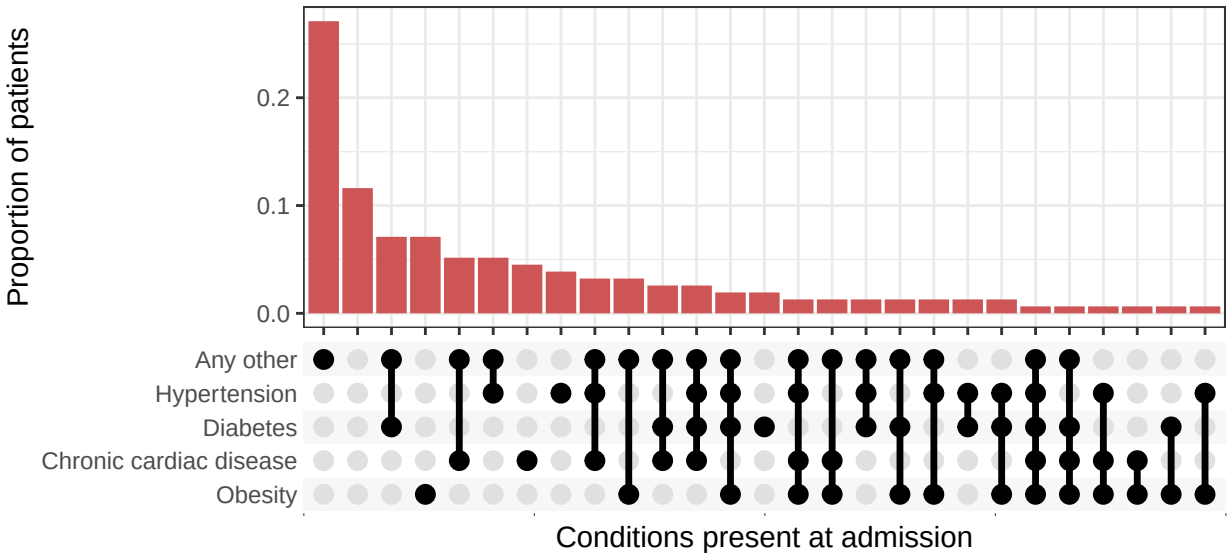

NA
Altered consciousness / confusion
Skin rash
Bleeding
Conjunctivitis
Lymphadenopathy
Chest pain
Cough (bloody sputum / haemoptysis)
Cough (with sputum)
Cough (no sputum)
Wheezing
History of fever
Shortness of breath
Headache
Fatigue / Malaise
Muscle aches
Joint pain
Abdominal pain
Vomiting / Nausea
Diarrhoea
Sore throat
Runny nose
phi coefficient
1.0
0.5
0.0
−0.5
−1.0

Figure 3: Top: Frequency of comorbidities seen at admission amongst COVID-19 patients. Bars are annotated with a fraction representing the number of patients presenting with this comorbidity over the number of patients for whom presence or absence of this comorbidity was recorded. Bottom: The distribution of combinations of the four most common comorbidities, amongst all patients for whom these data were recorded. Filled and empty circles below the x-axis indicate the presence or absence of each comorbidity. The "Any other" category contains all remaining comorbidities in the top plot, and any other comorbidities recorded as free text by clinical staff.




Proportion of patients
0.2
0.1
0.0
Any other
Hypertension
Diabetes
Chronic cardiac disease
Obesity
Conditions present at admission

Variables by age

Figure 4: Comorbidities stratified by age group. Boxes show the proportion of individuals with each comorbidity, with error bars showing 95% confidence intervals. The size of each box is proportional to the number of individuals represented. N is the number of individuals included in the plot (this may vary between plots due to data completeness).

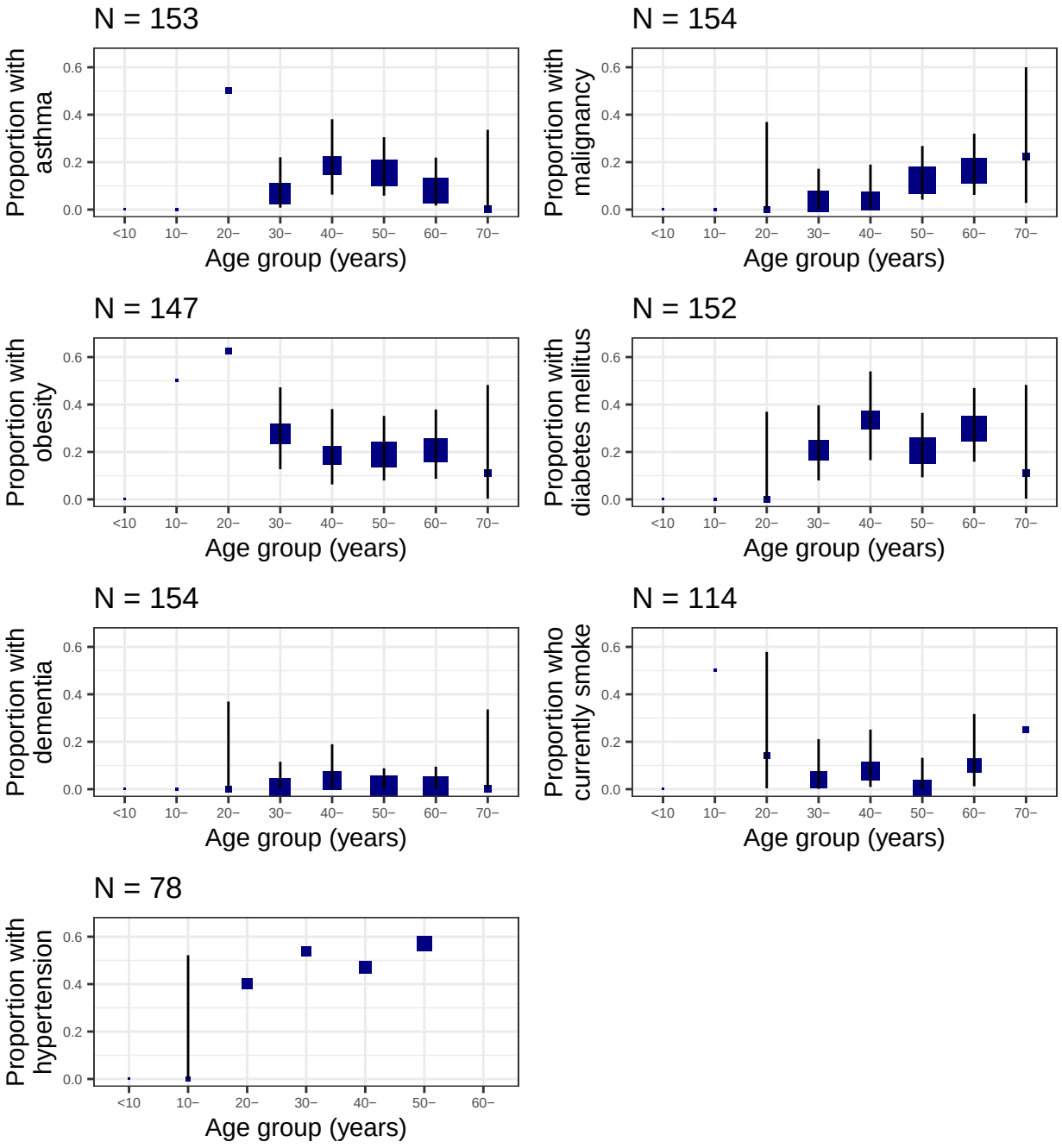
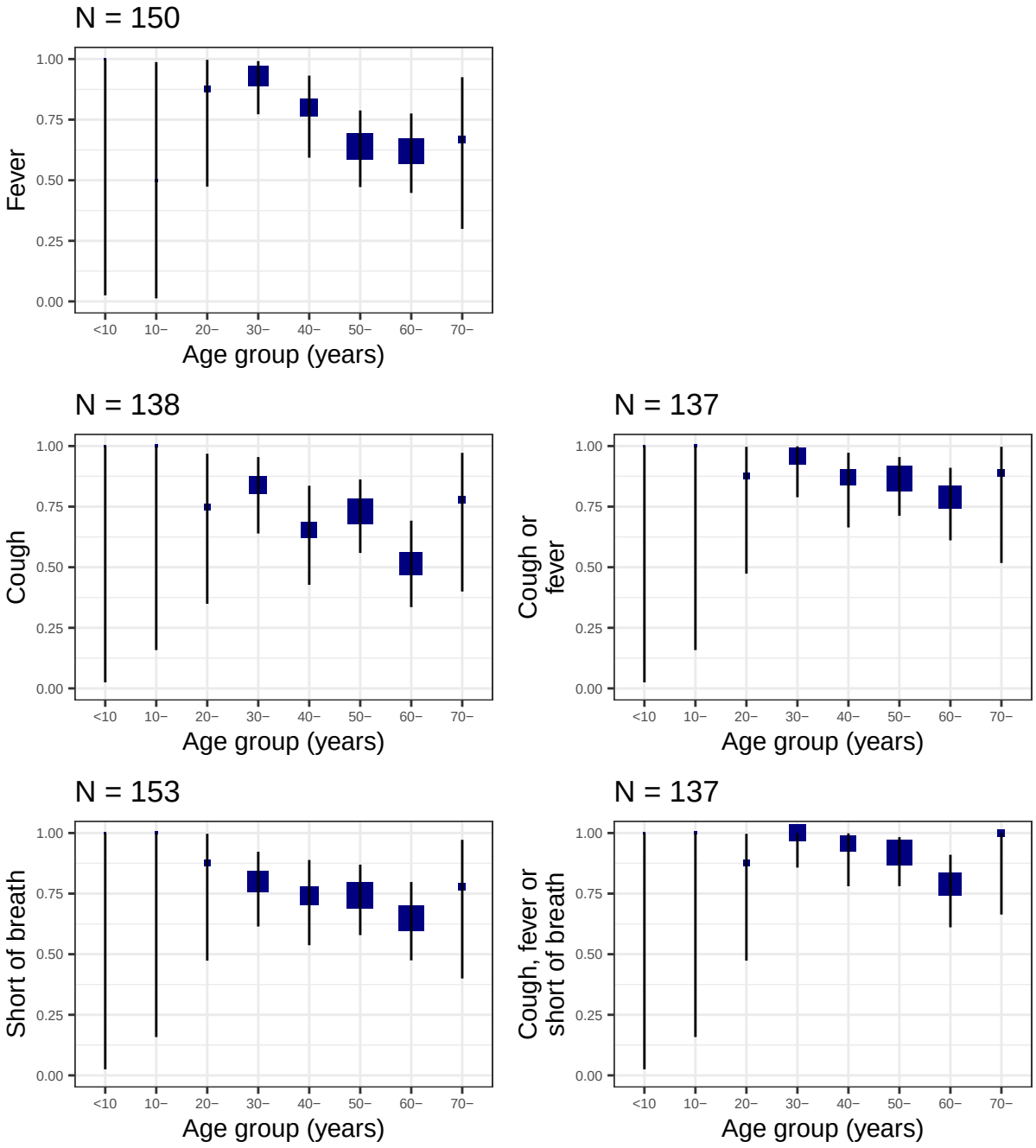


Figure 5: Symptoms recorded at hospital presentation stratified by age group. Boxes show the proportion of individuals with each symptom, with error bars showing 95% confidence intervals. The size of each box is proportional to the number of individuals represented. N is the number of individuals included in the plot (this may vary between plots due to data completeness). The following symptoms are grouped: lower respiratory is either wheeze or shortness of breath; upper respiratory is any of runny nose, sore throat or ear pain; gastrointestinal is any of abdominal pain, vomiting or diarrhoea; neurological is either seizures or confusion; and constitutional is any of myalgia, joint pain, fatigue or headache.



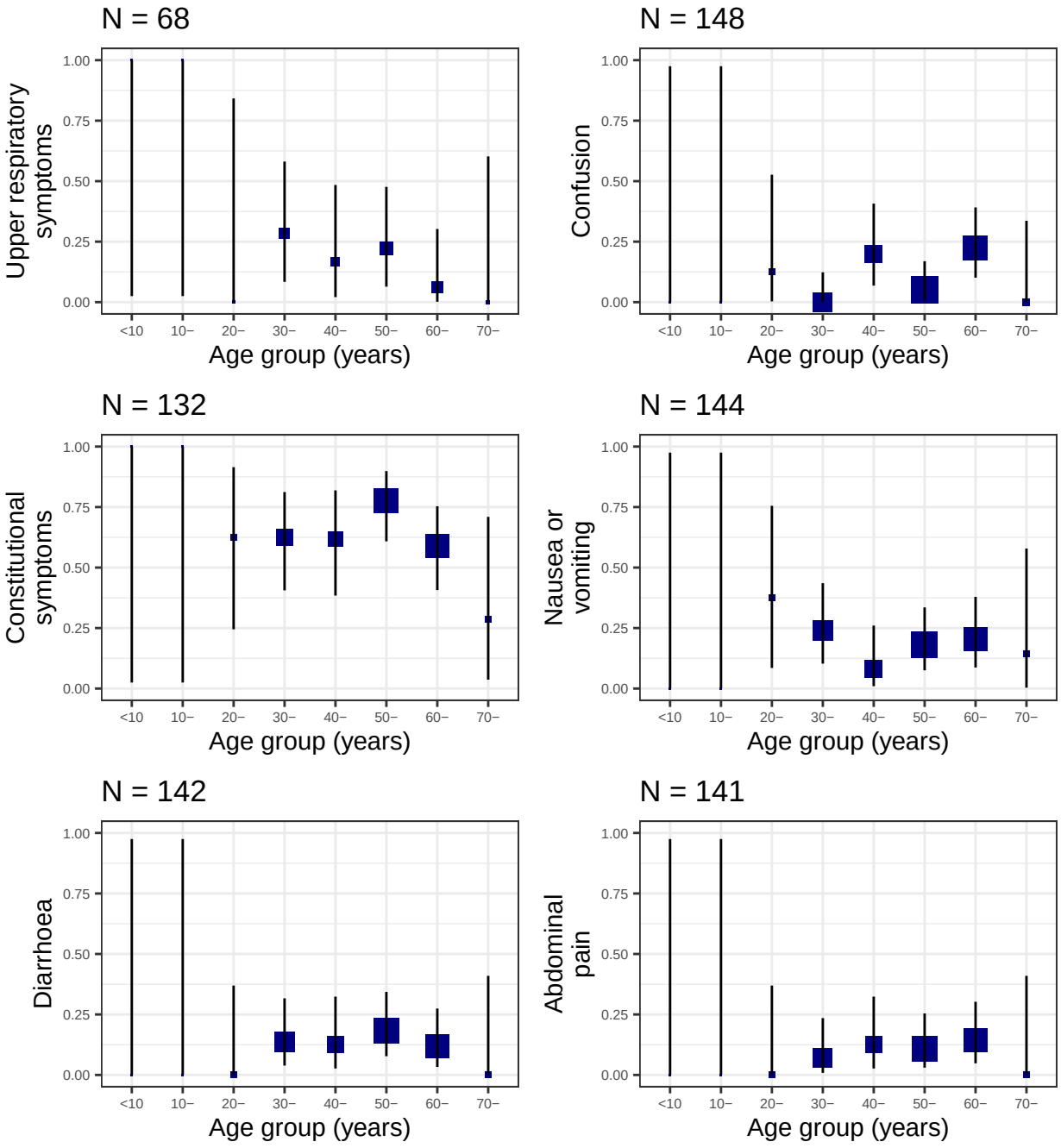

N = 68
Upper respiratory symptoms
1.00
0.75
0.50
0.25
0.00
<10
10–
20–
30–
40–
50–
60–
70–
Age group (years)
N = 148
Confusion
Age group (years)
N = 132
Constitutional symptoms
Age group (years)
N = 144
Nausea or vomiting
Age group (years)
N = 142
Diarrhoea
Age group (years)
N = 141
Abdominal pain
Age group (years)

Figure 6: Box and whisker plots for observations at hospital presentation stratified by age group. Outliers are omitted. N is the number of individuals included in the plot (this may vary between plots due to data completeness).

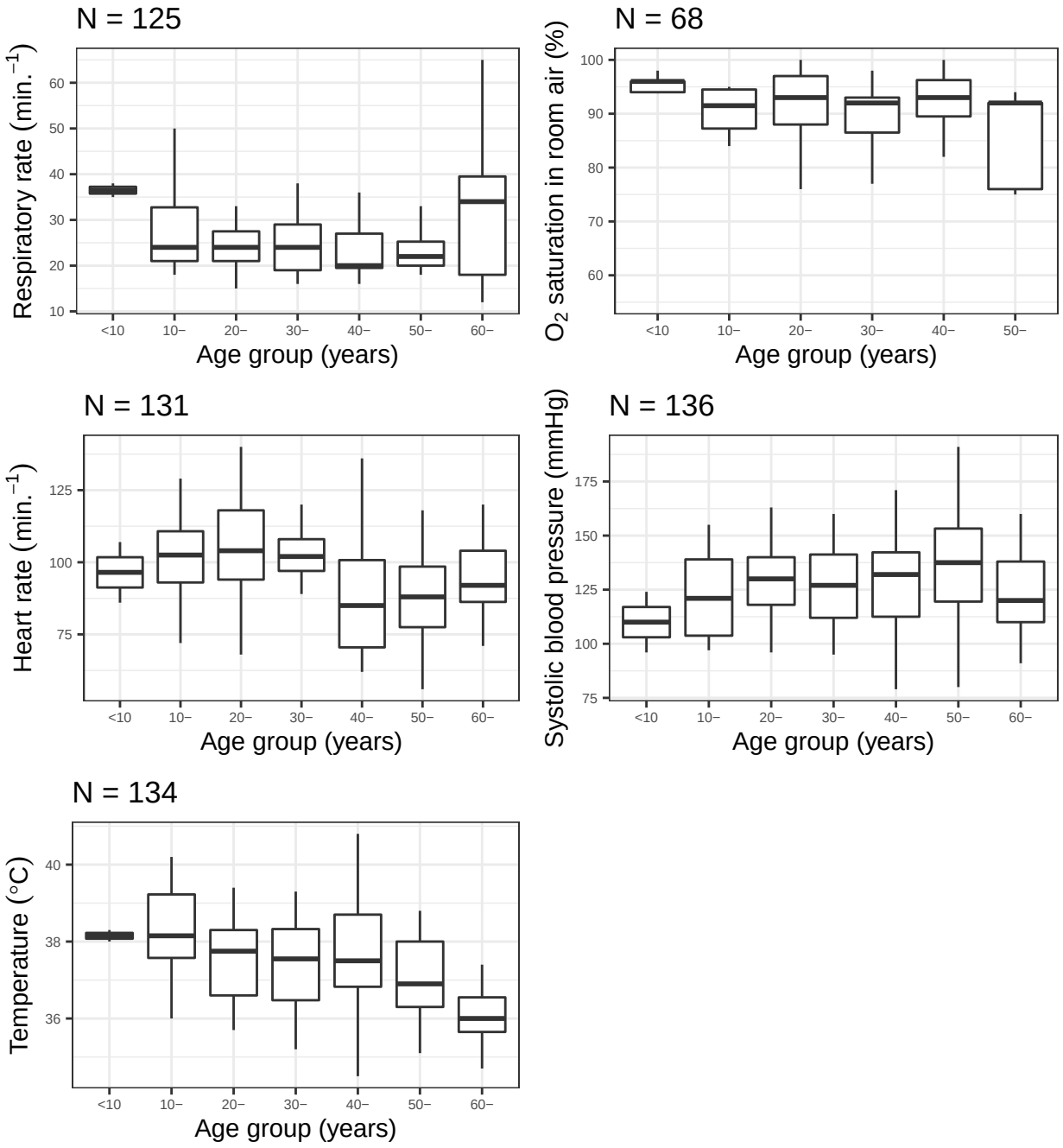
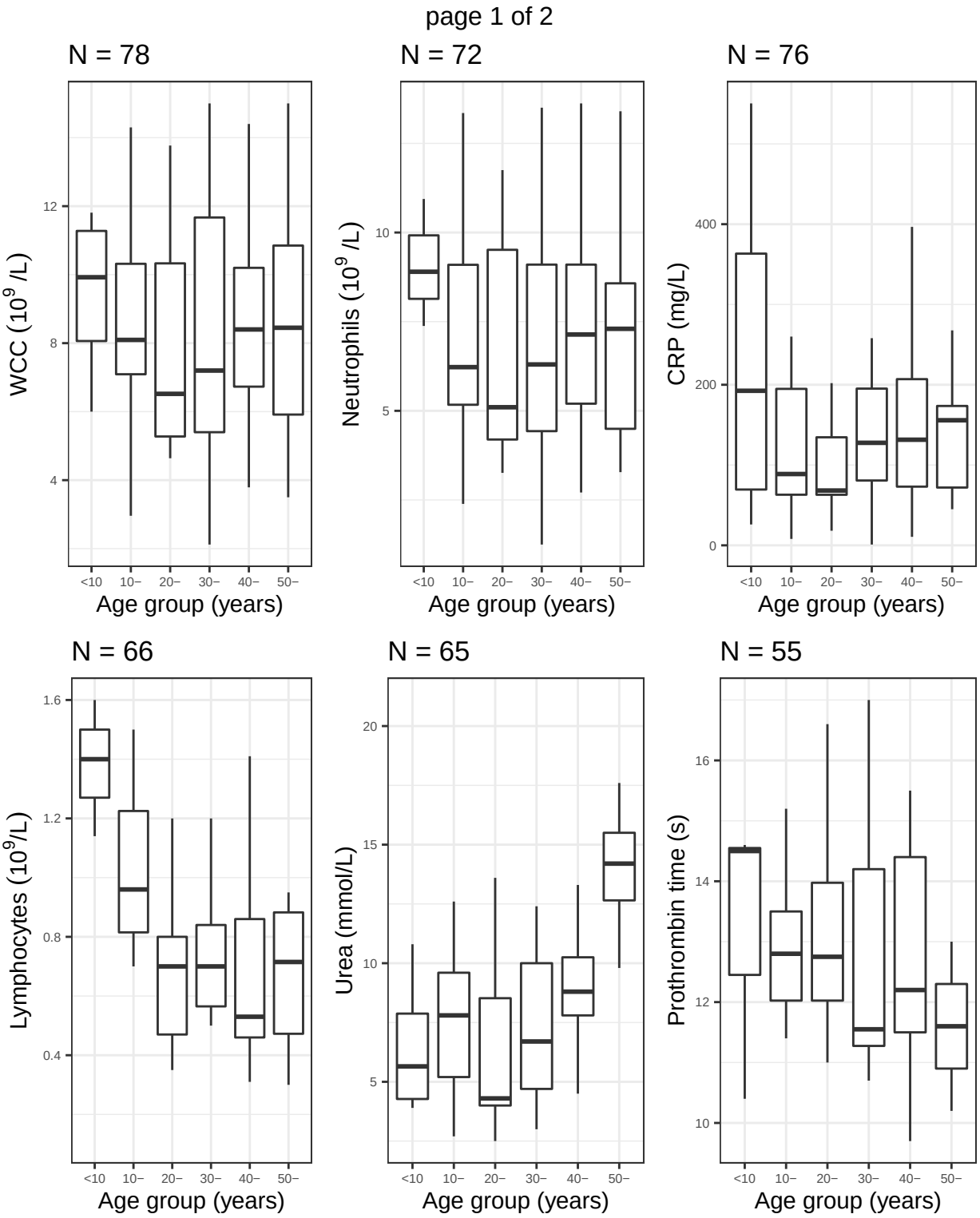
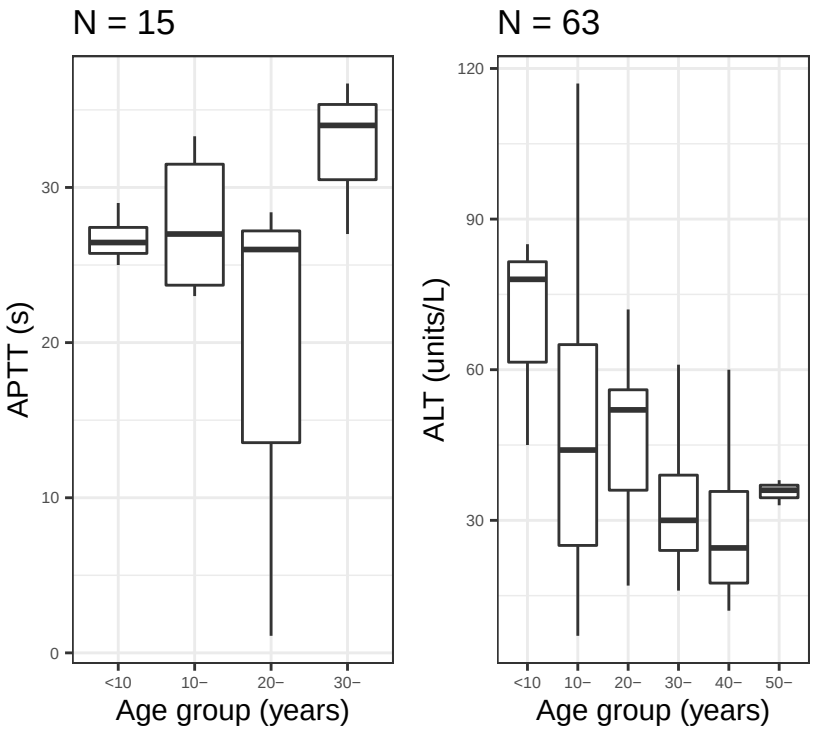
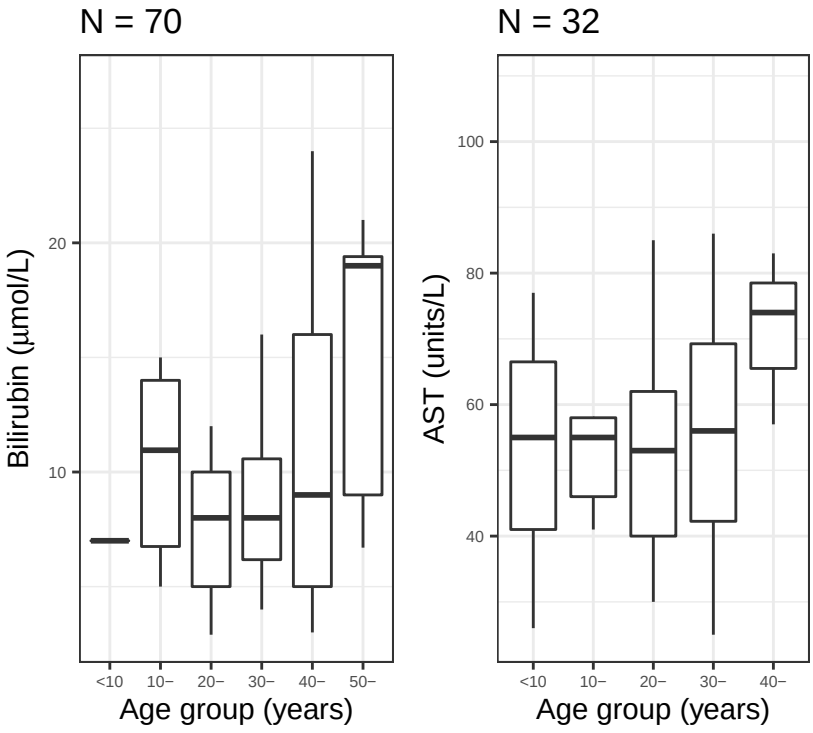


Figure 7: Box and whisker plots for laboratory results within 24 hours of hospital presentation stratified by age group. Outliers are omitted. N is the number of individuals included in the plot (this varies between plots due to data completeness). ALT, Alanine transaminase; APTT, Activated partial thromboplastin time; CRP, C-reactive protein




N = 15
APTT (s)
0
10
20
30
<10
10–
20–
30–
Age group (years)

N = 63
ALT (units/L)
30
60
90
120
<10
10–
20–
30–
40–
50–
Age group (years)


N = 70
Bilirubin (µmol/L)
10
20
<10
10–
20–
30–
40–
50–
Age group (years)

N = 32
AST (units/L)
40
60
80
100
<10
10–
20–
30–
40–
Age group (years)

Hospital stays and outcomes

Figure 8: Distribution of length of hospital stay, according to sex. This only includes cases with reported outcomes. The coloured areas indicate the kernel probability density of the observed data and the box plots show the median and interquartile range of the variable of interest. White dots are outliers.

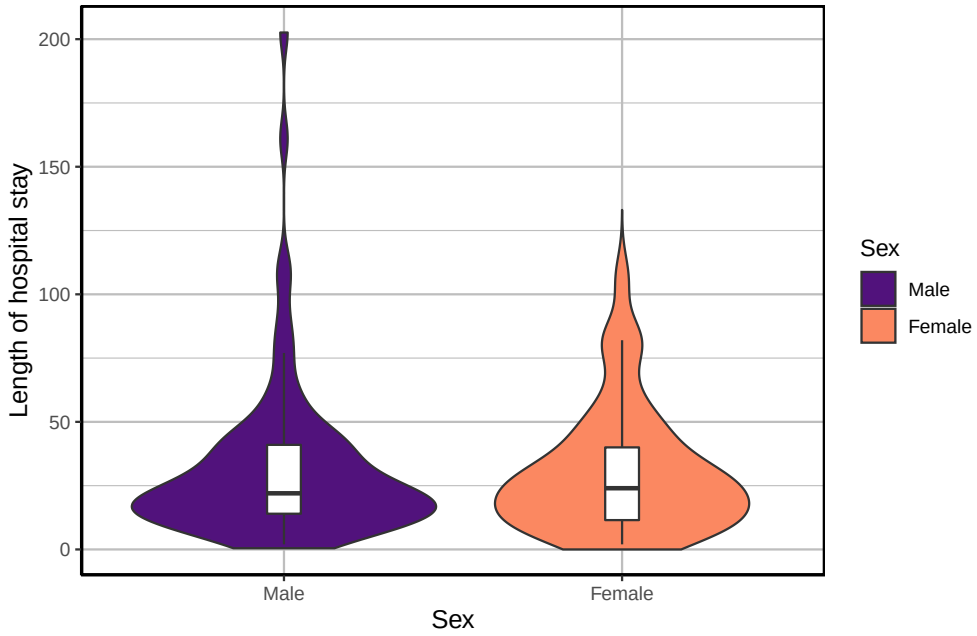


Figure 9: Distribution of length of hospital stay, according to patient age group. This only includes cases with reported outcomes. The coloured areas indicate the kernel probability density of the observed data and the box plots show the median and interquartile range of the variable of interest. White dots are outliers.

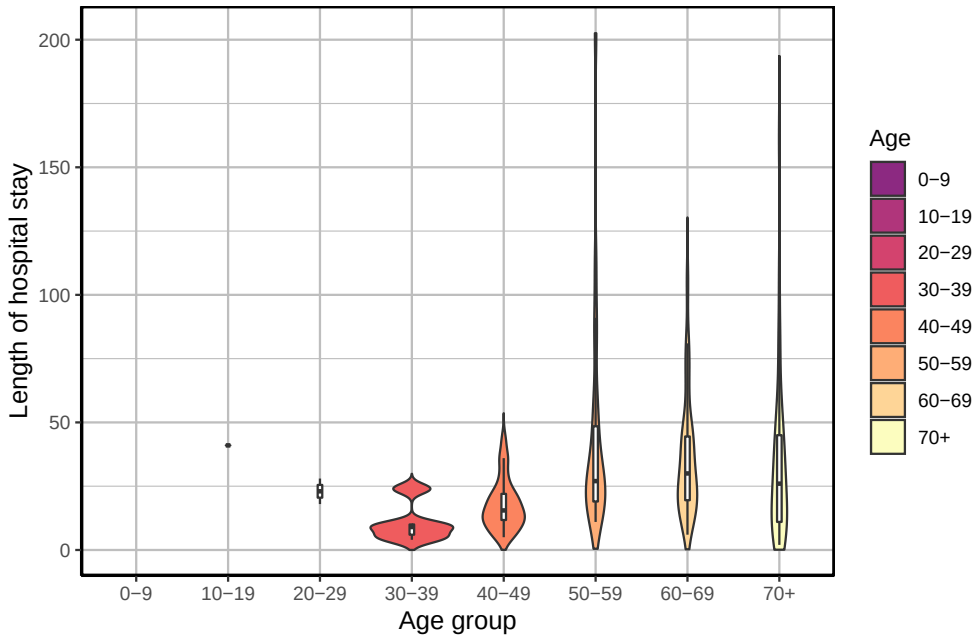


Figure 10: The distribution of patient status by number of days after admission. Patients with "Unknown" status have left the site at the time of report but have unknown outcomes due to missing data. Patients still on site at the time of report appear in the ongoing "ongoing care" for days which are in the future at that time. (For example, a patient admitted 7 days before the date of report and still on site at report would be categorised as "ongoing care" for days 8 and later.) The black line marks the end of 14 days; due to the cut-off, only a small number of patients appear in the "ongoing care" category left of this line.

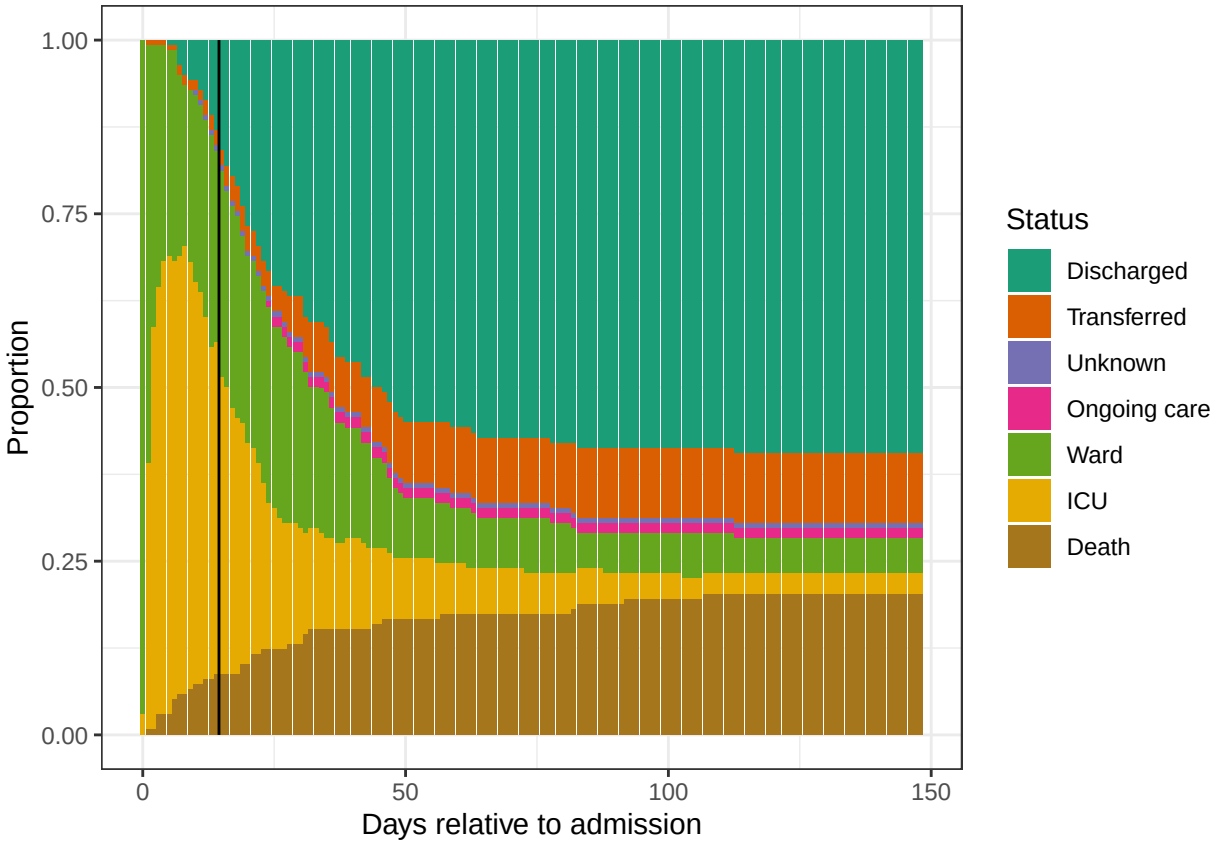
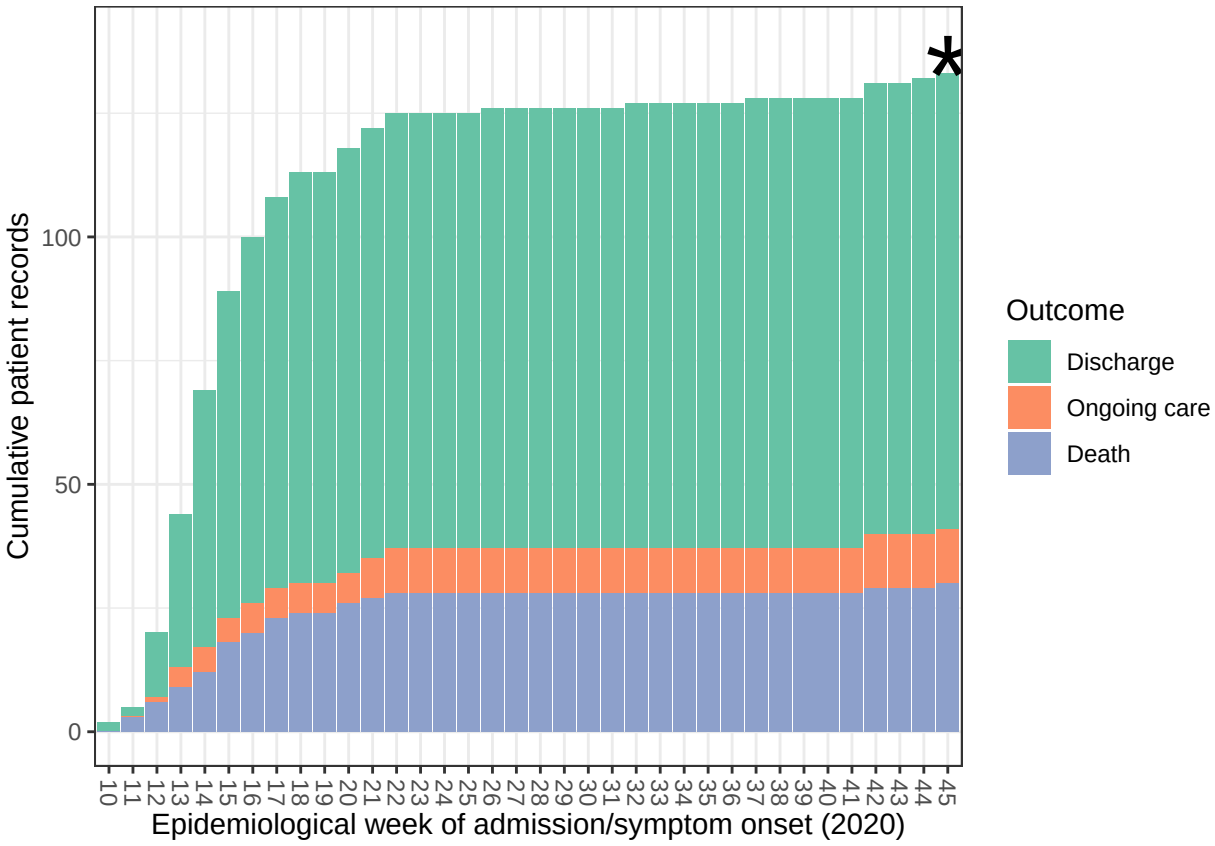


Figure 11: Patient numbers and outcomes by epidemiological week (of 2020) of admission (or, for patients infected in hospital, of symptom onset). The rightmost bar, marked with an asterisk, represents an incomplete week (due to the 14-day cutoff).



Treatment

Figure 12: Treatments used. This only includes patients for whom this information was recorded.

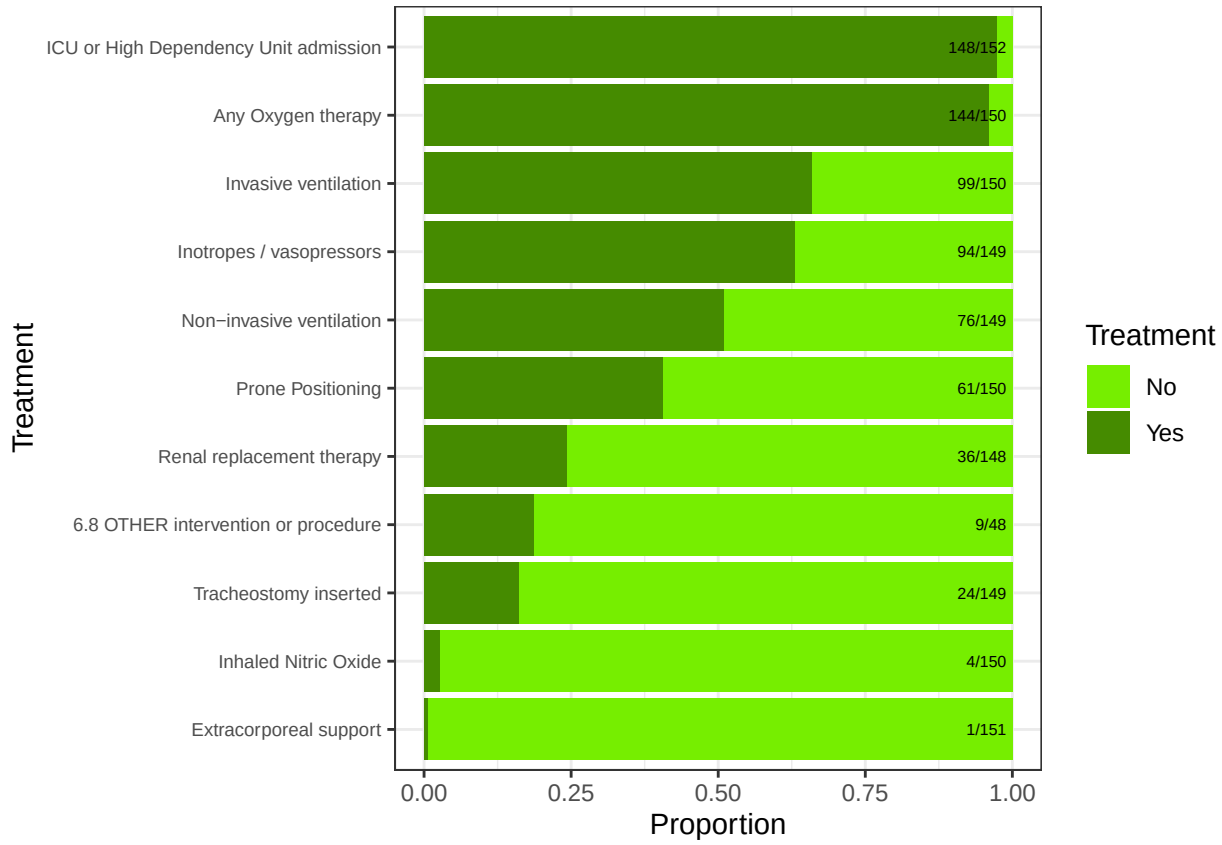
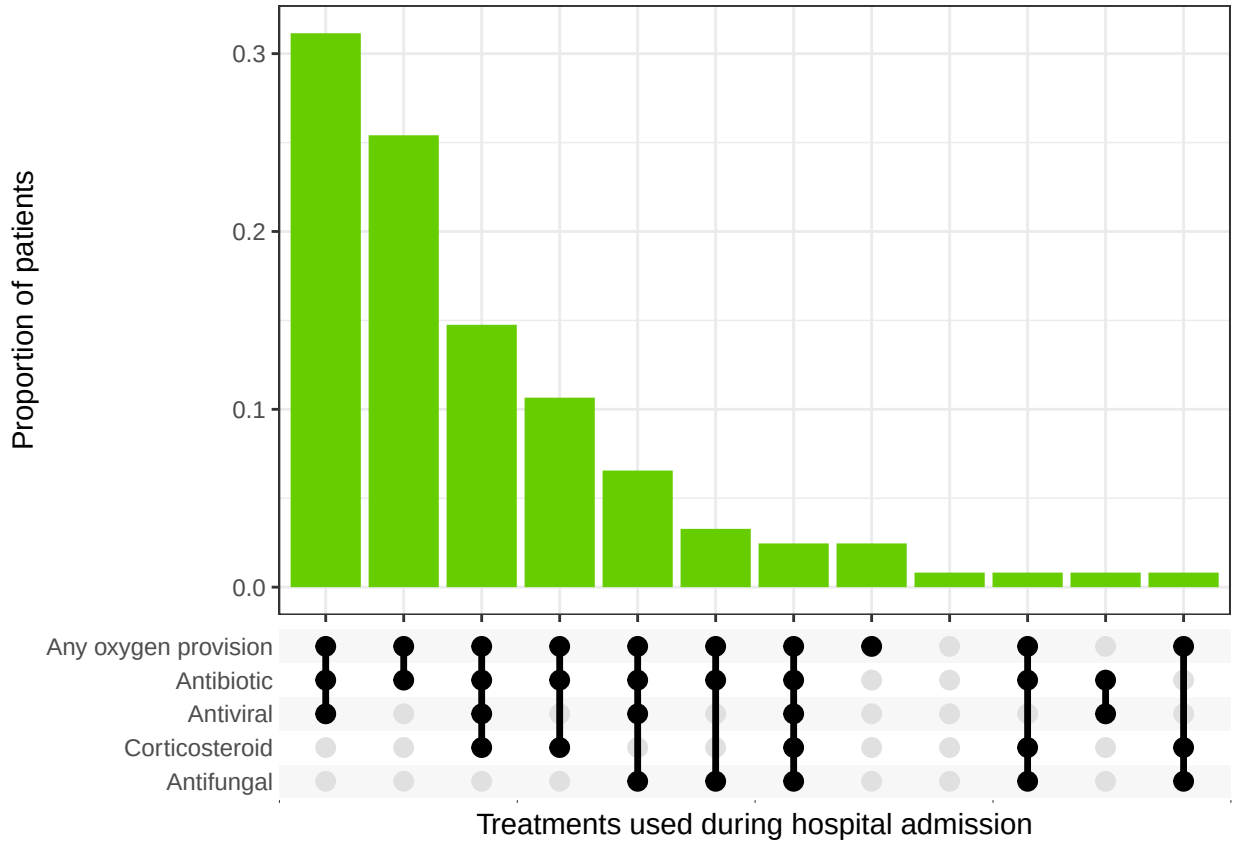


Figure 13: The distribution of combinations of antimicrobial treatments and steroids administered during hospital stay, across all patients with completed hospital stay and recorded treatment data. Filled and empty circles below the x-axis indicate treatments that were and were not administered.



Intensive Care and High Dependency Unit Treatments

Figure 14: Treatments used amongst patients admitted to the ICU. This only includes patients for whom this information was recorded.

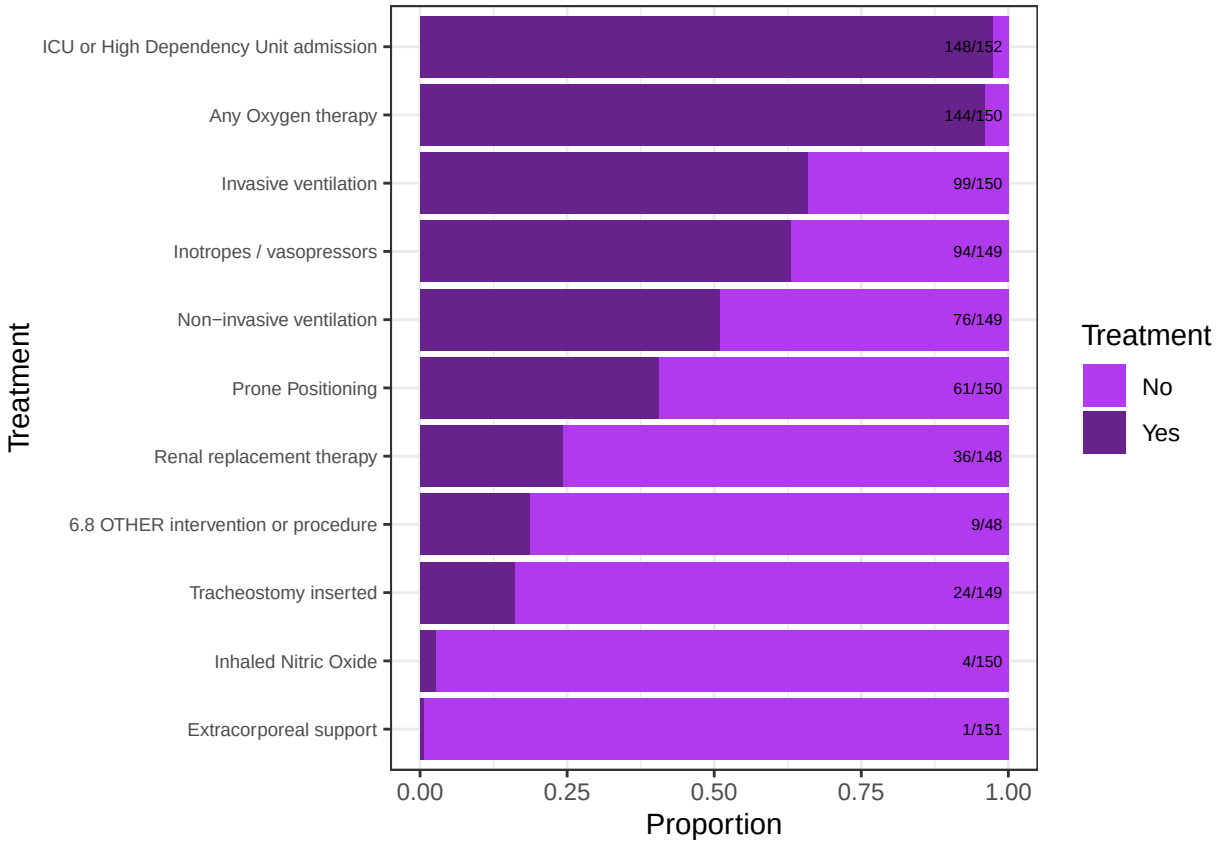


Figure 15: The distribution of combinations of treatments administered during ICU/HDU stay. Filled and empty circles below the x-axis indicate treatments that were and were not administered respectively.

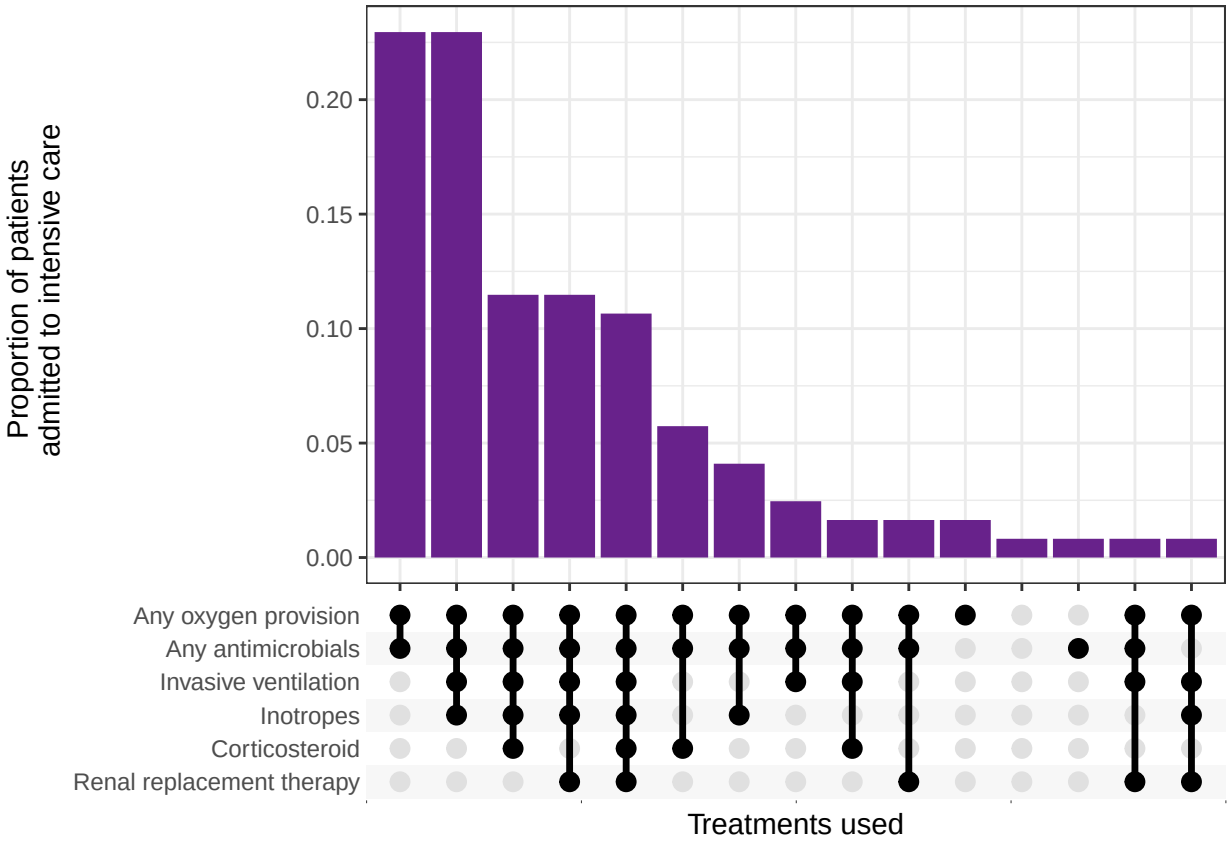
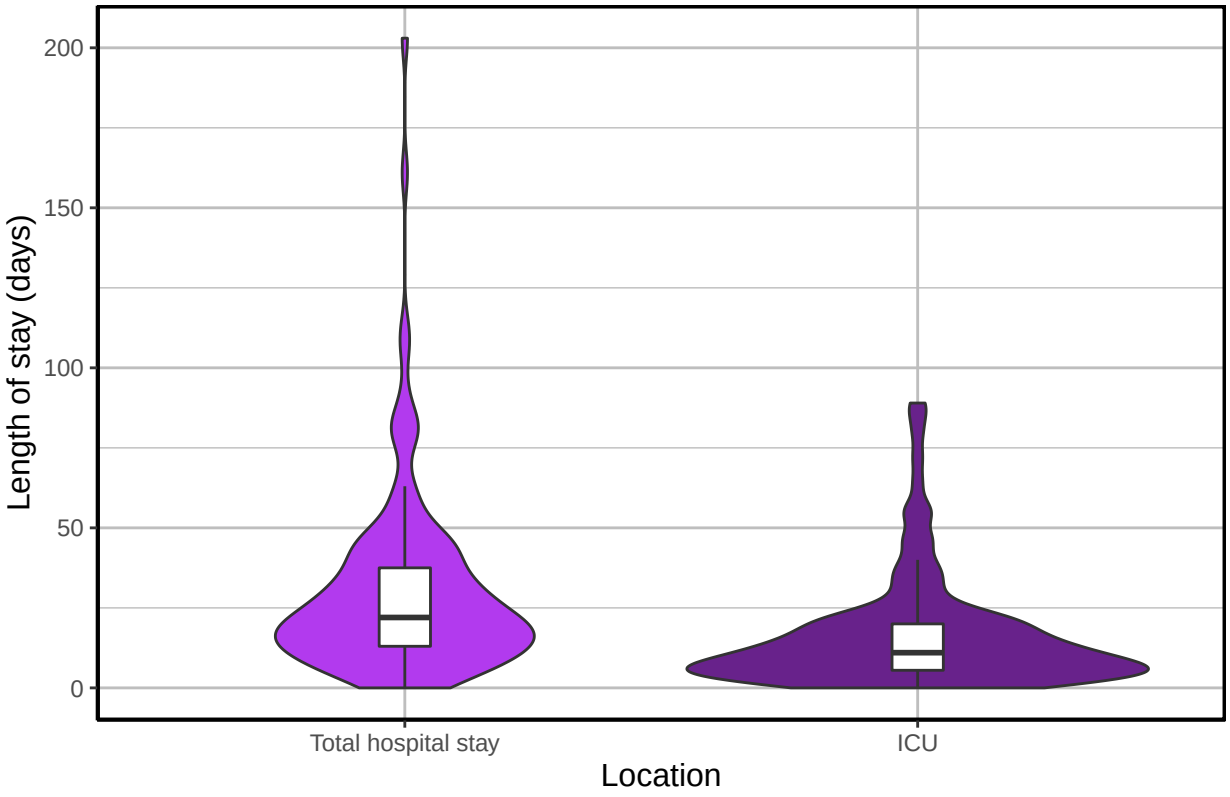


Figure 16: Distribution of lengths of stay for patients who were admitted to ICU/HDU: total length of stay for this group and length of stay within intensive care. This only includes cases with reported completed stays. The coloured areas indicate the kernel probability density of the observed data and the box plots show the mean and interquartile range of the variable of interest.



Statistical Analysis

Figure 17: Distribution of time from symptom onset to admission. The blue curve is the Gamma distribution fit to the data. The black dashed line indicates the position of the expected mean. Expected estimates, accounting for unobserved outcomes, are provided in the summary tables at the end of this report.

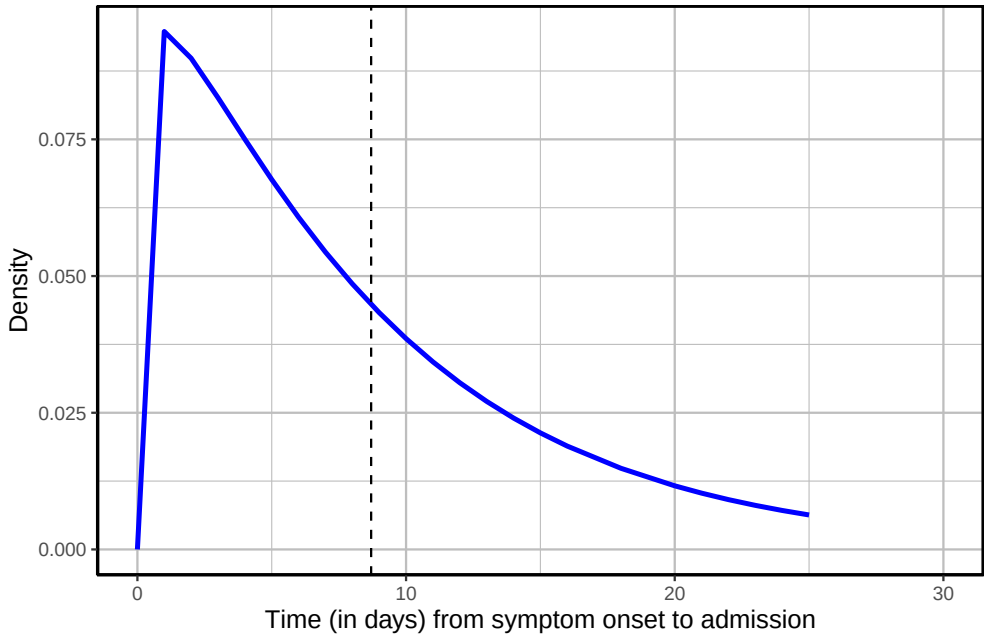


Figure 18: Distribution of time from admission to an outcome - either death or recovery (discharge). The blue curve is the Gamma distribution fit to the data. The black dashed line indicated the position of the expected mean.

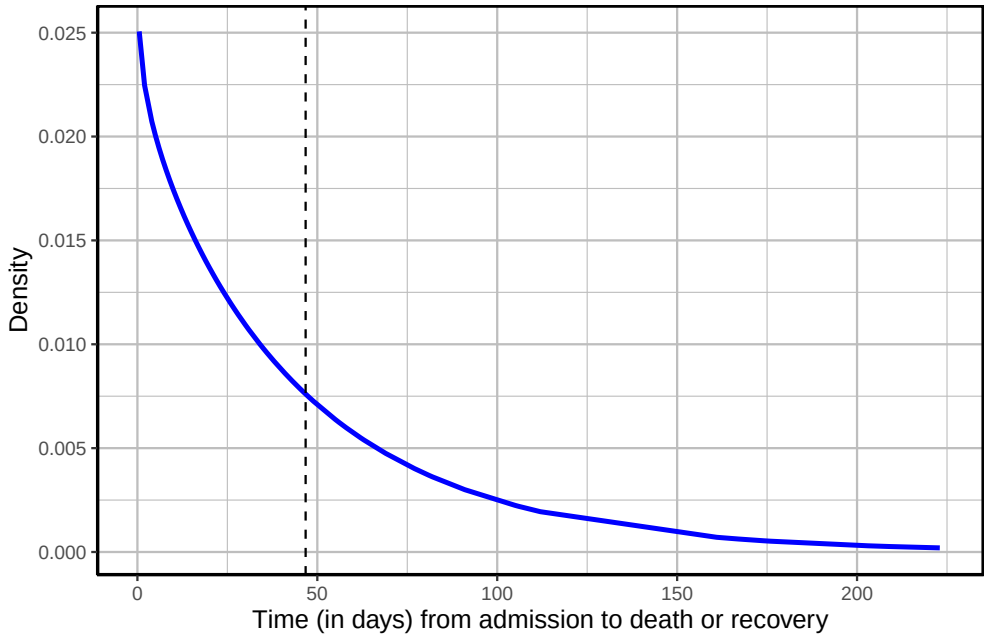
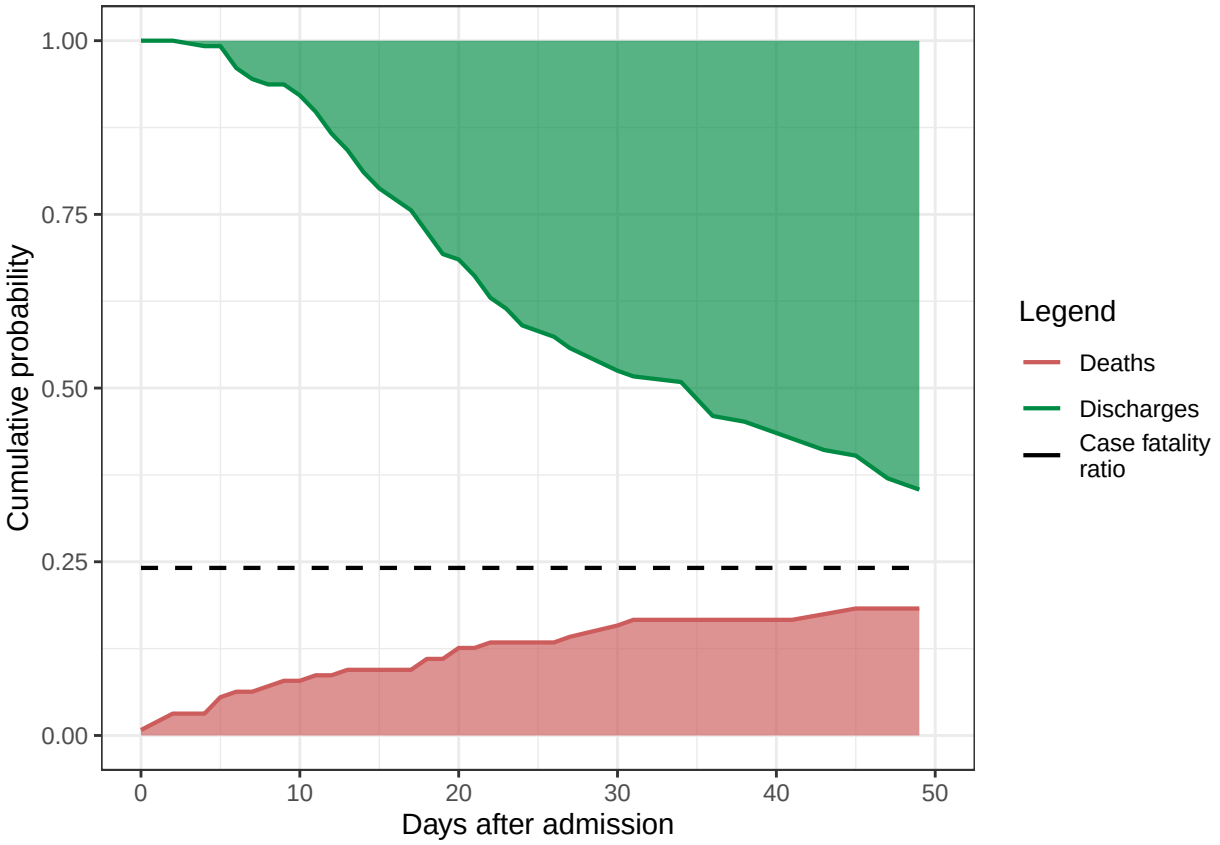


Figure 19: Nonparametric probabilities of death (red curve) and recovery (green curve) over time. The black line indicates the case fatality ratio (black). The method used here considers all cases, irrespective of whether an outcome has been observed. For a completed epidemic, the curves for death and recovery meet. Estimates were derived using a nonparametric Kaplan-Meier–based method proposed by Ghani *et al.* (2005).



Background

In response to the emergence of novel coronavirus (COVID-19), ISARIC launched a portfolio of resources to accelerate outbreak research and response. These include data collection, analysis and presentation tools which are freely available to all sites which have requested access to these resources. All data collection tools are designed to address the most critical public health questions, have undergone extensive review by international clinical experts, and are free for all to use. Resources are available on the ISARIC website and from the REDCAP administrator who can be contacted at sprintsari@ucd.ie

The ISARIC-COVID-19 CORE CASE REPORT FORM IRELAND, which was adopted from the ISARIC-WHO COVID-19 Case Record Form (CRF), enables the collection of standardised clinical data to inform patient management and public health response. These forms should be used to collect data on suspected or confirmed cases of COVID-19. The ISARIC-COVID-19 CORE CASE REPORT FORM IRELAND can be obtained from the SPRINT-SARI coordinator at sprintsari@ucd.ie.

To support researchers to retain control of the data and samples they collect, ISARIC also hosts a data platform, where data can be entered to a web-based REDCap data management system, securely stored, and used to produce regular reports on their sites as above. Data contributors are invited to input on the methods and contents of the reports, and can also contribute to the aggregated data platform which aggregates site-specific data from all other sites across the world who are using this system. For more information, visit the ISARIC website.

All decisions regarding data use are made by the institutions that enter the data. ISARIC keeps contributors informed of any plans and welcomes their input to promote the best science and the interests of patients, institutions and public health authorities. Feedback and suggestions are welcome at sprintsari@ucd.ie.

Methods

Patient details were submitted electronically by Ireland to the ISARIC database. Relevant background and presenting symptoms were recorded on the day of study recruitment. Daily follow-up was then completed until recovery or death. A final form was completed with details of treatments received and outcomes. All categories that represent fewer than five individuals have been suppressed to avoid the potential for identification of participants.

Graphs have been used to represent the age distribution of patients by sex and status (dead, recovered & still in hospital), the prevalence of individual symptoms on admission, comorbidities on admission, the length of hospital stay by sex and age group and the distribution of patient statuses by time since admission. In addition, the number of cases recruited by country and site, as well as the case count by status, has been represented.

Using a non-parametric Kaplan-Meier-based method (Ghani *et al.*, 2005), the case- fatality ratio (CFR) was estimated, as well as probabilities for death and recovery. This method estimates the CFR with the formula $a/(a+b)$, where a and b are the values of the cumulative incidence function for deaths and recoveries respectively, estimated at the last observed time point. In a competing risk context (i.e. where there are multiple endpoints), the cumulative incidence function for an endpoint is equal to the product of the hazard function for that endpoint and the survival function assuming a composite endpoint. It is worth noting that this method assumes that future deaths and recoveries will occur with the same relative probabilities as have been observed so far. Binomial confidence intervals for the CFR were obtained by a normal approximation (See Ghani *et al.*, (2005)).

To obtain estimates for the distributions of time from symptom onset to hospital admission and the time from admission to outcome (i.e. death or recovery), Gamma distributions were fitted to the observed data, accounting for unobserved outcomes. Parameters were estimated by a maximum likelihood procedure and confidence intervals for the means and variances were obtained by bootstrap.

All analysis were performed using the R statistical software (R Core Team, 2019).

Caveats

Patient data are collected and uploaded from start of admission, however a complete patient data set is not available until the episode of care is complete. This causes a predictable lag in available data influenced by the duration of admission which is greatest for the sickest patients, and accentuated during the up-phase of the outbreak.

Summary Tables

Proportions are presented in parantheses. Proportions have been rounded to two decimal places.

Table 1: Patient Characteristics

Description	Value
Size of cohort	156
By sex	
Male	107 (0.69)
Female	48 (0.31)
Unknown	1 ($5.5511151 \times 10^{-17}$)
By outcome status	
Dead	30 (0.19)
Recovered (discharged alive)	93 (0.6)
Still in hospital	11 (0.07)
Tranferred to another facility	22 (0.14)
Unknown	0 (0)
By COVID-19 status	
Positive (laboratory-confirmed)	156 (1.0)
Suspected	0 (0)
By age group	
0-9	0 (0)
10-19	1 (0.01)
20-29	2 (0.01)
30-39	8 (0.05)
40-49	30 (0.19)
50-59	27 (0.17)
60-69	40 (0.26)
70+	46 (0.29)
Unknown	2 (0.01)

Table 2: Prevalence of Symptoms

Symptoms	Present	Absent	Unknown
Shortness of breath	115 (0.74)	39 (0.25)	2 (0.01)
History of fever	111 (0.71)	40 (0.26)	5 (0.03)
Cough	97 (0.62)	42 (0.27)	17 (0.11)
Fatigue / Malaise	78 (0.5)	66 (0.42)	12 (0.08)
Muscle aches	35 (0.22)	106 (0.68)	15 (0.1)

Symptoms	Present	Absent	Unknown
Vomiting / Nausea	27 (0.17)	118 (0.76)	11 (0.07)
Sore throat	22 (0.14)	121 (0.78)	13 (0.08)
Headache	20 (0.13)	123 (0.79)	13 (0.08)
Diarrhoea	18 (0.12)	125 (0.8)	13 (0.08)
Chest pain	17 (0.11)	128 (0.82)	11 (0.07)
Altered consciousness / confusion	16 (0.1)	133 (0.85)	7 (0.04)
Abdominal pain	14 (0.09)	128 (0.82)	14 (0.09)
Joint pain	11 (0.07)	129 (0.83)	16 (0.1)
Runny nose	5 (0.03)	136 (0.87)	15 (0.1)
Wheezing	4 (0.03)	132 (0.85)	20 (0.13)
Bleeding	3 (0.02)	144 (0.92)	9 (0.06)
Conjunctivitis	0 (0)	147 (0.94)	9 (0.06)
4a.5. Ear pain	0 (0)	70 (0.45)	86 (0.55)
Lymphadenopathy	0 (0)	145 (0.93)	11 (0.07)
Skin rash	0 (0)	145 (0.93)	11 (0.07)
4a.20. Skin ulcers	0 (0)	72 (0.46)	84 (0.54)
NA	NA (NA)	NA (NA)	NA (NA)

Table 3: Prevalence of Comorbidities

Comorbidities	Present	Absent	Unknown
Other relevant risk factor(s)	62 (0.4)	92 (0.59)	2 (0.01)
Hypertension	39 (0.25)	40 (0.26)	77 (0.49)
Chronic cardiac disease	36 (0.23)	118 (0.76)	2 (0.01)
Diabetes	36 (0.23)	117 (0.75)	3 (0.02)
Obesity	35 (0.22)	113 (0.72)	8 (0.05)
Chronic kidney disease	21 (0.13)	134 (0.86)	1 (0.01)
Asthma	20 (0.13)	134 (0.86)	2 (0.01)
Malignant neoplasm	15 (0.1)	140 (0.9)	1 (0.01)
Chronic neurological disorder	13 (0.08)	142 (0.91)	1 (0.01)
Chronic pulmonary disease	13 (0.08)	139 (0.89)	4 (0.03)
Smoking	9 (0.06)	83 (0.53)	64 (0.41)
Chronic hematologic disease	7 (0.04)	148 (0.95)	1 (0.01)
Malnutrition	3 (0.02)	151 (0.97)	2 (0.01)
4b.10. AIDS/HIV	1 (0.01)	83 (0.53)	72 (0.46)
Dementia	1 (0.01)	154 (0.99)	1 (0.01)

Table 4: Prevalence of Treatments

The counts presented for treatments include all cases, not only cases with complete details of treatments (as expressed in the summary).

Treatments	Present	Absent	Unknown
ICU or High Dependency Unit admission	148 (0.95)	4 (0.03)	4 (0.03)
Oxygen therapy	147 (0.94)	8 (0.05)	1 (0.01)
Invasive ventilation	104 (0.67)	51 (0.33)	1 (0.01)
Inotropes / vasopressors	94 (0.6)	55 (0.35)	7 (0.04)
Non-invasive ventilation	87 (0.56)	68 (0.44)	1 (0.01)
Prone Positioning	61 (0.39)	88 (0.56)	7 (0.04)

Treatments	**Present**	**Absent**	**Unknown**
Renal replacement therapy	36 (0.23)	112 (0.72)	8 (0.05)
Tracheostomy inserted	24 (0.15)	125 (0.8)	7 (0.04)
6.8 OTHER intervention or procedure	9 (0.06)	37 (0.24)	110 (0.71)
Inhaled Nitric Oxide	4 (0.03)	145 (0.93)	7 (0.04)
Extracorporeal membrane oxygenation (ECMO)	3 (0.02)	152 (0.97)	1 (0.01)
NA	NA (NA)	NA (NA)	NA (NA)
NA	NA (NA)	NA (NA)	NA (NA)
NA	NA (NA)	NA (NA)	NA (NA)

Table 5: Key time variables.

Unlike the observed mean, the estimation process of the **expected mean** accounts for all cases, irrespective of whether an outcome has been observed. The expected mean is 'NA' for those variables for which parameter estimation could not be performed, due to the high proportion of unobserved end dates. The interquartile range is abbreviated 'IQR'.

Time (in days)	Mean (observed)	SD (observed)	Median (observed)	IQR (observed)	Expected mean (95% CI)
Length of hospital stay	32.4	34.6	22	28	46.8 (44.3, 50.1)
Symptom onset to admission	9.1	8.7	6	7	8.7 (8.4, 9.5)
Admission to ICU entry	5.5	9	1	5	5.5 (5, 6)
Duration of ICU	16	17	11	15	NA
Admission to IMV	6.8	12.9	1	4.5	6.8 (6.3, 7.5)
Duration of IMV	17.3	17.2	12	14.2	NA
Admission to NIV	6.4	11.3	2	5.2	6.4 (6, 7)
Duration of NIV	3.7	5.9	1	5.2	NA

ISARIC Team Members

This report is made possible through the efforts and expertise of the staff collecting data at our partner institutions in Ireland. For a list of global partners and team members, please visit https://isaric.tghn.org/covid-19-data-management-hosting-contributors/.

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The Management Committee for Ireland contains the persons above and Peter Doran, Kathy Brickell and Kate Ainscough.

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