

## ISARIC COVID-19 Clinical Data Report

### Final report January 2020 – January 2023

*International Severe Acute Respiratory and emerging Infections Consortium*

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\*group members, participating institutions and funders are listed at end of the report

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### Abstract

ISARIC (International Severe Acute Respiratory and emerging Infections Consortium) partnerships and outbreak preparedness initiatives enabled the rapid launch of standardised clinical data collection on COVID-19 in Jan 2020. Extensive global participation has resulted in a large, standardised collection of comprehensive clinical data from hundreds of sites across dozens of countries. Data are analysed regularly and reported publicly to inform patient care and public health response. This report, our 18th and final report, is a part of a series published over 3 years. Data have been entered for 945,317 individuals from 1807 partner institutions and networks across 76 countries.

The comprehensive analyses detailed in this report includes hospitalised individuals of all ages for whom data collection occurred between 30 January 2020 and up to and including 10 January 2023, AND who have laboratory-confirmed SARS-CoV-2 infection or clinically diagnosed COVID-19.

For the 845,291 cases who meet eligibility criteria for this report, selected findings include:

- Median age of 57 years, with an approximately equal (50/50) male:female sex distribution
- 29% of the cohort are at least 70 years of age, whereas 6% are 0-19 years of age
- The most common symptom combination in this hospitalised cohort is shortness of breath, cough, and history of fever, which has remained constant over time
- The five most common symptoms at admission were shortness of breath, cough, history of fever, fatigue/malaise, and altered consciousness/confusion, which is unchanged from the previous reports
- Age-associated differences in symptoms are evident, including the frequency of altered consciousness increasing with age, and fever, respiratory and constitutional symptoms being present mostly in those 40 years and above
- 15% of patients with relevant data available (845,291) were admitted at some point during their illness into an intensive care unit (ICU), which has decreased from 19% during the 3 years of ISARIC reporting
- Antibiotic agents were used in 37% of patients for whom relevant data are available (802,241), a significant reduction from our previous reports (80%) which reflects a shifting proportion of data contributed by different institutions; in ICU/HDU admitted patients with data available (64,669), 90% received antibiotics
- Use of corticosteroids was reported in 25% of all patients for whom data were available (809,043); in ICU/HDU admitted patients with data available (64,713), 71% received corticosteroids
- Outcomes are known for 762,728 patients and the overall estimated case fatality ratio (CFR) is 22% (95%CI 21.9-22), rising to 36% (95%CI 35.6-36.1) for patients who were admitted to ICU/HDU, demonstrating worse outcomes in those with the most severe disease

To access previous versions of **ISARIC COVID-19 Clinical Data Report** please use the link below:

<https://isaric.org/research/covid-19-clinical-research-resources/evidence-reports/>

NOTE: This preprint reports new research that has not been certified by peer review and should not be used to guide clinical practice.



## ISARIC (International Severe Acute Respiratory and Emerging Infections Consortium)

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

### **COVID-19 Report: Final report January 2020 - January 2023**

#### **Background**

This report describes the clinical presentation, treatment and outcome of a cohort of over 945,000 patients with COVID-19 hospitalised between January 2020 and January 2023 in 76 countries. This has been possible thanks to 1807 institutions and their clinical teams contributing to ISARIC (International Severe Acute Respiratory and Emerging Infection Consortium), a grassroots collaboration <https://isaric.org/>.

After over 750 million cases and over 6 million deaths, COVID-19 has shown us how pandemics disrupt populations by stretching healthcare systems, and shaking economies. Although clinicians and well-equipped surveillance systems can adapt to health emergencies by implementing new treatments and information systems, clinical research lacks this agility.

**The advantages of an international standardised case record form.** Novel diseases are, by definition, new; the scientific method is not. By developing consensus on a road map for clinical research methods before a pandemic, we are able to minimise further time defining study types, data collection tools, and potential outputs for evidence summarisation once the pathogen emerges. Using slightly adjusted standardised methods for novel diseases, evidence can be generated quickly.

While small observational studies are easy to conduct, they often record different data or may record variables in different ways. This may not allow data to be collated or findings to be compared across studies, or combined to produce a more powerful and accurate representation. In contrast, large international observational studies with a standardised form allow for international data comparisons, improved analytic control of confounders, and therefore enable the acquisition of high levels of evidence.

**How we got here with ISARIC:** In 2013, ISARIC and the World Health Organisation (WHO) implemented the standardised Clinical Characterisation Protocol to evolve clinical data into research evidence during health emergencies.

In January 2020, we launched our case report form when only 846 COVID-19 cases had been reported globally. The first patient was enrolled on 30 January 2020. Today, our partners have collected standardised, in-hospital clinical data from over 945,000 patients, in 1807 sites, across 76 countries. More than half of these patients live in low- and middle-income countries. This partner-fuelled initiative is to our knowledge the largest COVID-19 in-hospital international database in the world.

In this report, we present the current state of our database, which all our collaborators can access by submitting a statistical analysis plan to our clinical team. We encourage our collaborators to test their

research hypothesis within the framework of ISARIC's collaborative Partner Analysis scheme [2]. The majority of this database is additionally available to external researchers via application to our Data Access Committee at <https://www.iddo.org/covid19/data-sharing/accessing-data>

These analyses are available on the ISARIC COVID-19 Dashboard at <https://livedataoxford.shinyapps.io/CovidClinicalDataDashboard/>

To contribute, please contact [data@isaric.org](mailto:data@isaric.org)

## Methods

The results in this report were produced using data from the ISARIC COVID-19 database of international, prospective observational data on clinical features of patients admitted to hospital with COVID-19. Data collection was structured on the ISARIC/WHO Clinical Characterisation Protocol for Severe Emerging Infections, a standardized protocol for investigation of severe acute infections by pathogens of public health interest [3] and the ISARIC case report forms [4] designed for standardized data collection from the start of an outbreak and rapid dissemination of clinical information [5-9]. Data were collected on Research electronic Data Capture (REDCap, version 8.11.11, Vanderbilt University, Nashville, Tenn.), hosted by the University of Oxford. Additional data, collected using a wide variety of data systems, were submitted by international investigators who were not using the University of Oxford REDCap instance. Data were curated by the Infectious Diseases Data Observatory [10] to the CDISC Study Data Tabulation Model (SDTM) for harmonised analysis [11].

SDTM formatted data were processed in R 4.1.0 [12]. Initial data cleaning included custom scripts designed to identify results of laboratory SARS-CoV-2 testing, and to standardise nomenclature for comorbidities, symptoms at admission, treatments, and outcomes.

Patients were excluded if they did not have laboratory or clinically confirmed SARS-CoV-2 infection. Patients were considered to be lost to follow up if either a) they were transferred to another facility, or b) they had an unknown outcome and the last date upon which any data was recorded for them was 45 days or before the date of data extraction. Patients with unknown outcome where the last recorded data was less than 45 days old were instead categorised as receiving ongoing care.

Comorbidities, symptoms at admission, and treatments (in both the full population and the intensive care unit (ICU)/high dependency unit (HDU) population) were included in the report only if at least 10% of patients had their presence or absence recorded. Laboratory and vital sign measurements that fell within the top 2.5% and bottom 2.5% of values, within both the <10 year age group and the ≥ 10 year age group, were taken to be likely mis-entered and changed to missing for this report. Similarly, variables for time durations were converted to missing if their values were either negative or in the top 2.5% of values. Dates were converted to missing where they were before the 1st January 2020 (except for dates of birth and hospital admission) or after the date of data extraction.

The following COVID-19 symptom definitions were used:

- WHO:
  1. A combination of acute fever and cough,  
Or
  2. A combination of three or more of: fever, cough, general weakness and fatigue, headache, myalgia (we used muscle aches, joint pain), sore throat, coryza (we used runny nose), dyspnoea (we used shortness of breath), anorexia, nausea and vomiting, diarrhoea, altered mental status (we used altered consciousness or confusion)

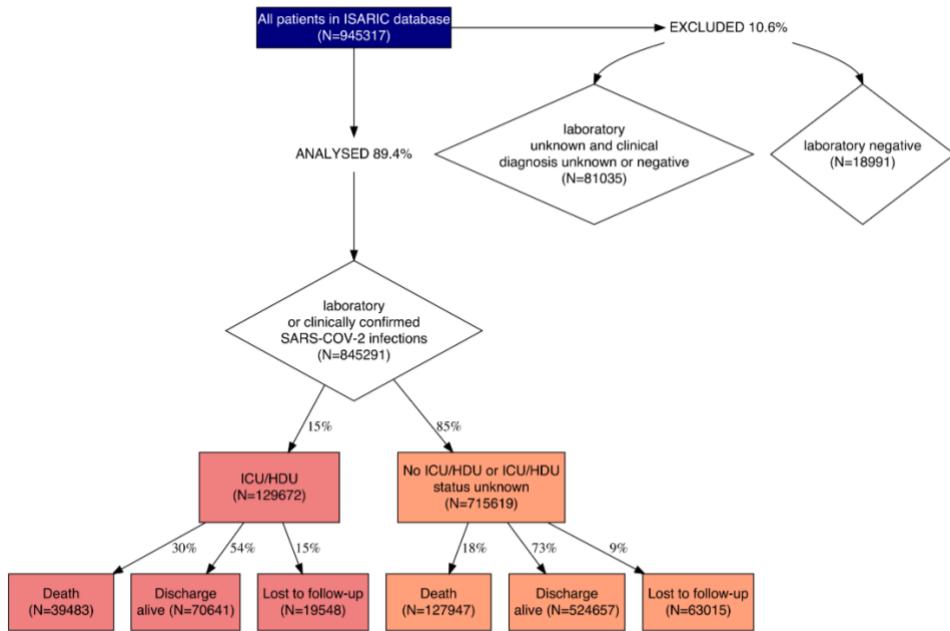
- Centers for Disease Control (CDC), United States:
  1. At least two of: fever, chills (not available), rigors (not available), myalgia, headache, sore throat, new olfactory and taste disorder,  
Or
  2. At least one of: cough, shortness of breath, difficulty breathing (not available)
- UK Health Security Agency:  
New cough (we used cough), or temperature  $\geq 37.8^{\circ}\text{C}$  (we used history of fever), or a loss or change in sense of smell or taste
- European Centre for Disease Prevention and Control:  
At least one of: cough, fever, shortness of breath, sudden onset anosmia, ageusia or dysgeusia

Data analysis was performed using the tidyverse collection of packages [13], as well as ff [14] and dplyr [15]. Data visualisation used ggplot [16] and its extension ggupset [17]. The report was generated using knitr [18]. This report included individuals for whom data collection commenced on or before 10 January 2023.

## Results

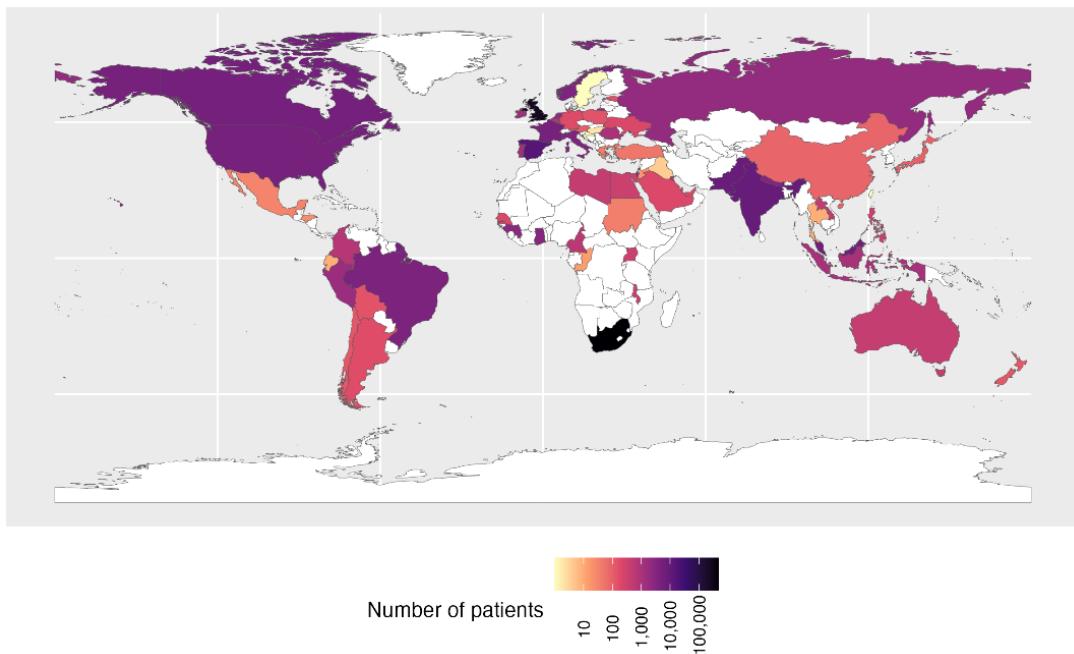
The flowchart (Figure 1) gives an overview of the cohort and outcomes as of 10 January 2023.

**Figure 1:** Overview of cohort and outcomes as of 10 January 2023.

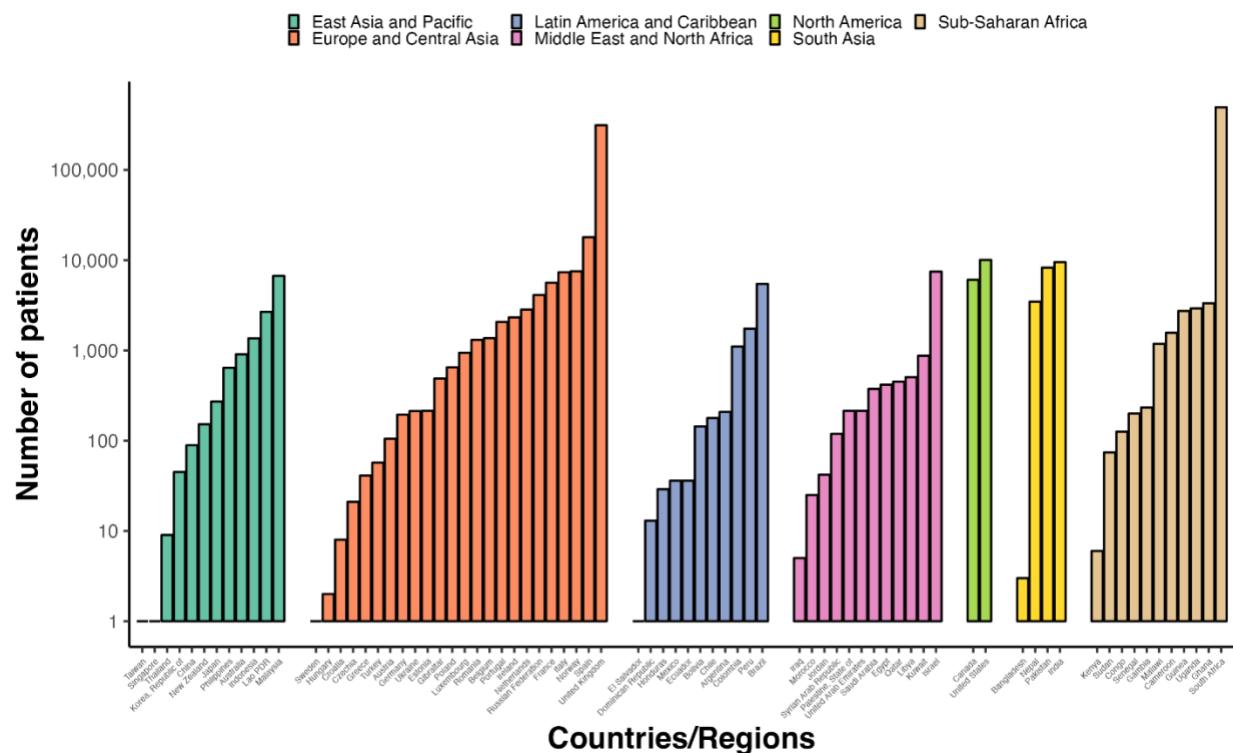


Data were contributed by 1807 sites in 76 countries (see Figure 2). 555635 (58.8%) of the patients were from low- and middle-income and 389603 (41.2%) from high-income countries. The two largest contributors to the database were South Africa (56.5%) and the UK (31.5%). Plots grouped by regions and calendar time are shown in Figure 3 and 4. The cohort satisfying the inclusion criteria had **845291** cases.

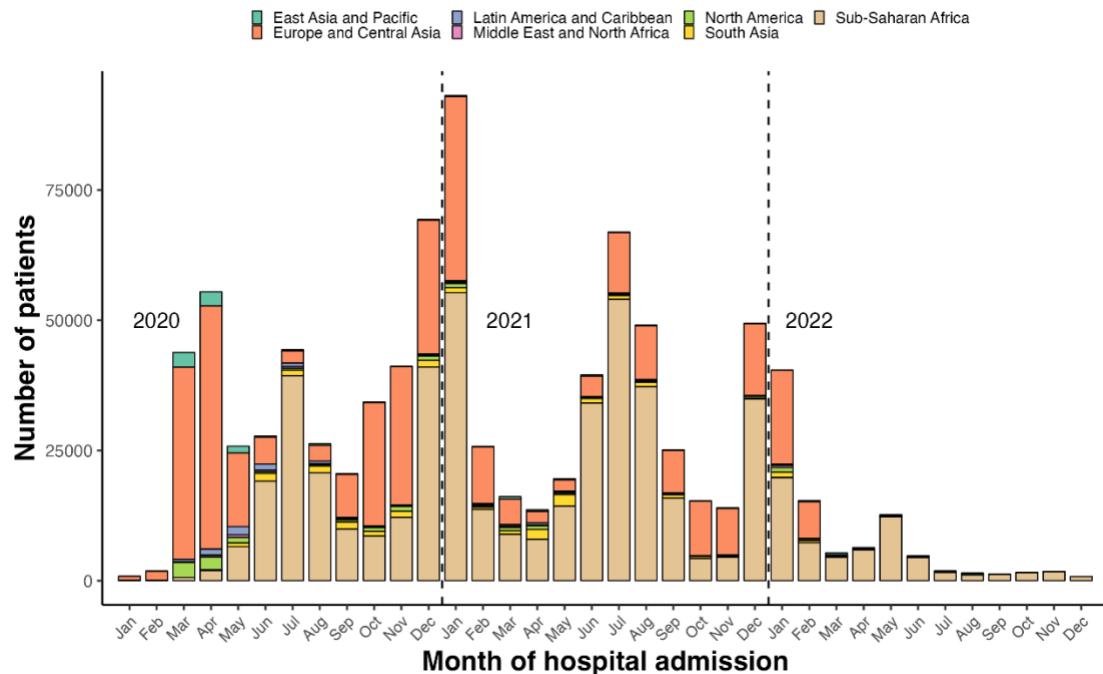
**Figure 2:** Distribution of patients by country



**Figure 3:** Distribution of patients by world bank region and country



**Figure 4:** Distribution of patients by world bank region and time



## Demographics

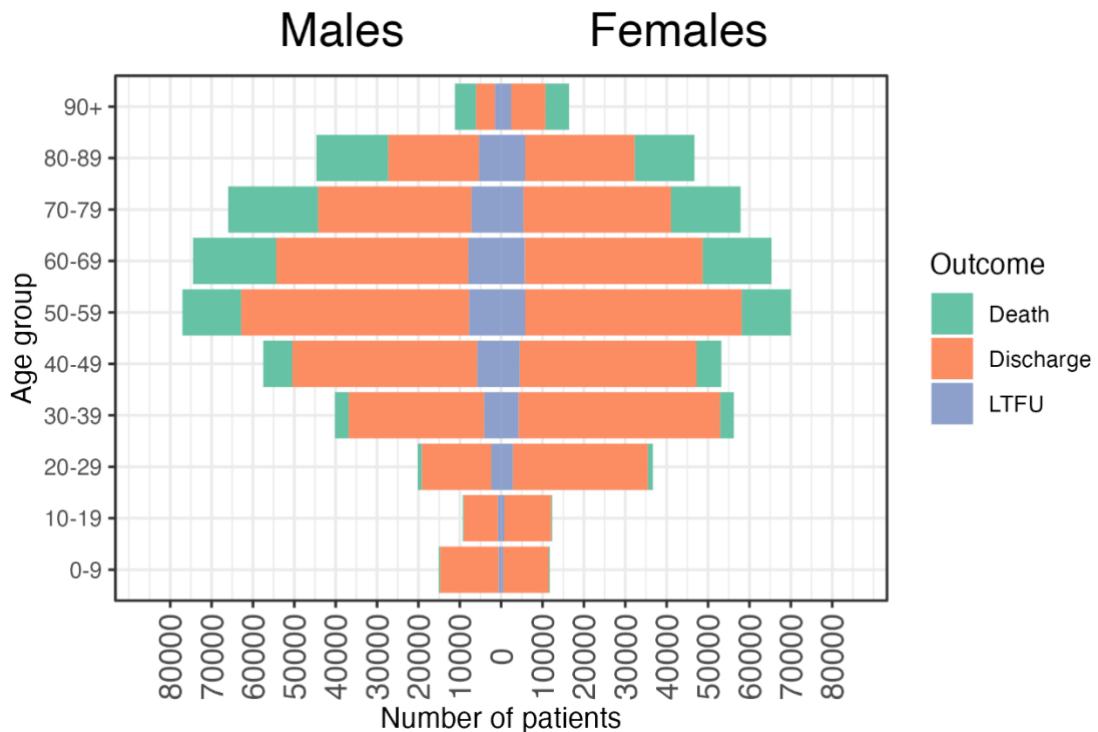
Of these 845291 cases, 416555 (49.3%) were males and 427476 (50.6%) were females. Sex was unreported for 1260 cases. The median age was 57 years, ranging from 0 to 120 years. One-third of the patients were 70 years old and above. Demographics, including age, sex, and outcome, are presented in Table 1 and Figure 5.

**Table 1:** Patient Characteristics. Proportions are presented in parentheses, and have been rounded to two decimal places.

Variable	Count (proportion)
Size of cohort	845291
By sex	
Female	427476 (0.51)
Male	416555 (0.49)
Unknown	1260 (0)
By outcome status	
Death	167430 (0.20)
Discharge	595298 (0.70)
LTFU	82563 (0.10)
By age group	
0-9	26898 (0.03)
10-19	21659 (0.03)
20-29	56907 (0.07)
30-39	96540 (0.11)
40-49	110828 (0.13)

Variable	Count (proportion)
50-59	147213 (0.17)
60-69	139938 (0.17)
70+	243126 (0.29)
Unknown	2182 (0)

**Figure 5:** Age and sex distribution of patients. Bar fills are outcome (death/discharge/lost to follow-up (LTFU)) at the time of report.



**Table 2:** Outcome by age and sex. Proportions are calculated using the row total as the denominator. Case fatality ratio: patients who died/patients not lost to follow up.

Variable	Death	Discharge	LTFU	Case fatality ratio
Age				
0-9	564 (0.02)	25242 (0.94)	1092 (0.04)	0.02
10-19	529 (0.02)	19580 (0.9)	1550 (0.07)	0.03
20-29	2235 (0.04)	49480 (0.87)	5192 (0.09)	0.04
30-39	6659 (0.07)	81562 (0.84)	8319 (0.09)	0.08
40-49	13013 (0.12)	87501 (0.79)	10314 (0.09)	0.13
50-59	26145 (0.18)	107529 (0.73)	13539 (0.09)	0.2
60-69	36780 (0.26)	89487 (0.64)	13671 (0.1)	0.29
70+	81377 (0.33)	134098 (0.55)	27651 (0.11)	0.38
Sex				
Female	76755 (0.18)	312498 (0.73)	38223 (0.09)	0.2
Male	90497 (0.22)	282193 (0.68)	43865 (0.11)	0.24

## Presenting symptoms

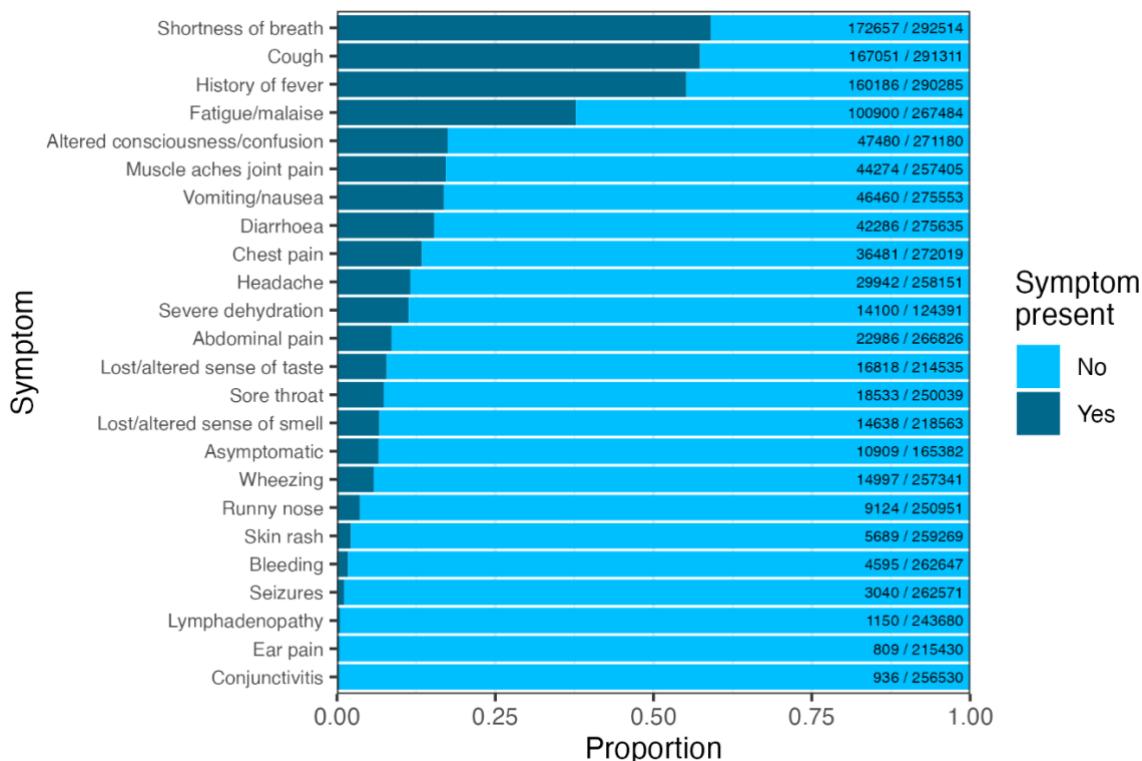
The observed mean number of days from (first) symptom onset to hospital admission was 5.4, with a standard deviation (SD) of 4.8 days and a median of 5 days.

A detailed analysis of symptoms from 60109 hospitalized symptomatic patients between 30 January and 3 August 2020 has been reported in a previous publication [19]. The prevalence of symptoms on admission to the hospital was summarised in Figure 6a. (Note that South Africa did not collect symptoms data. The overall frequency of missing data outside South Africa is 11%). The five most common symptoms at admission were shortness of breath, cough, history of fever, fatigue/malaise, and altered consciousness/confusion, accounting for 59%, 57.3%, 55.2%, 37.7%, 17.5% of patients with at least one symptom recorded.

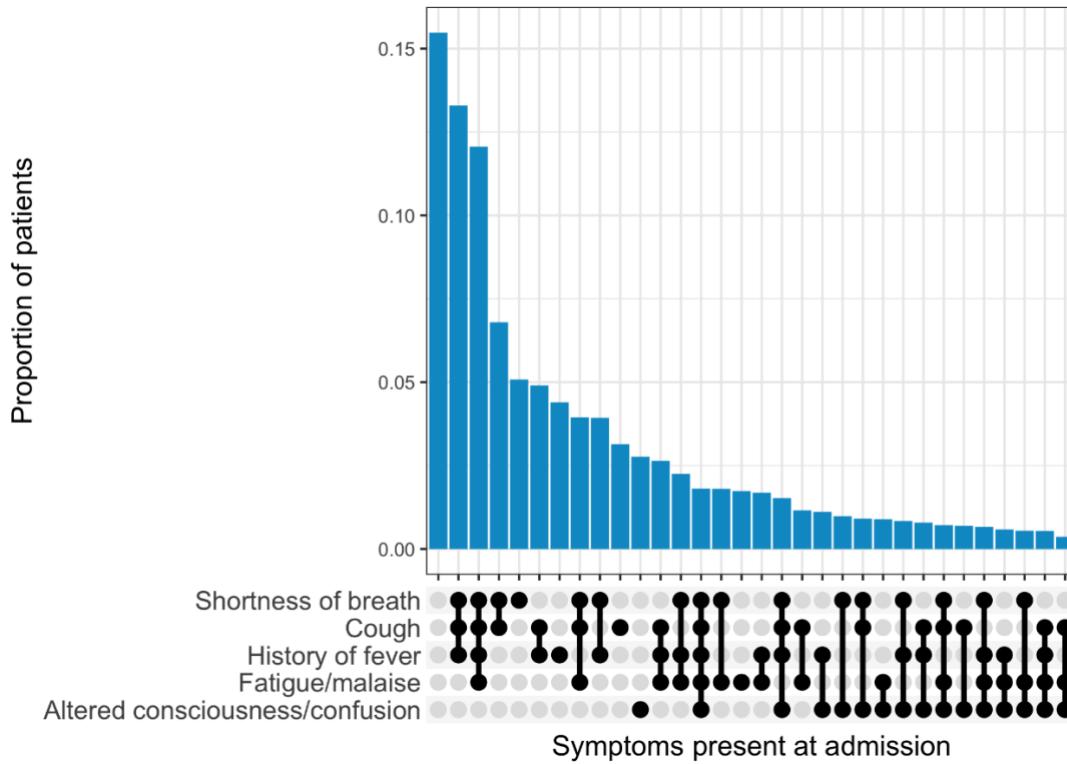
Clusters of symptoms are presented in Figure 6b and Figure 6c. The most common symptom combination was shortness of breath, cough, and history of fever.

**Figure 6:** Clinical symptoms of patients at admission

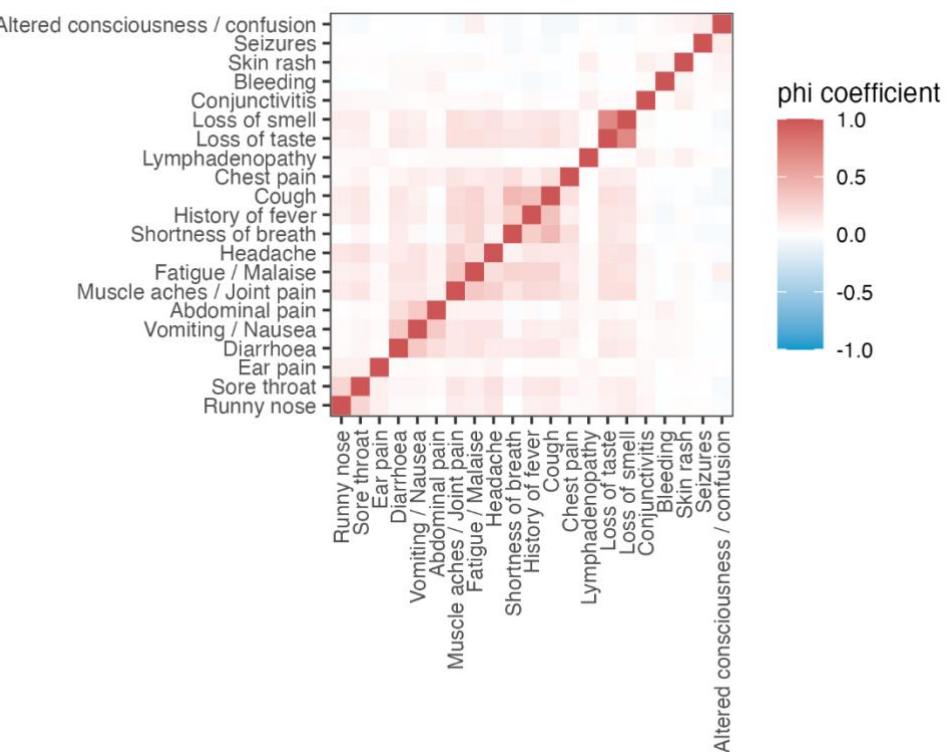
- (a) Frequency of symptoms seen at admission amongst COVID-19 patients. Bars are annotated with a fraction representing the number of patients presenting with this symptom over the number of patients for whom presence or absence of this symptom was recorded.



- (b) The distribution of combinations of the five 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.

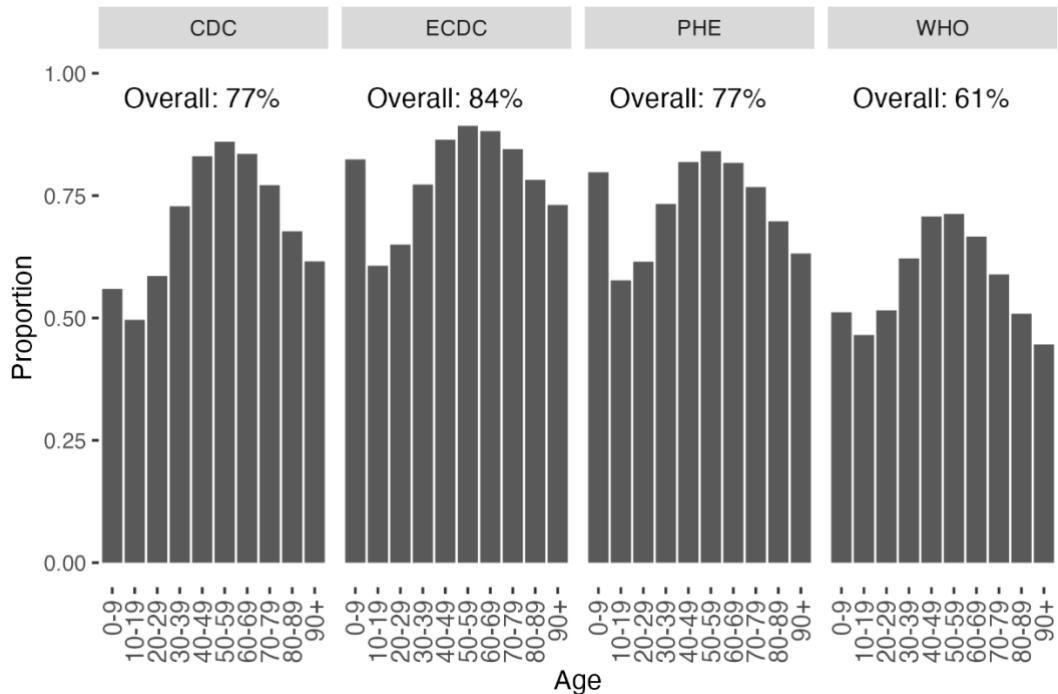


- (c) Heatmap for correlation between symptoms. Fill colour is the phi correlation coefficient for each pair of symptoms, calculated amongst patients with recorded presence or absence of both.



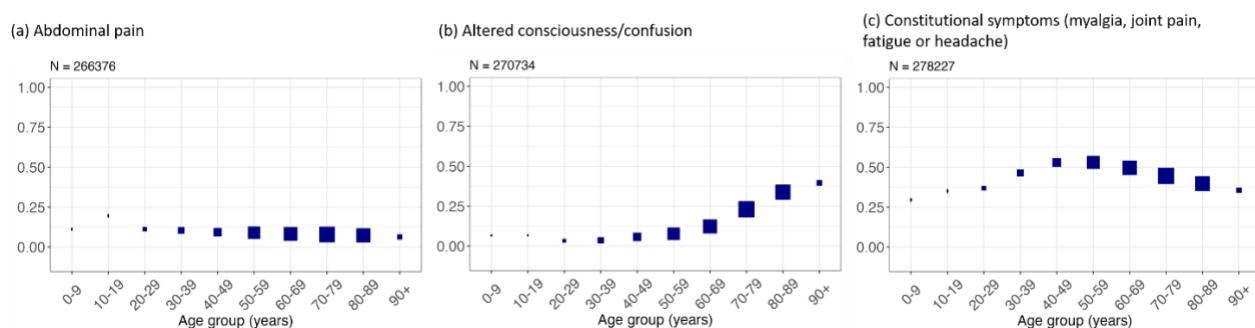
The observed symptoms on admission partly represented case definitions and policies for hospital admission, which may change as time passes. The overall percentages of patients meeting the four most common case definitions were 77%, 84%, 77%, 61% for CDC, ECDC, PHE, and WHO, respectively, and varies by age (Figure 7).

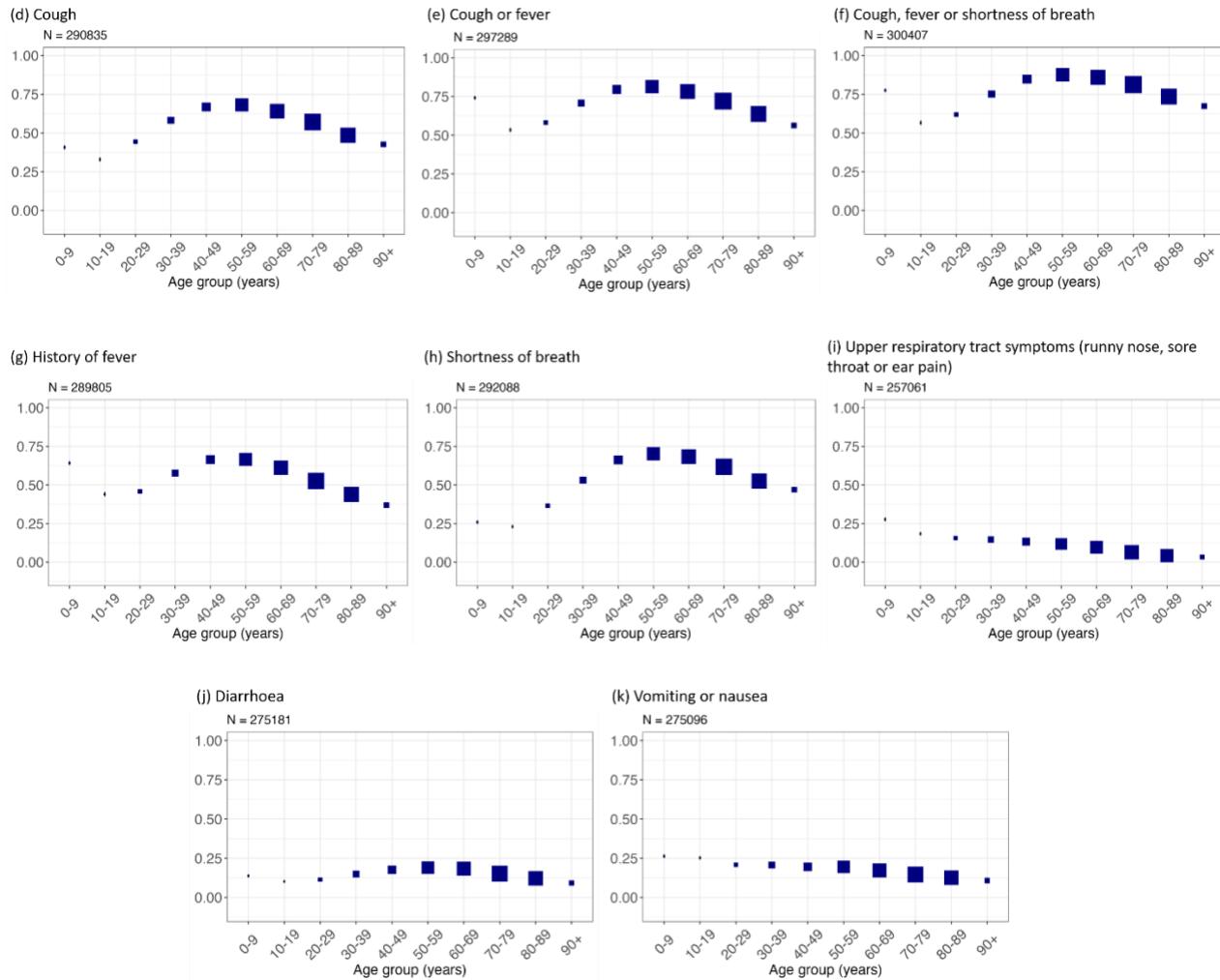
**Figure 7:** Proportion of patients that meet the 4 most common COVID-19 symptom case definitions by age



The frequency of presenting symptoms varied with age (Figure 8). Altered consciousness increased with age. The proportions of fever, respiratory and constitutional symptoms were higher in patients aged 40-60. Cough or fever were also common in children aged 0-9. The proportion of abdominal pain, diarrhoea, and vomiting were less age-dependent and similar across age groups.

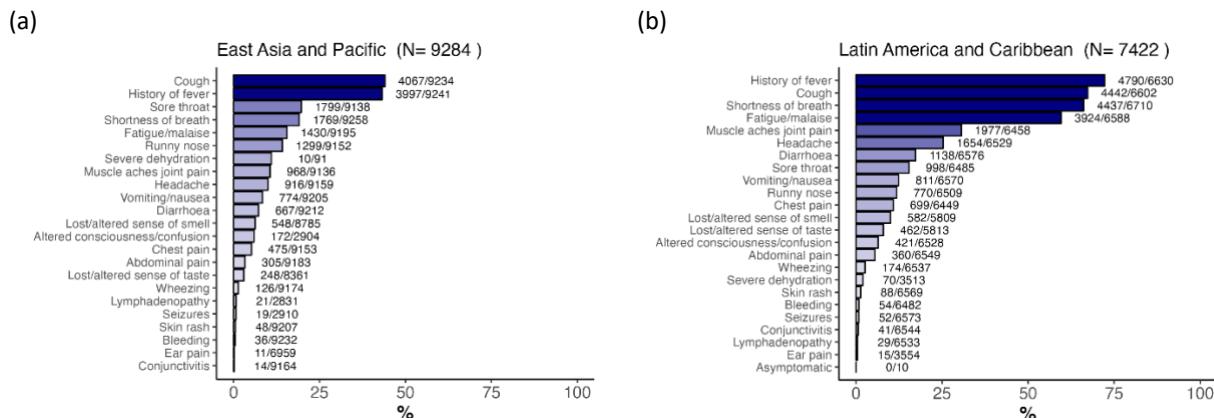
**Figure 8:** Symptoms recorded at hospital presentation stratified by age group. Boxes show the proportion of individuals with each symptom. The size of each box is proportional to the number of individuals represented. N is the number of individuals included in the plot (this varies between plots due to data completeness. The numbers for panel c, e, f, i were patients who had information on at least one symptom).



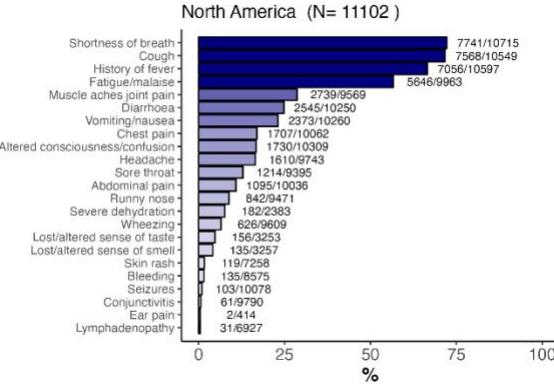


In Figure 9, we present the frequencies of the most common symptoms varied by regions. Each panel corresponds to a different region, and within region, symptoms that were present more often correspond to higher y-axis coordinates. To improve visualization, transparency decreases with increasing frequency. Across all geographical regions, shortness of breath, fever, and cough were the three symptoms with the highest prevalence.

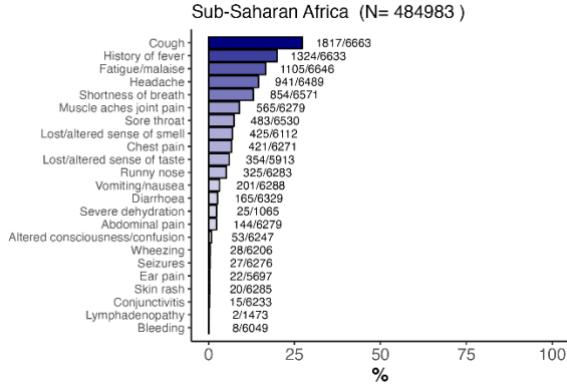
**Figure 9:** Symptoms recorded at hospital presentation stratified by region. The numbers next to each bar represent patients presented with this symptom/patients recorded. The N in the title represents the total number of patients in each region, including those with or without symptoms recorded.



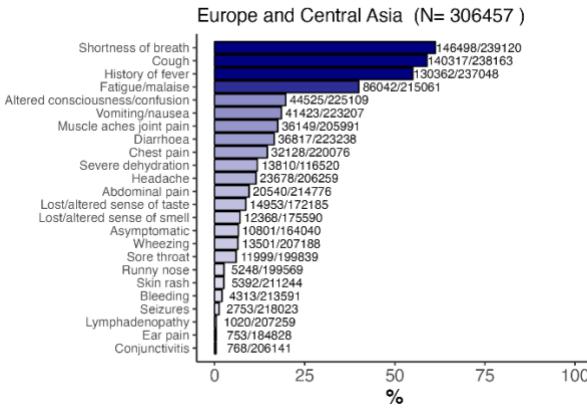
(c)



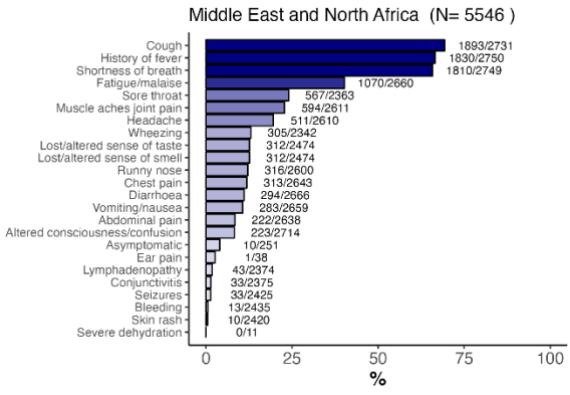
(d)



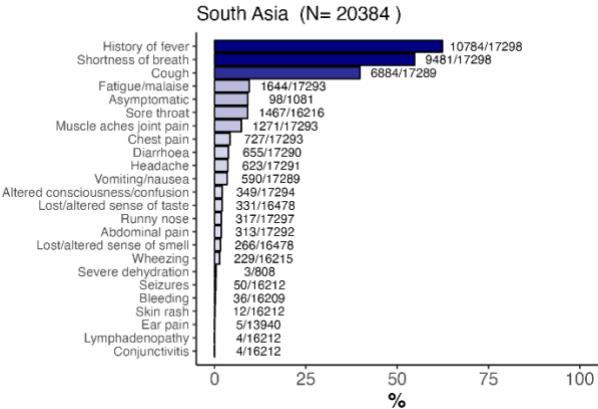
(e)



(f)



(g)



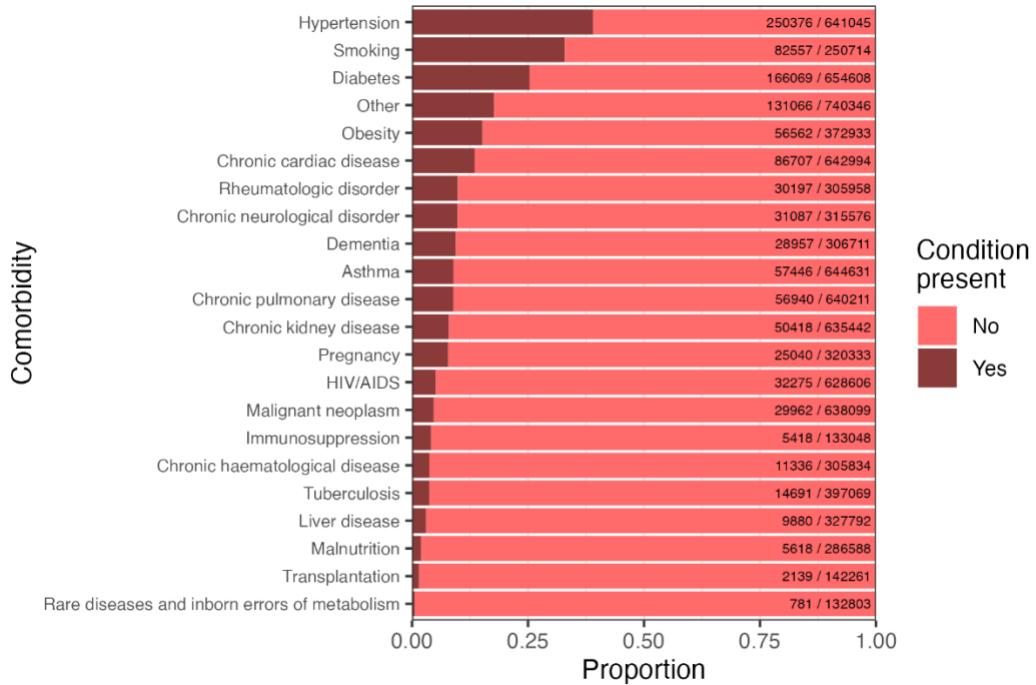
### Comorbidities and other concomitant conditions at admission

Information was available on at least 75% of cases for diabetes, chronic pulmonary disease, chronic kidney disease, asthma, malignant neoplasm, cardiac chronic disease, HIV/AIDS, and hypertension (Figure 10).

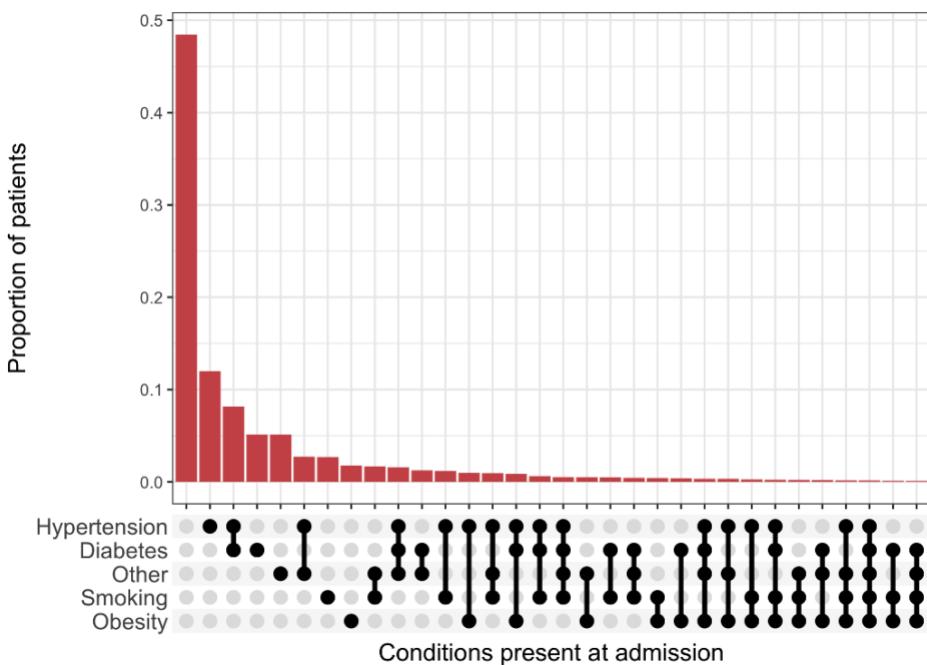
Conditions presented in at least 10% of cases were hypertension (40% of those reported), smoking (33%), diabetes (25%), obesity (15%), chronic cardiac disease (13%) (Figure 10a). Combinations of the five most prevalent conditions are presented in Figure 10b.

**Figure 10:** Comorbidities and other concomitant conditions

- (a) Frequency of comorbidities or other concomitant conditions 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.

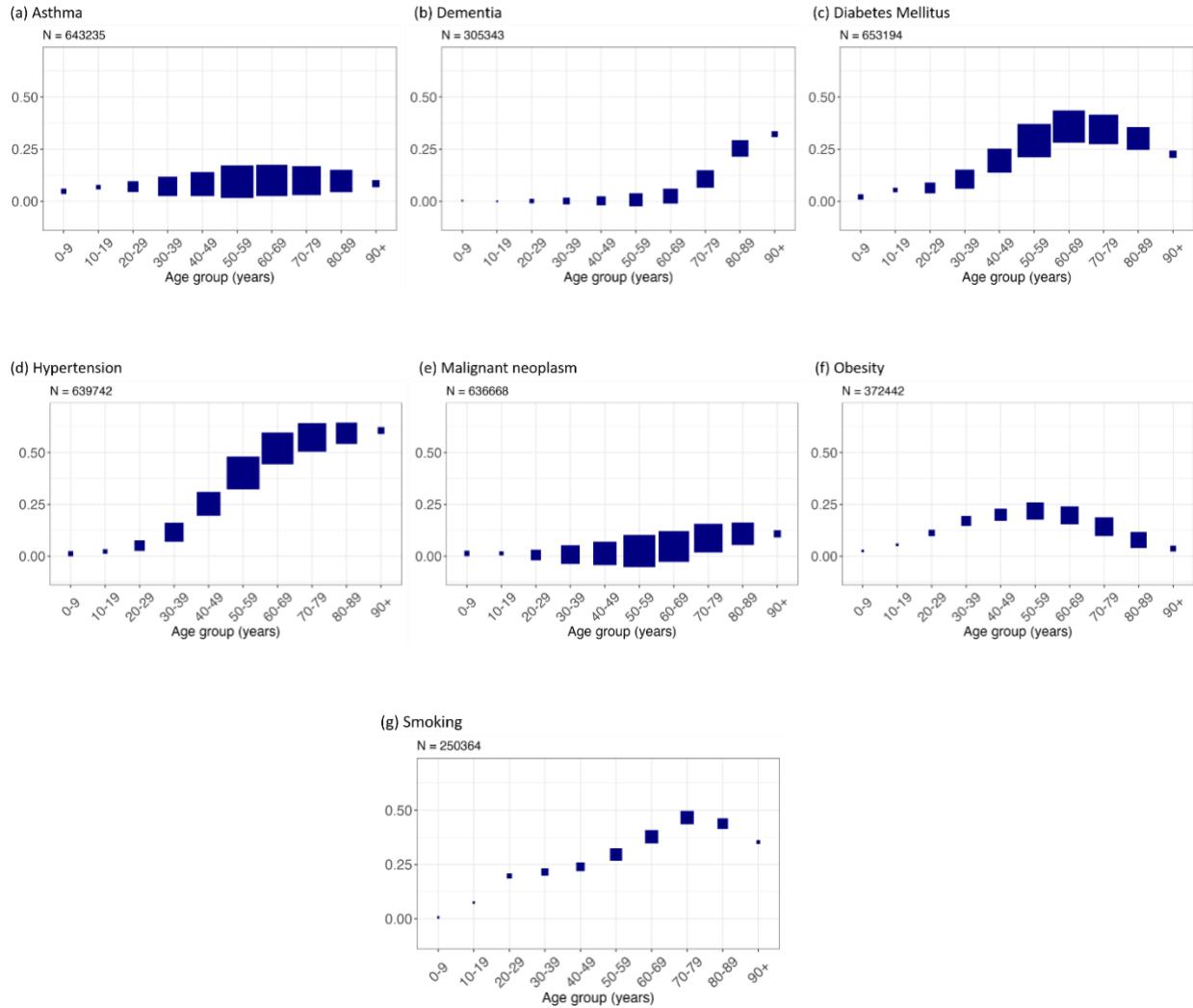


- (b) The distribution of combinations of the five most common such conditions, amongst all patients for whom these data were recorded. Filled and empty circles below the x-axis indicate the presence or absence of each comorbidity.



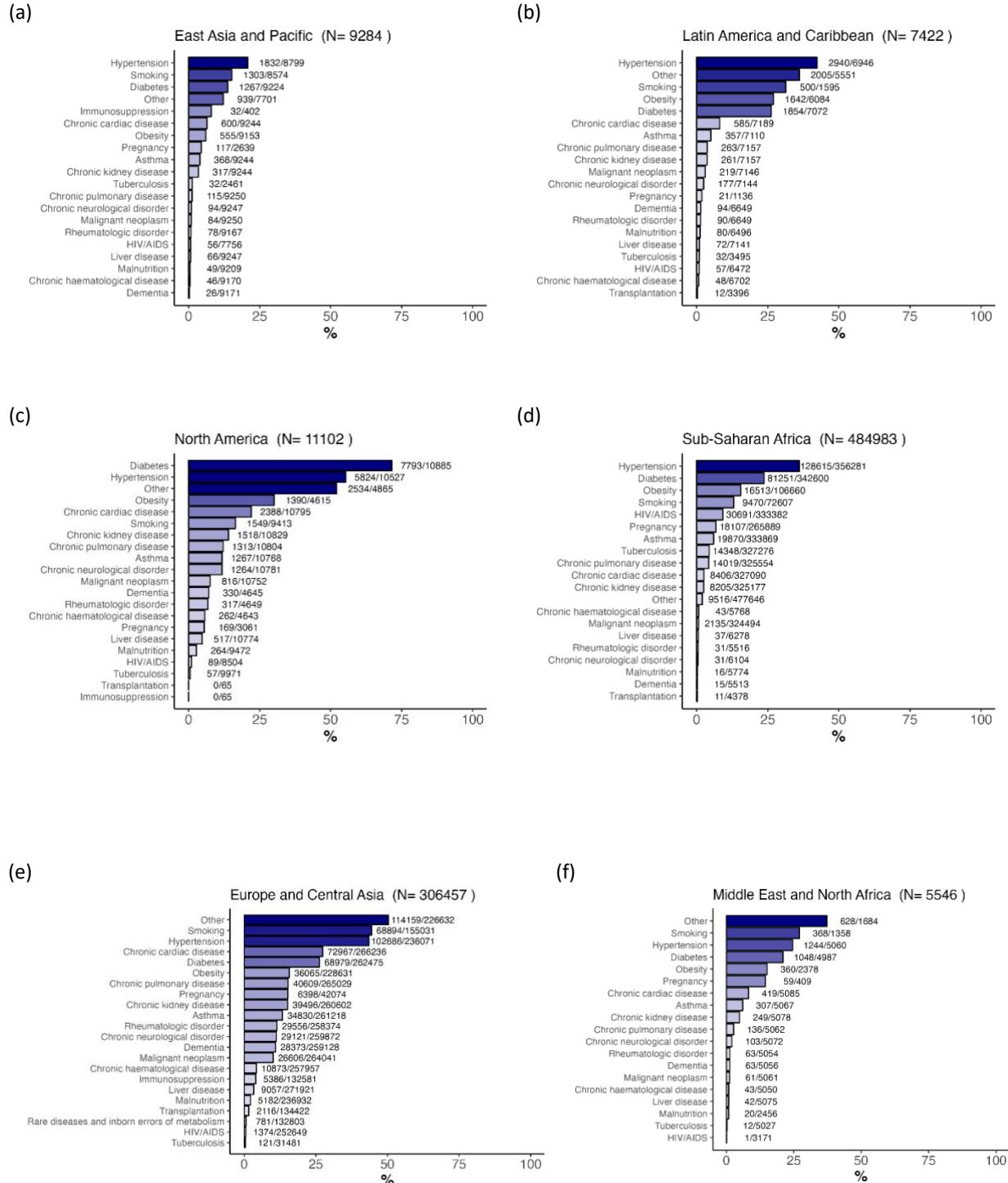
The age distribution of the most frequent concomitant conditions is presented in Figure 11. Dementia and hypertension increased with age.

**Figure 11:** Comorbidities recorded at hospital presentation stratified by age group. Boxes show the proportion of individuals with each symptom. The size of each box is proportional to the number of individuals represented. N is the number of individuals included in the plot (this varies between plots due to data completeness).

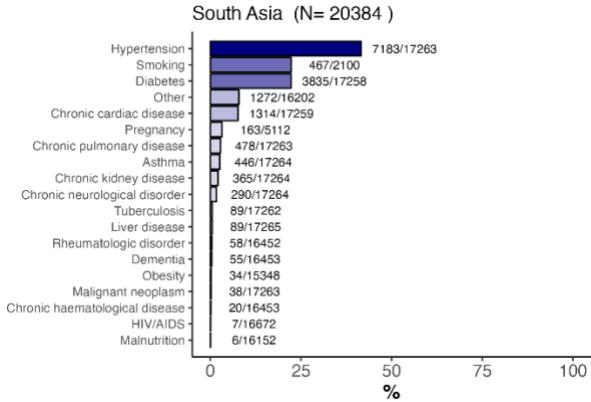


In Figure 12, the frequencies of most common comorbidities in patients by regions are presented. Each panel corresponds to a different region, and within region, more frequent comorbidities correspond to higher y-axis coordinates. To improve visualization, transparency decreases with increasing frequency. The most common comorbidities were hypertension, diabetes, obesity, chronic cardiac disease, smoking, which are similar across regions.

**Figure 12:** Comorbidities recorded at hospital presentation stratified by region. The numbers next to each bar represent patients presented with this symptom/patients recorded. The N in the title represents the total number of patients in each region, including those with or without symptoms recorded.



(g)

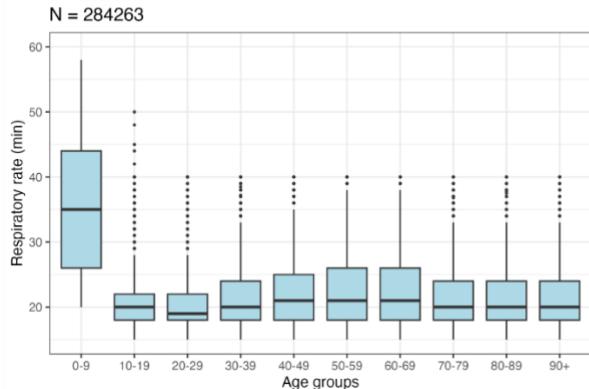


## Vital signs

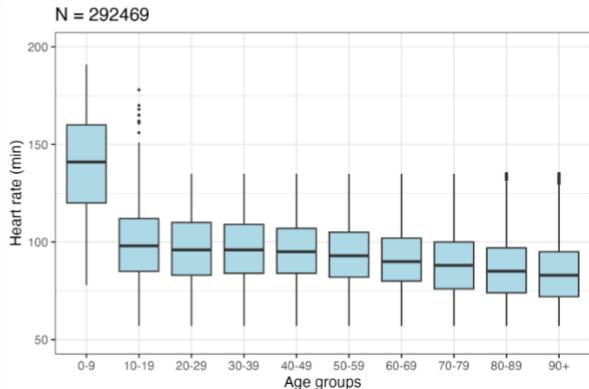
Oxygen saturation was recorded for 286853 patients at admission. Of these, 32.7% were on oxygen therapy, and 67.3% were not. At admission, the median oxygen saturation of those who were on oxygen therapy was 95%, whereas the median was 96% for those who were not on oxygen therapy (Figure 13 provides a breakdown of oxygen saturation by age and oxygen therapy status). Among those who were on oxygen therapy at admission (N = 93843), 34.7% had oxygen saturation <94, and among those who were not on oxygen therapy at admission (N = 193010), 24.1% had oxygen saturation <94. All vital signs are presented in Figure 13 by age.

**Figure 13:** Box and whisker plots for observations at hospital presentation stratified by age group. N is the number of individuals included in the plot (this varies between plots due to data completeness).

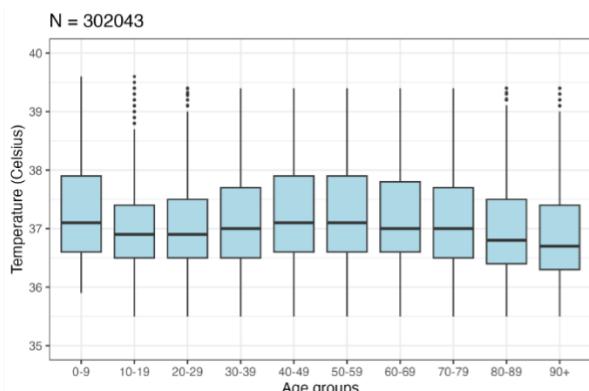
(a) Respiratory rate



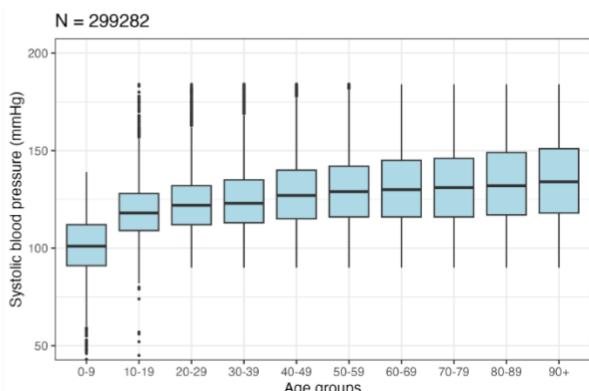
(b) Heart rate



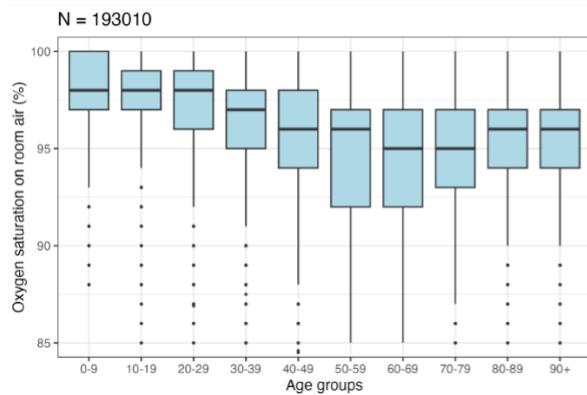
(c) Temperature



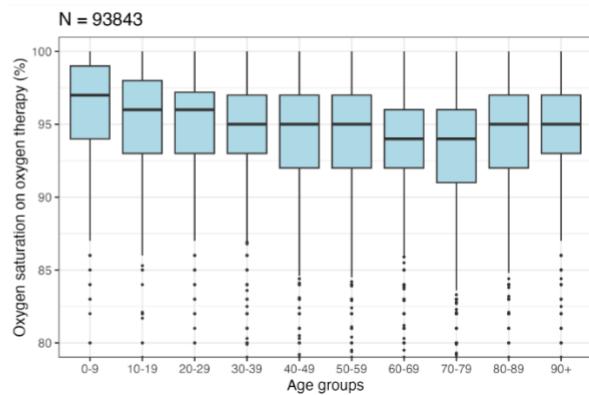
(d) Systolic blood pressure



(e) Oxygen saturation on room air



(f) Oxygen saturation on oxygen therapy

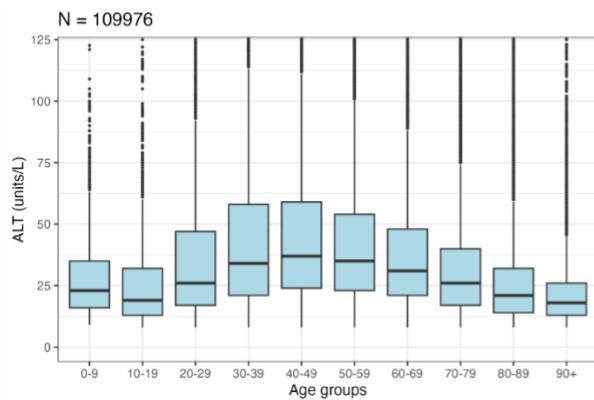


## Laboratory values

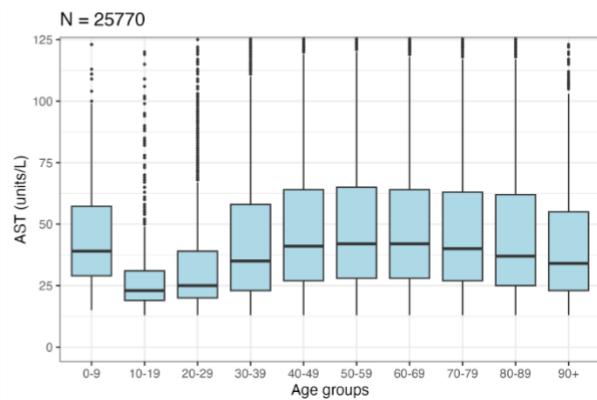
Laboratory tests results were available for a minority of patients. They are summarised in Figure 14.

**Figure 14:** Box and whisker plots for laboratory results within 24 hours of hospital presentation stratified by age group. N is the number of individuals included in the plot (this varies between plots due to data completeness).

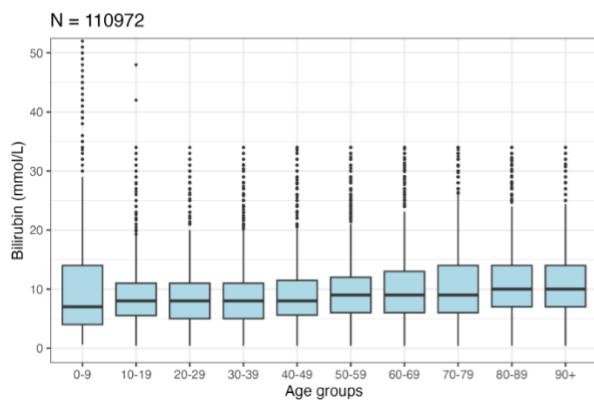
(a) Alanine transaminase (ALT)



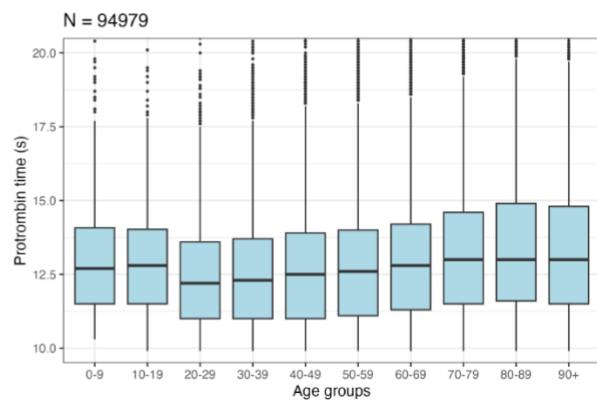
(b) Aspartate transaminase (AST)

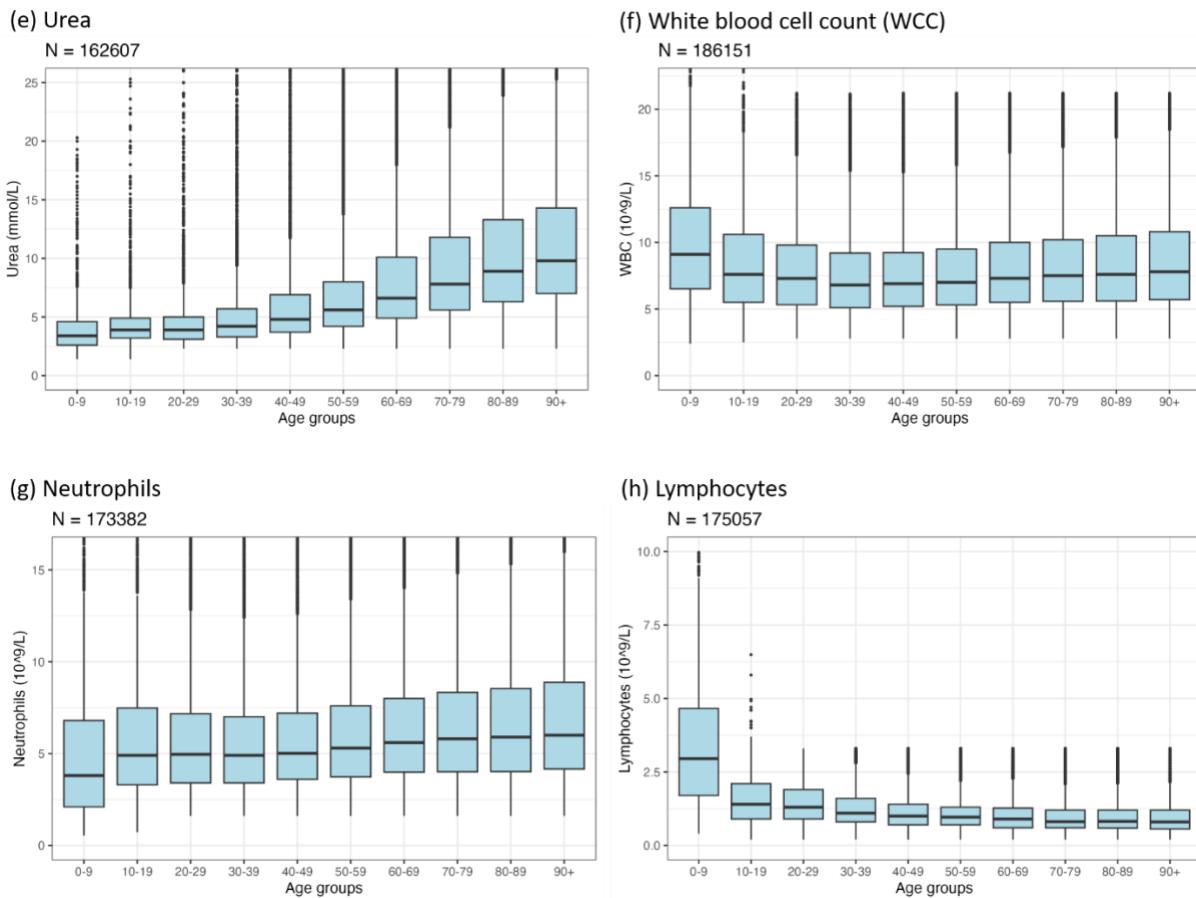


(c) Bilirubin



(d) Prothrombin time





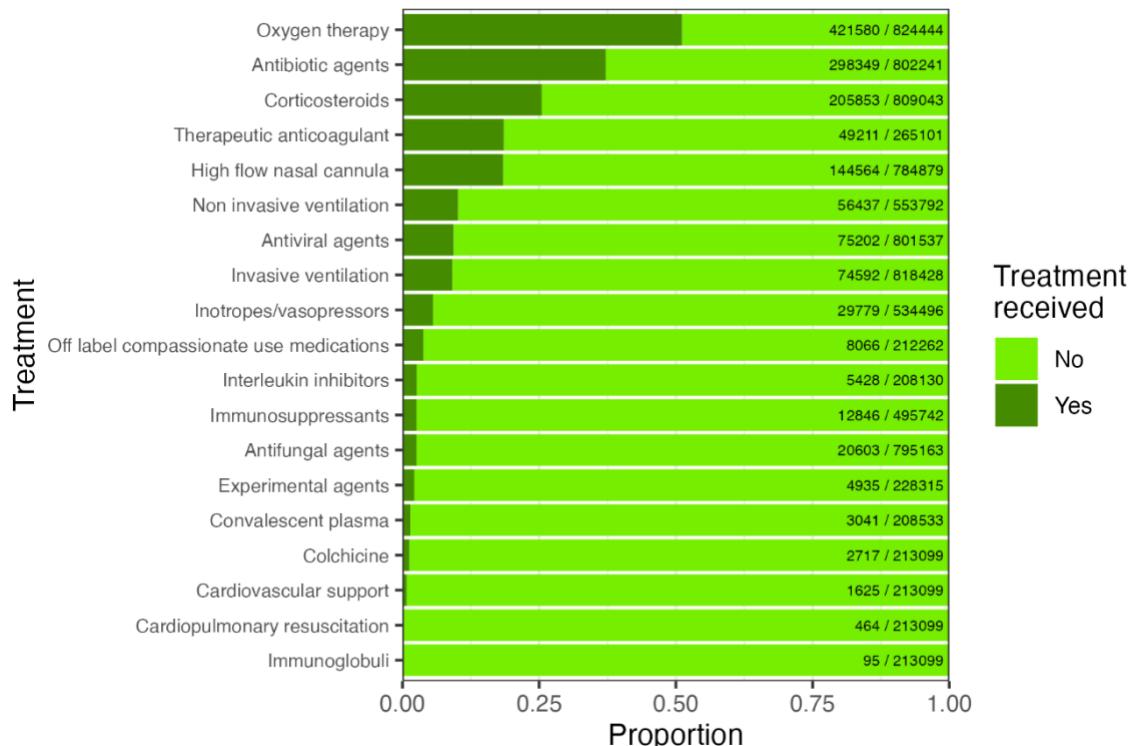
## Treatment

Antibiotics were given to 298349/802241 (37.2%) patients, and 75202/801537 (9.4%) received antivirals. These treatment categories were not mutually exclusive since some patients received multiple treatments - the denominators differ due to data completeness. Of 717419 patients with data available on oxygen supplementation within 24 hours from admission, 206247 (28.7%) received supplemental oxygen and 511172 (71.3%) did not. Throughout their stay in the hospital, 421580/824444 (51.1%) patients received some degree of oxygen supplementation; of these, 56437/553792 (10.2%) received non-invasive ventilation (NIV) and 74592/818428 (9.1%) IMV.

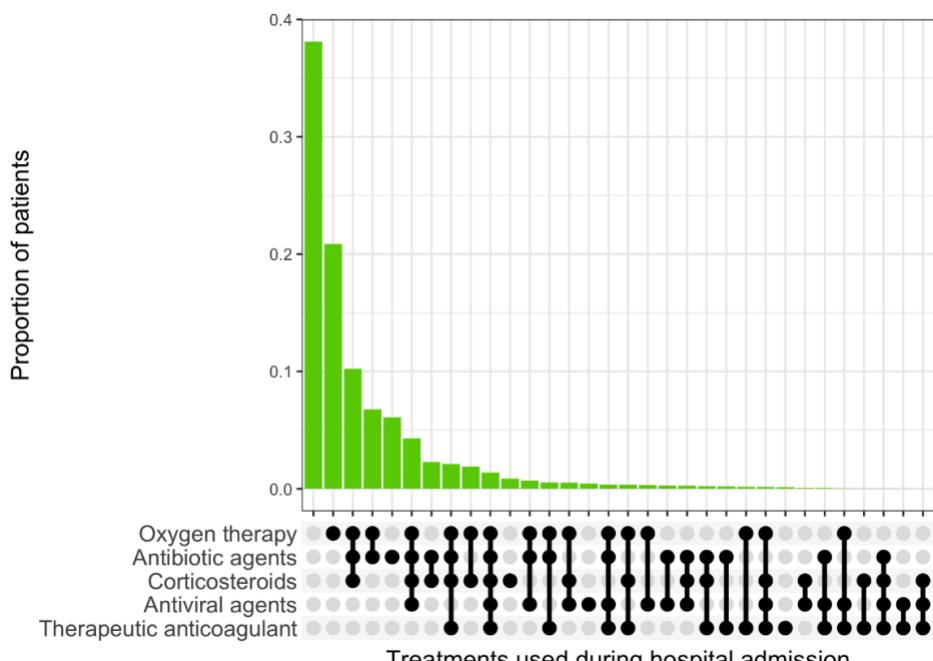
Corticosteroids were administered to 205853/809043 (25.4%) patients. This includes 34982/72276 (48.4%) of those who received IMV, 41849/54107 (77.3%) of those who had oxygen therapy but not IMV, and 31019/391729 (7.9%) of those who had no oxygen therapy. On 16 June 2020, results for dexamethasone were released from the RECOVERY randomized controlled trial [20,21]. This trial found that dexamethasone reduced deaths for patients receiving IMV and oxygen therapy, but not among patients not receiving respiratory support. Of patients admitted since 16 June 2020, corticosteroids were given to 27535/56216 (49%) of those who received IMV, and 28014/350016 (8%) of those with no oxygen therapy.

**Figure 15:** Treatments in the entire population

- (a) Proportions of patients receiving each treatment. Bars are annotated with a fraction indicating the number of individuals receiving each treatment over the number for which this information was non-missing. Oxygen therapy variable includes high flow nasal cannula, non-invasive ventilation, and invasive ventilation.



- (b) Distribution of combinations of antimicrobial treatments and steroids administered during hospital stay, across all patients with completed hospital stay and recorded treatment data. Oxygen therapy variable includes high flow nasal cannula, non-invasive ventilation, and invasive ventilation.



## Intensive Care and High Dependency Unit Treatments

Of the 845291 patients with data on ward admissions available, a total of 129672 (15.3%) were admitted at some point of their illness into an intensive care unit (ICU) or high dependency unit (HDU), among which, 39040 (53.6%) on the day of hospital admission (56879 patients without ICU admission date).

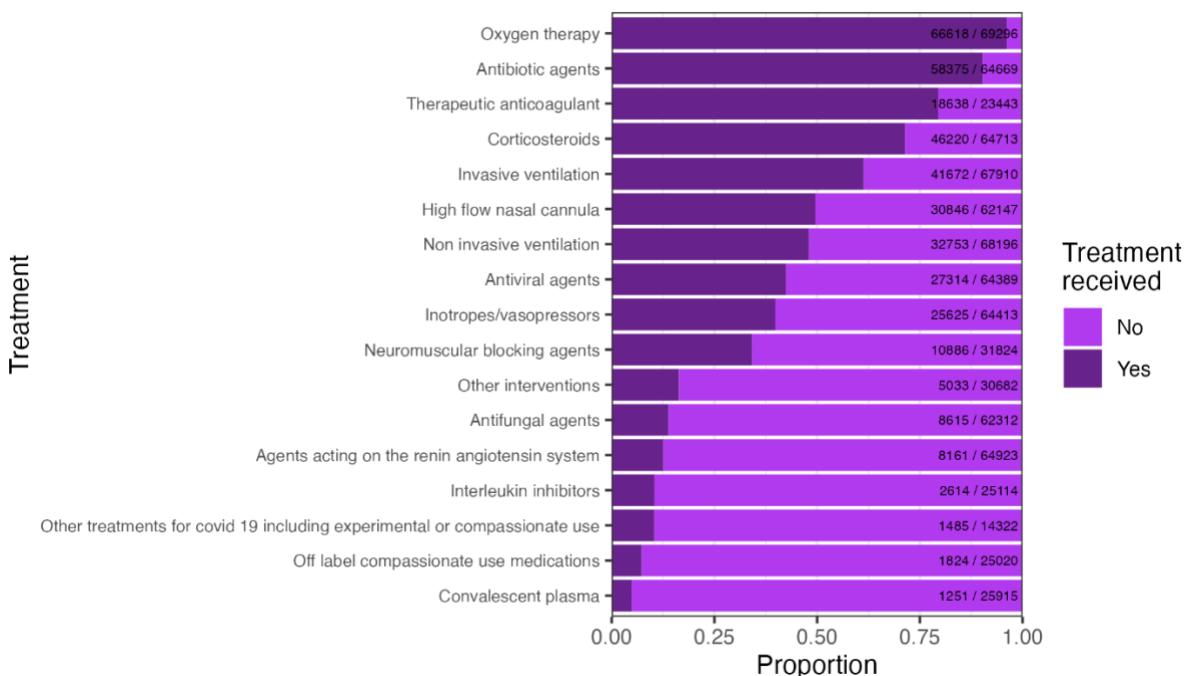
The range of treatments received whilst in ICU/HDU is presented in Figure 16a and Figure 16b. Of the patients admitted into ICU/HDU, 58375/64669 (90.3%) received antibiotics and 27314/64389 (42.4%) antivirals. 66618/69296 (96.1%) received some degree of oxygen supplementation, of which, 32753/68196 (48%) received NIV and 41672/67910 (61.4%) IMV.

A total of 56437 patients received non-invasive mechanical ventilation (NIV). The mean and median number of days from admission to receiving NIV were 2.2 days and 1 days respectively (SD: 3.6 days) – estimated from records on cases with complete records on dates of hospital admission and NIV onset (N = 36307). The mean and median duration for NIV were 3.9 days and 3 days respectively (SD: 3.5 days) – estimated based on only those cases which have completed NIV duration records (N = 11661).

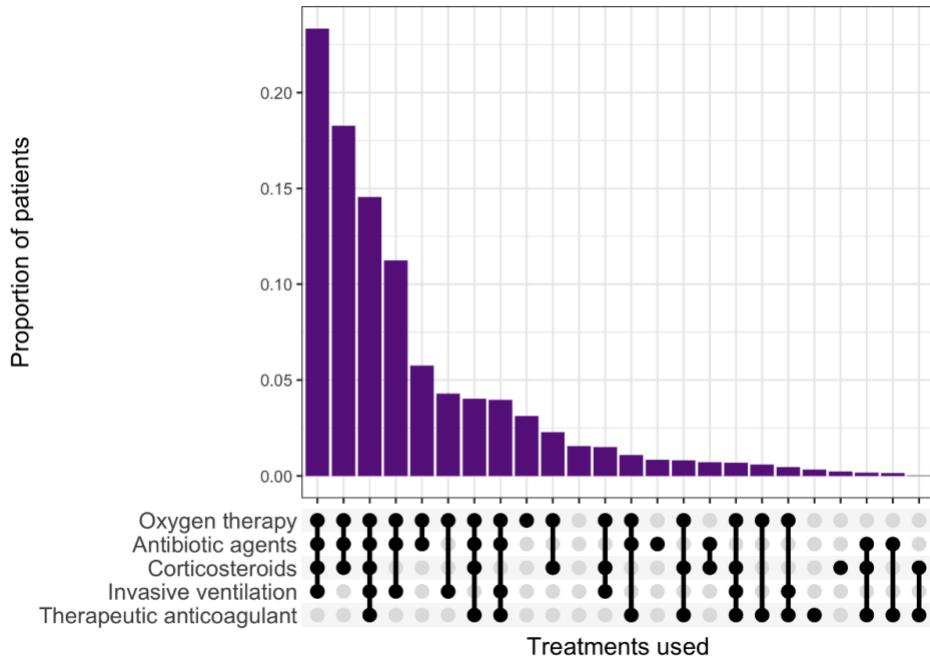
A total of 74592 patients received invasive mechanical ventilation (IMV). The mean and median duration from admission to receiving IMV were 3.4 days and 1 days respectively (SD: 4.7 days) – estimated from records on cases with complete records on dates of hospital admission and IMV onset (N = 27003). The mean, median and SD for the duration of IMV – estimated based on all 41046 cases with complete records on IMV stays – were 10.1 days, 7 days and 9.8 days respectively.

**Figure 16:** Treatments in the ICU/HDU population

- (a) Proportions of patients receiving each treatment. Bars are annotated with a fraction indicating the number of individuals receiving each treatment over the number for which this information was non-missing. Oxygen therapy variable includes high flow nasal cannula, non-invasive ventilation, and invasive ventilation.



- (b) 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. Oxygen therapy variable includes high flow nasal cannula, non-invasive ventilation, and invasive ventilation.



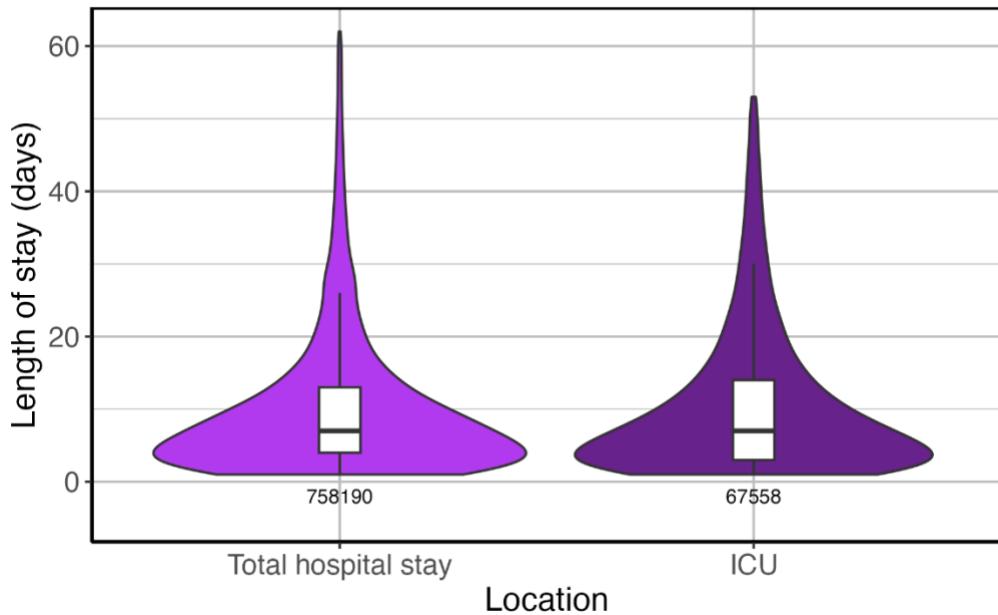
### Key time variables

The key time variables are presented in Table 3. Patients tend to come to the hospital within the first week of their illness with a mean of 5.4 days and a median of 5 days from symptoms onset. 53.4% of ICU/HDU admissions occurred within the first day at the hospital. The mean and median duration of hospital stay were 9.6 and 7 days, respectively. The duration of stay in ICU/HDU had a mean of 10.2 days and a median of 7 (SD: 10.3 days) – estimated on only those cases with complete records for ICU/HDU duration or ICU/HDU start/end dates (N = 71188).

**Table 3:** Key time variables. SD: Standard deviation; IQR: Interquartile range. Outliers (values greater than 120) were excluded prior to the computation of estimates.

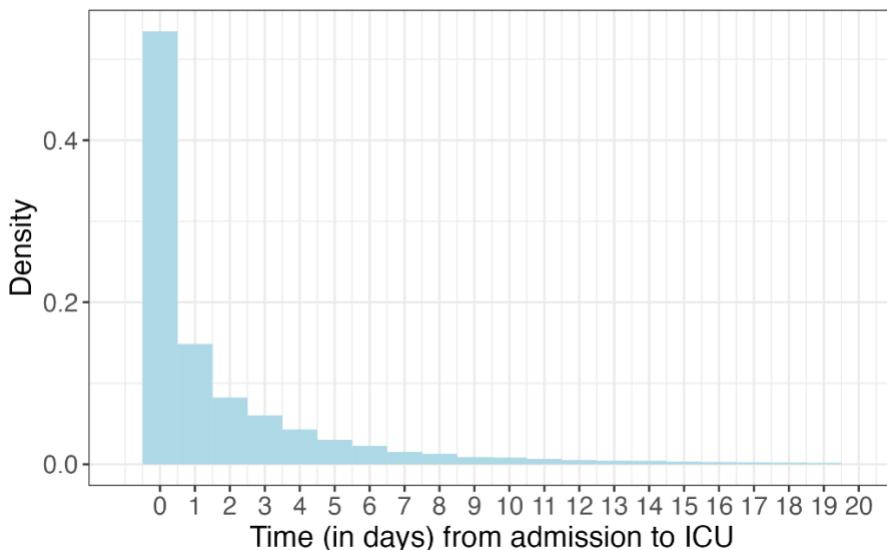
Time (in days)	Mean	SD	Median	IQR
Length of hospital stay	9.7	10	7	3-12
Symptom onset to admission	5.4	4.8	5	1-8
Admission to ICU entry	1.8	3.2	0	0-2
Duration of ICU	10.3	10.4	7	3-14
Admission to IMV	3.3	4.6	1	0-5
Duration of IMV	10.3	9.9	7	3-15
Admission to NIV	2.2	3.6	1	0-3
Duration of NIV	3.9	3.4	3	1-5

**Figure 17:** 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 median and interquartile range of the variable of interest.



The distribution of the number of days from admission to ICU admission is shown in Figure 18.

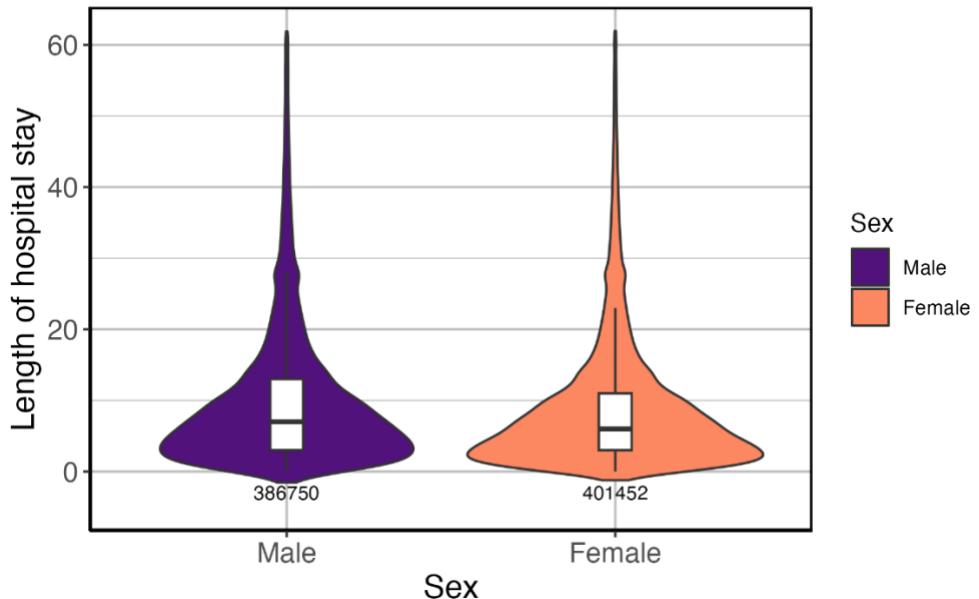
**Figure 18:** Distribution of time (in days) from hospital admission to ICU admission. The figure displays data on only those cases with a reported ICU start date.



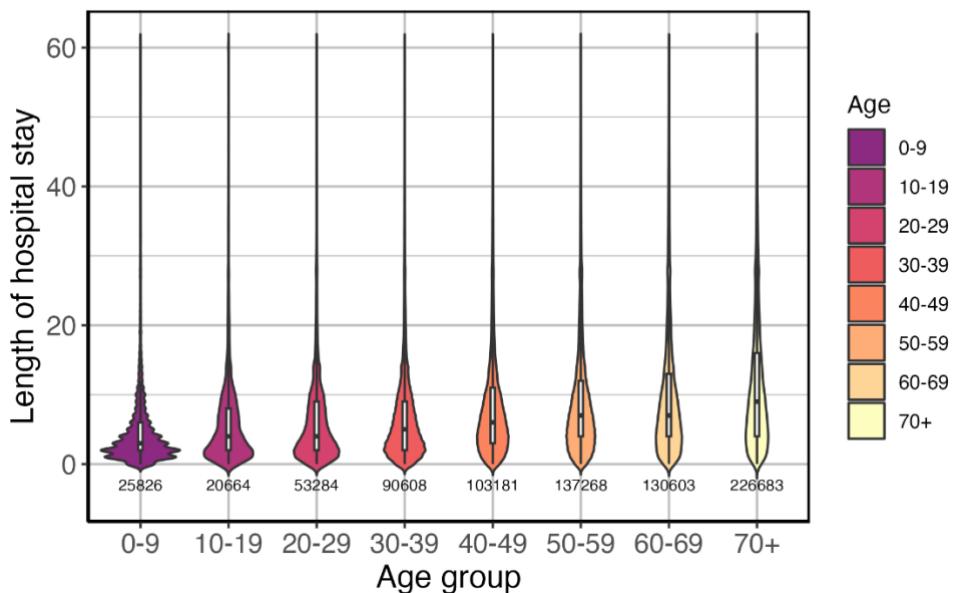
The observed mean duration for the number of days from hospital admission to outcome (death or discharge) was 9.4, with SD 9.5 days and a median of 7 days. These estimates were based on all cases which have completed records on length of hospital stay (N = 746709). The distributions of length of hospital stay are presented in Figure 19a according to sex and Figure 19b by patient age group.

**Figure 19:** Distribution of length of hospital stay. 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.

(a) Distribution of length of hospital stay, according to sex.



(b) Distribution of length of hospital stay, according to age.

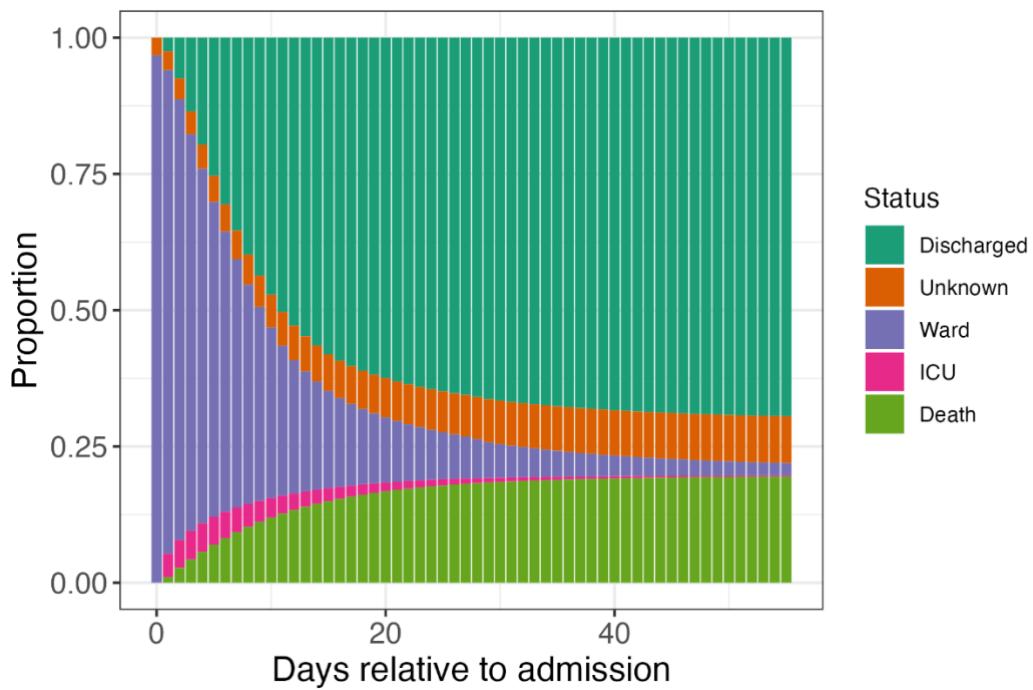


## Outcomes

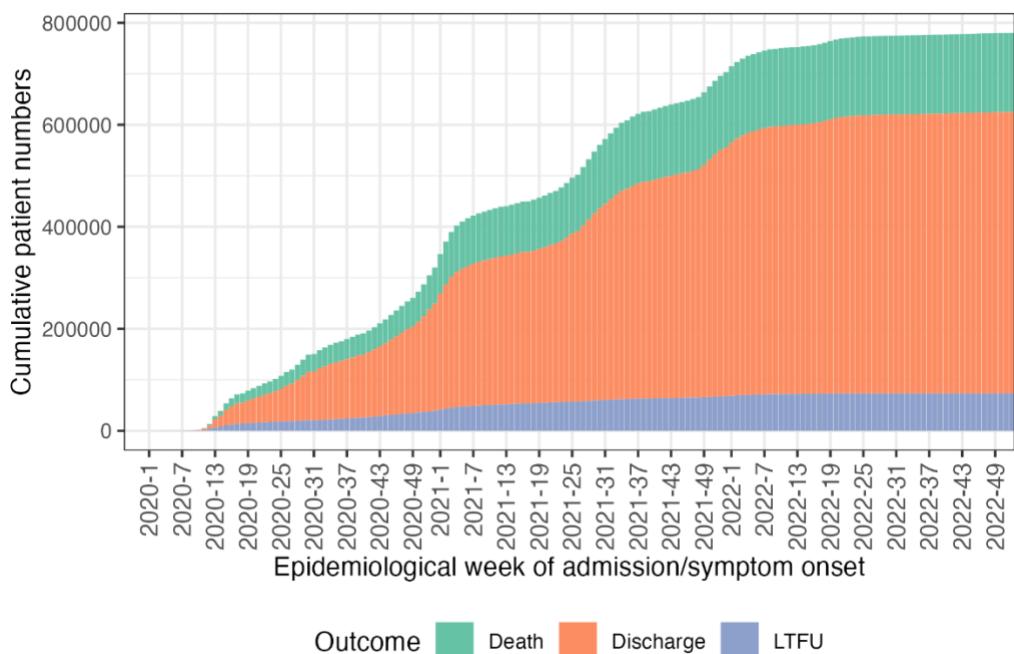
Outcomes were recorded for 762728 patients (90.2%), consisting of 595298 recoveries and 167430 deaths. Outcome records were unavailable for 82563 patients.

The overall estimated case fatality ratio (CFR) was 22% (95% CI 21.9-22) and was 35.9% (95% CI 35.6-36.1) for patients admitted to ICU/HDU - calculated out of those with data on outcome.

**Figure 20:** 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.



**Figure 21:** Cumulative patient numbers and outcomes by epidemiological week of admission (or, for patients infected in hospital, of symptom onset).



## Discussion and conclusions

COVID-19 has tested the effectiveness of ISARIC's operating model: a global, open-source, collaborative approach set up 10 years ago to prevent illness and deaths from infectious disease outbreaks. In January 2020, ISARIC launched its COVID-19 Clinical Characterisation Protocol (CCP) and Case Report Form (CRF) as well as a free data management platform for researchers to upload their clinical data, globally. The ISARIC COVID-19 CCP database was open and publicly accessible from late January 2020, when less than a thousand COVID-19 cases had been reported globally; by mid-February 2020, the first patient record was successfully uploaded on to the platform; by mid-March 2020, the platform had ten thousand records.

Now, 3 years into the pandemic, with more than 945,000 records, the ISARIC clinical data platform has grown to become the largest international individual patient dataset of COVID-19 hospitalised cases. ISARIC is a model of global peer-to-peer collaboration, with contributions by 1807 sites in 76 countries, with similar representations of patients from high-income and low- and middle-income countries.

This report describes the features of COVID-19 patients in the entire cohort, made from cases accrued over 36 months with different contributions from various countries. Everyone can trace the evolution over time of the database through 18 previous versions of this report. In addition, specific questions regarding clinical presentations, risks factors for outcomes, and trends are addressed through ad-hoc analyses.

Partners can submit ad-hoc request to perform analyses, to access the 945,000 case-based dataset, by using our Statistical Analysis Plan form (SAP). Once a SAP has been submitted, our statistical team assesses the plan for quality of research and feasibility of data analysis. Then, our clinical team provides feedback on clinical relevance and overlap with other analyses. Once this process has been completed, the SAP is sent to all ISARIC collaborators for the opportunity to review. This initial peer review process ensures that research is of the utmost quality and it helps encourage a truly participatory approach.

All ISARIC contributors are invited to participate in analyses through review and input on the SAP and the resulting publication. The outputs of our joint work are disseminated as widely as possible to inform patient care and public health policy. ISARIC aims to include the names of all those who contribute data in the cited authorship of publications, subject to the submission of contact details and confirmation of acceptance of the final manuscript within the required timelines, per ICMJE policies and the ISARIC publication policy.

**What have our partners achieved:** Using the ISARIC and ISARIC4C databases, our partners have produced a broad range of evidence. More than 100 reports and manuscripts have been published to date, and many more are in progress.

True international collaboration during a pandemic is key to putting data into action. ISARIC partners have achieved this objective, and the results are shown in this final report of the COVID-19 Clinical Database.

## Acknowledgement

We are grateful for the expertise and efforts of these individuals, listed at the end of this report. For further details and access to the resources listed above, go to [www.isaric.org](http://www.isaric.org)

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Bar-Ilan University, Ramat Gan; Rambam Hospital, Haifa; The Baruch Padeh Medical Center Poriya, Tiberias; Ziv Medical Centre, Safed.

Italy

Azienda Ospedaliero Universitario Pisana, Pisa; Azienda Provinciale per i Servizi Sanitari della Provincia Autonoma di Trento, Arco; Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico, Milan; Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome; Istituto Mediterraneo per i Trapianti e Terapie ad Alta Specializzazione, Palermo; Monaldi Hospital, Napoli; Ospedale Molinette, Torino; Ospedale Niguarda, Milan; Ospedale Papa Giovanni XXIII - Bergamo, Bergamo; Ospedale Sacro Cuore Don Calabria, Negrar Di Valpolicella; Ospedale San Gerardo, Monza; Ospedale San Paolo, Milan; Policlinico of Padova, Padova; Policlinicodi Orsola Universitàdi Bologna, Bologna; San Martino Hospital, Genoa; University Hospital Policlinico Paolo Giaccone, Palermo; University Hospital of Parma, Parma; University of Brescia, Brescia; University of Padua, Padua; Università Cattolica del Sacro Cuore, Rome.

Japan

Chiba University Hospital, Chiba; Fujieda Municipal General Hospital, Fujieda; Fukuoka University, Fukuoka; Hiroshima University, Hiroshima; Hokkaido University Hospital, Hokkaido; Hyogo Prefectural Kakogawa Medical Center, Hyogo; Kimitsu Chuo Hospital, Chiba; Kouritu Tousei Hospital, Seto City; Kyoto Medical Centre, Kyoto; Kyoto Prefectural University of Medicine, Kyoto; Mie University Hospital, Tsu; Nagoya University Hospital, Nagoya; Obihiro-Kosei General Hospital, Obihiro; Rinku General Medical Center, Osaka; Saiseikai Senri Hospital, Tochigi; Saiseikai Utsunomiya Hospital, Tochigi; Shizuoka Children's Hospital, Shizuoka; St. Marianna University School of Medicine, Kawasaki; Teine Keijinkai Hospital, Sapporo; Tohoku Medical and Pharmaceutical University, Sendai; Tohoku University, Sendai; Tokyo Metropolitan Tama Medical Center, Tokyo; Yokohama City University Medical Center, Yokohama.

Jordan

Prince Hamza Hospital, Amman.

Kenya

Mount Kenya University, Thika.

Kuwait

Al-Adan Hospital, Hadiya; Al-Amiri & Jaber Al-Ahmed Hospitals, Kuwait City.

Laos

Attapeu Provincial Hospital, Attapeu; Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit, Vientiane; Luang Namtha Provincial Hospital, Luang Namtha; Salavan Provincial Hospital, Salavan; Xieng Khouang Provincial Hospital, Phonsavan.

Libya

Al-Hawari Center of Surgical Specialty, Al-Hawari; Al-Thawra Teaching Hospital, Albayda; Aljufrah Clinical Isolation Center, Al Jufrah; Gharyan Central Hospital, Gharyan; Misurata Medical Center, Misurata; Regdalin Hospital, Regdalin; Sabha Medical Center, Sabha; Soug Althulatha Isolation Center, Tripoli; Swani Health Isolation Center, Tripoli; Tripoli Central Hospital, Tripoli; Tripoli University Hospital, Tripoli.

Luxembourg

Luxembourg Institute of Health, Strassen.

Malawi

Malawi-Liverpool-Wellcome Trust Clinical Research Programme, Lilongwe.

Malaysia

Hospital Universiti Sains Malaysia (Mix medical & surgical ICU), Kota Bharu; Hospital Universiti Sains Malaysia (SICU), Kota Bharu; International Islamic University Malaysia Medical Centre (IIUMMMC), Pahang; Kluang Hospital, Johor; Kuala Lumpur Hospital, WPKL; Lahad Datu Hospital, Sabah; Melaka Hospital, Melaka; National Institutes of Health (NIH), Ministry of Health Malaysia, Setia Alam; Permai Hospital, Johor; Pulau Pinang Hospital, Pulau Pinang; Queen Elizabeth Hospital, Sabah; Raja Perempuan Zainab II Hospital, Kelantan; Raja Permaisuri Bainun Hospital, Perak; Sarawak General Hospital, Sarawak; Sultanah Aminah Hospital, Johor; Sultanah Bahiyah Hospital, Kedah; Sultanah Nur Zahirah Hospital, Terengganu; Sungai Buloh Hospital, Selangor; Sunway Medical Centre, Selangor; Tawau Hospital, Sabah; Tengku Ampuan Afzan Hospital, Pahang; Tuanku Fauziah Hospital, Perlis; Tuanku Ja'afar, Negeri Sembilan; University Malaya Medical Centre, Kuala Lumpur.

Mayotte

Centre Hospitalier de Mayotte, Mamoudzou.

Mexico

Hospitales Puerta de Hierro, Jalisco; UMAE CMN IMSS Hospital de Pediatría, Mexico City; University of Guadalajara Health Sciences Center, Guadalajara.

Morocco

Centre Hospitalier Universitaire Ibn Sina, Rabat.

Nepal

B & B Hospital, Lalitpur; Chitwan Medical College (COVID ICU), Chitwan; Chitwan Medical College (MICU), Chitwan; Grande International Hospital, Kathmandu; Hospital for Advanced Medicine and Surgery (HAMS), Kathmandu; Karuna Hospital, Kathmandu; Nepal Mediciti Hospital (COVID ICU), Lalitpur; Nepal Mediciti Hospital (Nepal Mediciti ICU), Lalitpur; Nidan Hospital, Lalitpur; Om Hospital, Kathmandu; Tribhuvan University Teaching Hospital (COVID ICU), Kathmandu; Tribhuvan University Teaching Hospital (GICU), Kathmandu; Tribhuvan University Teaching Hospital (ICU C), Kathmandu.

Netherlands

Adrz, Goes; Alrijne Hospital, Leiden; Beatrix ziekenhuis, Gorinchem; Canisius Wilhelmina Ziekenhuis, Nijmegen; Catharina Ziekenhuis, Eindhoven; Coöperatie Medisch Specialistisch Bedrijf, Amsterdam; Erasmus Medical Centre, Rotterdam; Flevoziekenhuis, Almere; Franciscus Gasthuis & Vlietland, Rotterdam; Gelre Hospitals, Zutphen; Leiden University Medical Center, Leiden; Maastricht University Medical Centre, Maastricht; Meander Medical Centre, Amersfoort; Medisch Spectrum Twente, Zutphen; Noordwest-Ziekenhuisgroep, Den Helder; Reinier de Graaf Gasthuis, Delft; Spaarne Gasthuis, Haarlem; Tergooi Hospital, Hilversum; University Medical Center Groningen, Groningen; Ziekenhuisgroep Twente, Hengelo.

New Zealand

Auckland City Hospital (CVICU), Auckland; Auckland City Hospital (DCCM 82), Auckland; Dunedin Public Hospital, Dunedin; Middlemore Hospital (Canties Manukan Health), Otahuhu; Nelson Hospital, Nelson; Waikato Hospital, Hamilton; Waitemata District Health Board, Auckland; Wellington Regional Hospital, Wellington.

## Norway

Akershus University Hospital, Nordbyhagen; Drammen Hospital, Drammen; Oslo University Hospital, Oslo; Sykehusapoteket Bærum, Gjettum; The Norwegian Corona Cohort, Oslo; University Hospital of North Norway, Tromso.

## Pakistan

Abbasi Shaheed Hospital (Covid Ward), Karachi; Abbasi Shaheed Hospital (MICU), Karachi; Abbasi Shaheed Hospital (SARI ICU), Karachi; Abbasi Shaheed Hospital (SICU), Karachi; Azeema Sheikh Hospital, Islamabad; Bahria International Hospital (MICU), Islamabad; Bahria International Hospital (SICU), Islamabad; Critical Care Asia Site A-AF-012-002, Karachi; Critical Care Asia Site A-AF-012-003, Karachi; Critical Care Asia Site A-AF-015-002, Karachi; Darul Sehat Hospital (GICU), Karachi; Darul Sehat Hospital (SARI ICU), Karachi; Doctors Hospital (SARI ICU), Lahore; Doctors Hospital (SICU), Lahore; GMMM Teaching Hospital, Sukkar; Hameed Latif Hospital (MICU), Lahore; Hameed Latif Hospital (SARI ICU), Lahore; Hameed Latif Hospital (SICU), Lahore; Jinnah Hospital, Lahore; Jinnah Post-Graduate Medical Center (SICU), Karachi; Lady Reading hospital (Floor 1-isolation ward), Peshawar; Lady Reading hospital (Floor 2- SARI ICU), Peshawar; Lady Reading hospital (Floor 3- SARI ICU-2), Peshawar; Lady Reading hospital (GICU(OLD)), Peshawar; Lady Reading hospital (GICU), Peshawar; Lahore General Hospital, Lahore; Lahore General Hospital (Phase 3 SICU), Lahore; Liaquat University Hospital (SICU), Hyderabad; Mayo Hospital Lahore (BICU), Lahore; NICVD (CCU-2), Karachi; NICVD (MICU), Karachi; NICVD (SICU), Karachi; NICVD (Sari ICU), Karachi; National Hospital & Medical Center (SARI ICU), Lahore; National Hospital & Medical Center (SICU), Lahore; North West General Hospital (COVID Isolation Ward 4), Peshawar; North West General Hospital (COVID ward), Peshawar; North West General Hospital (HDU), Peshawar; North West General Hospital (MICU), Peshawar; North West General Hospital (SARI ICU), Peshawar; North West General Hospital (SICU), Peshawar; PIMS (MICU), Islamabad; PIMS (Sari ICU), Islamabad; Pakistan Kidney & Liver Institute (SARI ICU), Lahore; Pakistan Kidney & Liver Institute (SICU), Lahore; Patel Hospital (GICU), Karachi; Patel Hospital (SARI ICU), Karachi; SIUT Hospital, Karachi; Sheikh Zayed Medical College Rahim yar Khan (Mixed ICU), Rahim yar Khan; Sheikh Zayed Medical College Rahim yar Khan (SARI ICU), Rahim yar Khan; South City Hospital Karachi (MICU), Karachi; South City Hospital Karachi (SARI ICU), Karachi; South City Hospital Karachi (SARI Isolation Ward), Karachi; Ziauddin Medical University Clifton Campus (COVID Isolation Ward), Karachi; Ziauddin Medical University Clifton Campus (MICU), Karachi; Ziauddin Medical University Clifton Campus (SICU), Karachi; Ziauddin Medical University Clifton Campus (Sari ICU), Karachi; Ziauddin Medical University North Nazimabad Campus (3rd Floor COVID Isolation Ward), Karachi; Ziauddin Medical University North Nazimabad Campus (COVID Isolation Ward), Karachi; Ziauddin Medical University North Nazimabad Campus (General COVID Isolation Ward), Karachi; Ziauddin Medical University North Nazimabad Campus (MICU), Karachi; Ziauddin Medical University North Nazimabad Campus (Semi Medicine COVID Isolation Ward), Karachi.

## Palestine

Al Ahli Hospital, Hebron; Alshifa Hospital, Gaza.

## Peru

Clínica Internacional, Lima; Hospital Emergencia Ate Vitarte, Lima; Hospital Nacional Edgardo Rebagliati Martins, Lima; Hospital de Emergencias Villa El Salvador, Lima; Instituto Nacional del Niño San Borja, Lima.

## The Philippines

Angeles University Foundation Medical Center, Angeles; Makati Medical Centre, Makati.

## Poland

Consortium IMGEN, Piaseczno; Department of Children's Infectious Diseases, Medical University of Warsaw, Warsaw; Institute of TB and Lung Diseases, Warsaw; University Hospital in Krakow, Krakow.

## Portugal

Centro Hospital e Universitário de Coimbra, Coimbra; Centro Hospitalar Universitário do Algarve, Portimão; Centro Hospitalar Universitário do Porto (CHUP), Porto; Centro Hospitalar Vila Nova de Gaia/Espinho, Espinho; Centro Hospitalar de Leiria, Leiria; Centro Hospitalar de Tondela-Viseu, Viseu; Centro Hospitalar e Universitário de Coimbra - Hospital Pediátrico, Coimbra; Comissão de Ética - Unidade Local de Saúde de Matosinhos, Porto; Hospital Beatriz Ângelo, Loures; Hospital Curry Cabral - Intensive Care Unit - UCIP7, Lisbon; Hospital Da Luz, Lisbon; Hospital Egas Moniz, Lisboa; Hospital Espírito Santo de Évora, Évora; Hospital Garcia de Orta, Almada; Hospital Professor Doutor Fernando Fonseca, Amadora; Hospital Santa Maria, Centro Hospitalar Universitário Lisboa Norte, Amadora; Hospital São Francisco Xavier, Lisbon; Hospital Vila Franca de Xira, Lisbon; Hospital de Abrantes - ICU, Abrantes; Hospital de Curry Cabral - Infectious Diseases, Lisbon; Hospital de Curry Cabral - Internal Medicine, Lisbon; Hospital de São José -U.U.M., Lisbon; São João Hospital Centre, Porto; Unidade Local de Saúde de Alto Minho, Viana Do Castelo.

Qatar

Hamad General Hospital, Doha.

Romania

Grigore T Popa University of Medicine and Pharmacy, Bucharest; National Institute for Infectious Diseases Matei Bals, Bucharest.

Russia

Sechenov University, Moscow.

Réunion

Centre Hospitalier Félix-Guyon, Saint-Denis; Centre Hospitalier Universitaire de Saint-Pierre, Saint-Pierre.

Saint Martin (French)

Centre Hospitalier Universitaire de Martinique, Fort-de-France.

Saudi Arabia

Dr Mohammad Alfagih Hospital, Riyadh; King Abdulaziz Medical City, Riyadh; King Faisal Hospital Research Center, Riyadh; King Saud Medical City, Riyadh.

Senegal

CHU de Fann/Albert Royer, Dakar; Centre Hospitalier de l'Ordre de Malte (CHOM), Dakar; Hospital Center University De Fann, Dakar; Hospital Dalal Jamm, Dakar; Hôpital De Ndamatou, Deni Mali Gueye; Hôpital Principal de Dakar, Dakar; Hôpital de Diamnadio, Dakar; Institut Pasteur de Dakar, Dakar.

Singapore

National University Hospital, Singapore.

South Africa

2 Military Hospital, Cape Town; 3 Military Hospital, Bloemfontein; A-AJ-001-001; A-AJ-001-002; A-AJ-001-003; AbaQulusi Private Hospital, Vryheid; Aberdeen Hospital, Aberdeen; Abraham Esau Hospital, Calvinia; Addington Hospital, Durban; Adelaide Hospital, Adelaide; Ahmed Al-Kadi Private Hospital, Durban; Alan Blyth Hospital, Ladismith; Albert Nzula District Hospital, Trompsburg; Alexandra Hospital, Cape Town; Aliwal North Hospital, Maletsuwa; All Saints Hospital, Ngcobo; Amajuba Memorial Hospital, Volksrust; Ampath Emfuleni Mediclinic, Vanderbijlpark; Andries Vosloo Hospital, Somerset East; Arwyp Medical Centre, Kempton Park; Aurora Hospital, Gqeberha; Aurora Rehabilitation Hospital, Gqeberha; Bambisanza Hospital, Lusikisiki; Barberton Hospital, Barberton;

Bayview Private Hospital (Life), Mossel Bay; Beaufort West Hospital, Beaufort West; Bedford Hospital, Bedford; Beethoven Recovery Centre, Hartbeespoort; Belfast Hospital (HA Grove), Belfast; Benedictine Hospital, Nongoma; Bertha Gxowa Hospital, Germiston; Bethal Hospital, Bethal; Bethesda Hospital, Bethesda; Bheki Mlangeni Hospital, Johannesburg; Bill Pickard Hospital, Prieska; Bisho Hospital, Bisho; Bloemcare Psychiatric Hospital, Bloemfontein; Boitumelo Hospital, Kroonstad; Bongani Nurses' Dormitory Surge Facility, Edenburg; Bongani Regional Hospital, Welkom; Botlokwa Hospital, Mmatake; Botshabelo Hospital, Botshabelo; Botshelong Empilweni Hospital, Vosloorus; Botshilu Private Hospital, Soshanguve; Brackengate Intermediate Care, Cape Town; Brewelskloof Hospital, Worcester; Brits Hospital, Brits; Bronkhorstspruit Hospital, Bronkhorstspruit; Brooklyn Chest Hospital, Cape Town; Bryanston Subacute, Sandton; Burgersdorp Hospital, Burgersdorp; Busamed - Paardevlei private hospital, Cape Town; Busamed Bram Fischer International Airport Hospital, Bloemfontein; Busamed Gateway Private Hospital, Umhlanga; Busamed Harrismith Private Hospital, Harrismith; Busamed Hillcrest Private Hospital, Outer West Durban; Busamed Modderfontein Private Hospital Orthopaedic and Oncology Centre, Lethabong; Butterworth Hospital, Butterworth; CTICC COVID Intermediate Care, Cape Town; Cairnhall Hospital, Bloemfontein; Cala Hospital, Cala; Caledon Hospital, Caledon; Canzibe Hospital, Ngqeleni; Cape Gate Mediclinic, Cape Town; Capital hospital, Durban; Care Cure Queenstown, Queenstown; Carewell Sub-Acute Hospital, Still Bay; Carletonville Hospital, Carletonville; Carolina Hospital, Carolina; Cathcart Hospital, Cathcart; Catherine Booth Hospital, Amatikulu; Cecilia Makiwane Hospital, Mdantsane; Ceres Hospital, Ceres; Ceza Hospital, Ceza; Charles Johnson Memorial District Hospital, Nqutu; Charlotte Maxeke Hospital, Johannesburg; Chris Hani Baragwanath Hosp, Johannesburg; Christ The King Hospital, Ixopo; Citrusdal Hospital, Citrusdal; Clairwood Hospital, Durban; Clanwilliam Hospital, Clanwilliam; Clinix Naledi Nkanyelezi Hospital, Sebokeng; Clinix Solomon Stix Morewa Hospital, Johannesburg; Cloete Joubert Hospital, Barkly East; Cofimvaba Hospital, Cofimvaba; Corona Sub-Acute Hospital, Bethlehem; Cradock Hospital, Cradock; Crescent Clinic, Cape Town; Cullinan Rehabilitation Hospital, Cullinan; DP Marais Santa Centre, Cape Town; DR C N Phatudi Hospital, Mohlahlareng; Daxina Hospital, Lenasia; Daymed Private Hospital, Pietermaritzburg; De Aar Hospital, De Aar; Diamant Hospital, Jagersfontein; Dihlabeng Hospital, Bethlehem; Dilokong Hospital, Driekop; Donald Fraser Hospital, Thohoyandou; Donald Gordon Medical Centre, Johannesburg; Dora Nginza Hospital, Gqeberha; Dordrecht Hospital, Dordrecht; Doris Goodwin Hospital, Pietermaritzburg; Douglas CHC, Douglas; Dr George Mukhari Hospital, Ga-Rankuwa; Dr Harry Surtie Hospital, Upington; Dr JS Moroka Hospital, Thaba Nchu; Dr Malizo Mpehle Hospital, Tsolo; Dr S K Matseke Memorial Hospital, Diepmeadow; Dr Yusaf Dadoo Hospital, Krugersdorp; Duff Scott Memorial Hospital, City of Matlosana; Dundee Hospital, Dundee; Durdoc Hospital, Durban; East Griqualand & Usher Memorial Hospital, Kokstad; Eden Gardens Private Hospital, Pietermaritzburg; Edendale Hospital, Pietermaritzburg; Edenvale Hospital, Edenvale; Eerste River Hospital, Cape Town; Ekombe Hospital, Nkandla; Elim Hospital, Elim; Elizabeth Donkin Hospital, Gqeberha; Elizabeth Ross Hospital, Phuthaditjhaba; Elliot Hospital, Elliot; Ellisras Hospital, Lephala; Elsie Ballot Hospital, Amersfoort; Emalahleni Private Hospital, Emalahleni; Embhuleni Hospital, Elukwatin; Emmaus Hospital, Winterton; EmoyaMed Private Hospital, Bloemfontein; Empilweni Hospital, Tienbank; Empilweni Hospital, Gompo; Ermelo Provincial Hospital, Ermelo; Eshowe Hospital, Eshowe; Eskom Academy of Learning Quarantine Site, Midrand; Esselenpark School of Excellence Quarantine Site, Tembisa; Estcourt Hospital, Estcourt; Evander Hospital, Evander; Evuxakeni Hospital, Giyani; FH Odendaal Hospital, Modimolle; False Bay Hospital, Cape Town; Far East Rand Hospital, Springs; Fezi Ngubentombi Provincial Hospital, Sasolburg; Fisha wellness Hospital, Pretoria; Fort Beaufort Hospital, Fort Beaufort; Fort England Hospital, Makhanda; Fort Napier Hospital, Pietermaritzburg; Frere Hospital, East London; Fritz Visser Hospital, Nupoort; Frontier Hospital, Queenstown; GJ Crooke's Hospital, Scottburgh; Ganyesa Community Hospital, Ganyesa; General Justice Gizenga Mpanza Hospital, Durban; George Hospital, George; George Masebe Hospital, Haakdoring; Glen Grey Hospital- Lady Frere, Emalahleni; Greenville Hospital, Etyeni; Grey Hospital, Qonce; Grey's Hospital, Pietermaritzburg; Greytown Hospital, Greytown; Greytown Specialized TB Hospital, Greytown; Groblersdal Hospital, Groblersdal; Groote Schuur Hospital, Cape Town; Hanover Park Clinic Wc Par, Cape Town; Harry Comay Hospital Wc Hch, George; Hayani Psychiatric Hospital, Thohoyandou; Heidelberg Hospital, Heidelberg; Heideveld Cdc Wc Hvp, Cape Town; Heideveld Emergency Centre, Cape Town; Helderberg Hospital, Cape Town; Helderberg Village, Somerset West, Cape Town; Helen Joseph Hospital, Johannesburg; Helene Franz Hospital, Bochum; Hermanus Hospital, Hermanus; Hewu Hospital, Lukhanji; Hibiscus Cato Ridge Private Hospital, Cato Ridge; Hibiscus private hospital, Shepstone; Highway Subacute and Rehabilitation Hospital, Hillcrest; Hilldale Health Care Centre, Bloemfontein; Hillcrest Hospital, Hillcrest; Hlabisa Hospital, Nongoma; Holy Cross Hospital, Flagstaff; Hopetown Hospital, Hopetown; House Idahlia Critical Care Surge Facility, Bloemfontein; Humansdorp Hospital, Humansdorp; Indwe Hospital, Indwe; Inkosi Albert Luthuli Hospital, Durban; Isilimela Hospital, Gomolo; Isivivana Private Hospital, Humansdorp; Itemoheng Hospital, Senekal; Itshelejuba Hospital, Highlands; JMH Ascot Park Hospital, Durban; JMH City Hospital, Durban; JMH Isipingo Hospital, Durban; Jamestown Hospital, Jamestown; Jane Furse Hospital, Jane Furse; Job Shimankana Tabane Hospital, Rustenburg; Joe Morolong Memorial Hospital, Vryburg; John Daniel Newsberry Hospital, Cloolan; Jose Pearson TB Hospital, Bethelsdorp; Jubilee Hospital, Temba; Kakamas Hospital,

Kakamas; Kalafong Hospital, Pretoria; Kareedouw Hospital, Kareedouw; Karl Bremer Hospital, Cape Town; Kathu private hospital, Kathu; Katleho Hospital, Virginia; Keimoes Hospital, Keimoes; Kgapane Hospital, Modjadjiskloof; Khayelitsha Dist Hospital, Cape Town; Khotsong TB Hospital, Matatiele; Kiaat Private hospital, Mbombela; KimMed Private Hospital, Kimberley; King Dinuzulu Hospital, Berea; King Edward VIII Hospital, Durban; Klerksdorp Hospital, Klerksdorp; Knysna Hospital, Knysna; Knysna Private Hospital Wc Kvh, Knysna; Kokstad Private Hospital, Kokstad; Komani Hospital, Queenstown; Komga Hospital, Komga; Kopanong Hospital, Vereeniging; Kuruman Hospital, Kuruman; Kwa-Magwaza Hospital, KwaMagwaza; KwaDukuza Private Hospital, KwaDukuza; Kwamhlanga Hospital, KwaMhlanga; La Verna Private Hospital, Ladysmith; Lady Grey Hospital, Lady Grey; Ladysmith Hospital, Ladysmith; Laingsburg Hospital, Laingsburg; Lapa Munnik Hospital, Porterville; Lebowakgomo Hospital, Lebowakgomo; Lenmed Ahmed Kathrada Hospital, Johannesburg; Lenmed Ethekwini Hospital and Heart Centre, Newlands East; Lenmed Randfontein Private Hospital, Randfontein; Lenmed Royal Hospital and Heart Centre, Kimberly; Lenmed Zamokuhle Private Hospital, Tembisa; Lentegeur Hospital, Cape Town; Leratong Hospital, Krugersdorp; Letaba Hospital, Nkowankowa; Life Ann cron Hospital, Klerksdorp; Life Beacon Bay Private Hospital, East London; Life Bedford Gardens Hospital, Germiston; Life Brackenview, Alberton; Life Brenthurst Hospital, Johannesburg; Life Carstenhof Hospital, Midrand; Life Carstenview Hospital, Midrand; Life Chatsmed Garden Hospital, Chatsworth; Life Cosmos Hospital, Emalahleni; Life Dalview Hospital, Brakpan; Life East London Private Hospital, East London; Life Empangeni Private Hospital, Empangeni; Life Entabeni Hospital, Berea; Life Eugene Marais Hospital, Pretoria; Life Flora Hospital, Roodepoort; Life Fourways Hospital, Sandton; Life Genesis Clinic Saxonwold, Johannesburg; Life Glynnview Hospital, Benoni; Life Groenkloof Hospital, Pretoria; Life Health Care (Faerie Glen), Pretoria; Life Hilton Private Hospital, Hilton; Life Hunterscraig Hospital, Gqeberha; Life Kingsbury Hospital, Cape Town; Life Midmed Hospital, Middelburg; Life Mt Edgecombe Hospital, Phoenix; Life Pasteur Hospital, Bloemfontein; Life Peglerae Hospital, Rustenburg; Life Poortview Hospital, Roodepoort; Life Queenstown Private Hospital, Queenstown; Life Riverfield Rehab Centre, Randburg; Life Robinson Private Hospital, Randfontein; Life Roseacres Hospital, Germiston; Life Rosepark Hospital, Bloemfontein; Life Springs Parkland Hospital, Springs; Life St Dominic's Hospital, East London; Life St George's Hospital, Gqeberha; Life Suikerbosrand Hospital, Gauteng; Life The Glynnwood Hospital, Benoni; Life Vincent Pallotti Hospital, Cape Town; Life West Coast Private Hospital, Vredenburg; Life Westville Hospital, Durban; Life Wilgeheuwel Hospital, Roodepoort; Life Wilgers Hospital, Pretoria; Life the Crompton hospital, Pinetown; Livingstone Hospital, Gqeberha; Louis Pasteur Private Hospital, Pretoria; Louis Trichardt Hospital, Louis Trichardt; Lydenburg Hospital, Lydenburg; Lynnmed Clinic, Pretoria; MANCOVS Surge Facility, Virginia; Maclear Hospital, Maclear; Madadeni Hospital, Newcastle; Madwaleli Hospital, Madwaleli; Madzikane Ka Zulu Memorial Hospital, Mount Frere; Mafube Hospital, Frankfort; Mahatma Gandhi Memorial Hospital, Phoenix; Mahikeng Provincial Hospital, Mahikeng; Malamulele Hospital, Malamulele; Malmesbury Infectious Disease Hosp Wc Mid, Malmesbury; Mamelodi Hospital, Pretoria; Manapo Hospital, Phuthaditjhaba; Mangazi Hospital, Mangazi; Mani Dipico Hospital, Colesberg; Mankweng Hospital, Mankweng; Maphuta L Malatji Hospital, Phalaborwa; Mapulaneng Hospital, Bushbuckridge; Martjie Venter Hospital, Tarkastad; Maseve Filed - Royal Bafokeng (priv), Rustenburg; Matatiele Private Hospital, Matatiele; Matibidi Hospital, Matibidi; Matikwana Hospital, Mkhuhlu; Matlala Hospital, Matlala; Mbongolwane Hospital, Mbongolwane; Mccords Hospital, Berea; Mecklenburg Hospital, Limpopo; Medforum Private Hospital, Pretoria; Medicare private hospital, Rustenburg; Mediclinic Bloemfontein, Bloemfontein; Mediclinic Brits, Brits; Mediclinic Cape Town, Cape Town; Mediclinic Constantiaberg, Cape Town; Mediclinic Durbanville, Cape Town; Mediclinic Ermelo Hospital, Ermelo; Mediclinic Gariep Hospital, Kimberley; Mediclinic Geneva Hospital, George; Mediclinic George Hospital, George; Mediclinic Gynaecological Hospital, Pretoria; Mediclinic Heart Hospital, Pretoria; Mediclinic Hermanus, Hermanus; Mediclinic Highveld Hospital, Trichardt; Mediclinic Hoogland Hospital, Bethlehem; Mediclinic Howick, Howick; Mediclinic Kimberley, Kimberley; Mediclinic Klein Karoo Hospital, Oudtshoorn; Mediclinic Kloof Hospital, Pretoria; Mediclinic Legae Hospital, Mabopane; Mediclinic Lephale Hospital, Lephale; Mediclinic Limpopo, Polokwane; Mediclinic Louis Leipoldt, Cape Town; Mediclinic Midstream, Olifantsfontein; Mediclinic Milnerton Hospital, Cape Town; Mediclinic Morningside, Johannesburg; Mediclinic Muelmed Hospital, Pretoria; Mediclinic Paarl Hospital, Paarl; Mediclinic Panorama Hospital, Cape Town; Mediclinic Pietermaritzburg Hospital, Pietermaritzburg; Mediclinic Plettenberg Bay Hospital, Plettenberg Bay; Mediclinic Potchefstroom Hospital, Potchefstroom; Mediclinic Sandton Hospital, Sandton; Mediclinic Stellenbosch, Stellenbosch; Mediclinic Thabazimbi, Thabazimbi; Mediclinic Tzaneen, Tzaneen; Mediclinic Upington, Upington; Mediclinic Vereeniging Hospital, Vereeniging; Mediclinic Vergelegen, Cape Town; Mediclinic Victoria, oThongathi; Mediclinic Welkom Hospital, Welkom; Mediclinic Winelands Orthopaedic Hospital, Stellenbosch; Mediclinic Worcester, Worcester; Medicross Cape Town Foreshore Theatre, Cape Town; Medicross Procare, Kingsburgh; Medicross Richards Bay Day Theatre, Richards Bay; Medicross Upington Day Theatre, Upington; Medicross Wembley House, Pietermaritzburg; Medicross langeberg, Cape Town; Medleb, Lebowakgomo; Melomed Gatesville, Cape Town; Melomed Mitchells Plain Private Hospital, Cape Town; Melomed Richards Bay Private Hospital, Richards Bay; Melomed Tokai Private Hospital, Cape Town; Melomed bellville, Cape Town;

Mercantile Private Hospital, Gqeberha; Messina Hospital, Musina; Middelburg Hospital, Middelburg; Midland Hospital, Graaff-Reinet; Midlands Medical Centre Private Hospital, Pietermaritzburg; Midvala Private Hospital, Vereeniging; Mitchell's Plain Covid Field Intermediate Care; Mitchell's Plain District Hosp; Mjanyana Hospital; Mmametlhae Hospital, Napier; Modimolle MDR TB Hospital; Mohau Hospital; Mokopane Hospital; Molteno Hospital; Montagu Hospital; Montebello Hospital; Mooimed Private Hospital; Morehill Clinic Physical rehab; Mossel Bay Hospital; Mosvold Hospital; Mount Ayliff Hospital; Mowbray Maternity Hospital; Mseleni Hospital; Mthatha Private Hospital; Murchison Hospital; Murraysburg Hospital; N17 Hospital; Nala Hospital; Nasrec Quarantine Site; National District Hospital; National Institute for Communicable Diseases, Johannesburg; Nelson Mandela Academic Hospital; Nelspruit Medi Clinic; Nessie Knight Hospital; Netcare Akasia Hospital; Netcare Alberlito Hospital; Netcare Blaauwberg Hospital; Netcare Bougainville Hospital; Netcare Ceres Hospital; Netcare Christiaan Barnard Memorial Hospital; Netcare Clinton; Netcare Cuyler Hospital; Netcare Femina Hospital; Netcare Garden City Hospital; Netcare Greenacres Hospital; Netcare Jakaranda Hospital; Netcare Kingsway Hospital; Netcare Kroon Hospital; Netcare Krugersdorp Hospital; Netcare Kuils River Hospital; Netcare Lakeview Hospital; Netcare Linksfield Hospital; Netcare Linkwood Hospital; Netcare Linmed Hospital; Netcare Margate Hospital; Netcare Milpark Hospital; Netcare Montana Hospital; Netcare Moot Hospital; Netcare Mulbarton Hospital; Netcare N1 City Hospital; Netcare Olivedale Hospital; Netcare Optiklin Hospital; Netcare Parklands Hospital; Netcare Pelonomi Private Hospital; Netcare Pholoso Hospital; Netcare Pinehaven Hospital; Netcare Pretoria-East Hospital; Netcare Rehabilitation Hospital; Netcare Rosebank Hospital; Netcare St Anne's Hospital; Netcare St Augustine Hospital; Netcare Sunninghill Hospital; Netcare Sunward Park Hospital; Netcare The Bay Hospital; Netcare Umhlanga Hospital; Netcare Union Hospital; Netcare Unitas ECMO Centre; Netcare Unitas Hospital; Netcare Vaalpark Clinic; Netcare Waterfall Hospital; Netcare ferncrest hospital; New Kensington Clinic (Life); New Somerset Hospital; Newcastle Hospital; Newcastle Private Hospital; Ngwelezana Hospital; Nkandla Hospital; Nketoana District Hospital; Nkhensani Hospital; Nkonjeni Hospital; Nkqubela Chest Hospital; Nompumelelo Hospital; Nurture Cape View; Nurture Ilembe; Nurture Newlands; Nurture Queenstown; Nurture Rynmed; Nurture Sunnyside; Nurture Vereeniging; Nurture Woodlands (Mental Health Institution); ODI Community Hospital; Orsmond TB Hospital; Osindisweni Hospital; Othobothini CHC; Otto Du Plessis Hospital; Oudtshoorn Hospital; Paarl Hospital; Park Lane Clinic; Parys Hospital; Pelonomie Hospital; Phekolong Hospital; Philadelphia Hospital; Pholosong Hospital; Phumelela Hospital; Phuthuloha Hospital; Piet Retief Hospital; Polokwane Hospital; Port Alfred Hospital; Port Shepstone Hospital; Postmasburg Hospital; Potchefstroom Hospital; Pretoria Eye Institute Arcadia, Pretoria; Pretoria Urology Hospital, Pretoria; Pretoria West Hospital; Prieska Hospital; Prince Albert Hospital; Prince Cyril Zulu Cdc; Prince Mshiyeni Hospital; Prof ZK Matthews Hospital; Queen Nandi Regional Hospital, Empangeni; RH Matjhabeng Hospital; RH Phodiclinic; RH Piet Retief Hospital; RH Rand Hospital; RK Khan Hospital; Radie Kotze Hospital; Rahima Moosa Mother And Child Hospital; Red Cross Childrens Hospital; Rev Dr Elizabeth Mamisa Chabula-Nxiweni Field Hospital; Richmond Hospital; Riemland Clinic; Rietvlei Hospital; Riversdale Hospital; Rob Ferreira Hospital; Robert Mangaliso Sobukwe Hospital; Robertson Hospital; Rondebosch medical centre; SS Gida Hospital; Sabie Hospital; Sawas Hospital; Schweizer Reneke Hospital; Sebokeng Hospital; Sekororo Hospital; Seniorita Ntlabathi District Hospital; Seshego Hospital; Settlers Hospital PPP; Shelly Beach Private Hospital; Shifa private hospital; Shongwe Hospital; Siloam Hospital; Sipetu Hospital; Sizwe Tropical Diseases Hosp; Sonstraal Hospital; South Rand Hospital; Springbok Hospital; St Aidan's Mission Hospital; St Andrews Hospital; St Apollinaris Hospital; St Barnabas Hospital (Ntlaza); St Elizabeth Hospital; St Francis Hospital (aliwal North); St Helena GM Hospital; St Lucy's Hospital; St Margarets Hospital; St Mary's Hospital; St Mary's Hospital - Umtata; St Patrick's Hospital; St Rita's Hospital; Standerton Hospital; Standerton Tb Hospital; Stellenbosch Hospital; Sterkfontein Hospital; Sterkstroom Hospital; Steve Biko Academic Hospital; Steynsburg Hospital; Stikland Psychiatric Hospital; Stoffel Coetze Hospital; Stutterheim Hospital; Sundays Valley Hospital; Sunningdale Hospital; Sunshine Hospital; Swartland Hospital; Swellendam Hospital; Tafalofefe Hospital; Tambo Memorial Hospital; Tara H Moross Hospital; Taung Hospital; Tayler Bequest Hospital (matatiele); Taylor Bequest Hospital (mount Fletcher); Tb Specialised Hospital (barberton); Telkom Learning Centre Quarantine Site; Tembisa Hospital; Thabamoopo Psychiatric Hosp; Thabazimbi Hospital; The Fountain Private Hospital; Thebe Hospital; Thelle Mogoerane Regional Hospital; Themba Hospital; Thulasizwe Hospital; Thusanong Hospital; Tintswalo Hospital; Tokollo Hospital; Tonga Hospital; Tower Psychiatric Hospital; Town Hill Hospital; Tshepo-Themba Private Hospital; Tshepong Hospital; Tshilidzini Hospital; Tshwane District Hospital, Pretoria; Tshwane Rehabilitation Hospital, Pretoria; Tygerberg Hospital; Uct Private Academic Hospital; Uitenhage Hospital; Umlamli Hospital; Umphumulo Hospital; Umtata General Hospital; Uniondale Hospital; Universitas Hospital; Universitas Private Hospital; Universitas Underground Parking Surge Facility; Untunjambili Hospital; Valkenberg Hospital; Van Velden Hospital; Victoria Hospital; Victoria Hospital (alice); Victoria Private Hospital; Vista Clinic; Voortrekker Hospital; Vredenburg Hospital; Vredendal Hospital; Vryburg private hospital; Vryheid Hospital; WF Knobel Hospital; Warmbaths Hospital; Waterval-boven Hospital; Wentworth Hospital; Wesfleur Hospital; Weskoppies Hospital; West Vaal Hospital; Western Cape Rehabilitation Centre; Wilhelm Stahl Hospital; Willowmore Hospital; Wilmed Park Private Hospital; Winburg Hospital; Winterberg Tb Hospital;

Witbank Hospital; Witpoort Hospital; Worcester Hospital Wc Woc; Zebediela Hospital, Magatle; Zithulele Hospital, Mqanduli; Zoutpansberg Private Hospital, Louis Trichardt; Zuid Afrikaans Hospital, Pretoria.

South Korea

Chonnam National University Hospital, Dong-gu; Keimyung University Dong San Hospital, Daegu; Kyung Pook National University Chilgok Hospital, Daegu; Seoul National University Bundang Hospital, Seoul; Severance Hospital, Seoul.

Spain

Hospital 12 de Octubre, Madrid; Hospital Clinic de Barcelona, Barcelona; Hospital Nuestra Señora de Gracia, Zaragoza; Hospital Puerta de Hierro Majadahonda, Madrid; Hospital Ramon y Cajal, Madrid; Hospital Universitari Sagrat Cor, Barcelona; Hospital Universitari Sant Joan D'Alacant, Alicante; Hospital Universitario Dr Negrín, Las Palmas; Hospital Universitario Virgen de Valme, Seville; Hospital Universitario de Alava, Araba; Hospital Vall d'Hebron, Barcelona; Hospital Verge de la Cinta, Tortosa; Hospital del Mar, Barcelona; La Paz Hospital, Madrid; Reina Sofia University Hospital, Cordoba; Rio Hortega University Hospital, Valladolid; San Pedro de Alcantara Hospital, Cáceres; University Hospital Virgen del Rocío / Institute of Biomedicine of Seville, Seville.

Sudan

Atbara Teaching Hospital, Atbara; Jabra Hospital Khartoum, Khartoum; Soba University Hospital, Khartoum.

Syrian Arab Republic

Al-Mouwasat University Hospital, Damascus; Tishreen University Hospital, Latakia.

Taiwan

National Taiwan University Hospital, Taipei City.

Thailand

Siriraj Piyamaharajkarun Hospital (SiPH), Bangkok.

Turkey

Marmara University Hospital, Istanbul.

Uganda

Entebbe regional referral hospital, Entebbe; Lubaga hospital, Kampala; Mengo hospital, Kampala; St. Francis hospital Nsambya, Kampala; Uganda Virus Research Institute, Entebbe; Uganda virus research institute clinic, Entebbe.

Ukraine

Kharkiv Regional Clinical Infectious Diseases Hospital, Kharkiv; Lugansk State Medical University - Department of Internal Medicine No2, Lugansk.

United Arab Emirates

Cleveland Clinic Abu Dhabi, Abu Dhabi; NMC Al Nahda Hospital Dubai, Dubai; NMC Royal Hospital, Abu Dhabi.

United Kingdom

Aberdeen Royal Infirmary, Aberdeen; Abraham Cowley Unit, Chertsey; Adamson Hospital, Cupar; Addenbrooke's Hospital, Cambridge; Airedale General Hospital, Steeton; Alder Hey Children's NHS Foundation Trust, Liverpool;

Alderney Hospital, Poole; Amherst Court, Chatham; Arrowe Park Hospital, Wirral; Ashworth Hospital, Liverpool; Barnet Hospital, Barnet; Barnsley Hospital, Barnsley; Basildon University Hospital, Basildon; Basingstoke and North Hampshire Hospital, Basingstoke; Bassetlaw Hospital, Worksop; Bedford Hospital, Bedford; Bedford Hospital South Wing, Bedford; Beech House, Maidstone; Birmingham Children's Hospital, Birmingham; Birmingham City Hospital, Birmingham; Birmingham and Solihull Mental Health NHS Foundation Trust, Birmingham; Blackberry Hill Hospital, Bristol; Blackpool Victoria Hospital, Blackpool; Blandford Community Hospital, Blandford Forum; Borders General Hospital, Melrose; Bowmere Hospital, Chester; Bradford Royal Infirmary, Bradford; Bridport Community Hospital, Bridport; Brighton General Hospital, Brighton; Bristol Royal Hospital for Children, Bristol; Bristol Royal Infirmary, Bristol; Bronglais General Hospital, Aberystwyth; Broomfield Hospital, Chelmsford; Bryn Beryl Hospital, Pwllheli; Burton Hospital, Burton-on-Trent; CUH at Basildon University Hospital, Basildon; Caithness General Hospital, Wick; Caludon Centre, Coventry; Cameron Hospital, Leven; Campbeltown Hospital, Campbeltown; Castle Hill Hospital, Cottingham; Cefni Hospital, Llangefni; Central Middlesex Hospital, London; Charing Cross Hospital, London; Charlton Lane Hospital, Cheltenham; Chelsea & Westminster Hospital, London; Chesterfield Royal Hospital, Chesterfield; Chirk Community Hospital, Wrexham; Cirencester Hospital, Cirencester; Clatterbridge Cancer Centre -Wirral, Wirral; Cockermouth Hospital, Cockermouth; Colchester General Hospital, Colchester; Colwyn Bay Community Hospital, Colwyn Bay; Community Rehabilitation Team (East), Leicester; Conquest Hospital, Saint Leonards; Copeland Unit, Whitehaven; Countess of Chester Hospital, Chester; County Hospital, Stafford; Cowal Community Hospital, Dunoon; Croydon University Hospital, Thornton Heath; Cumberland Infirmary, Carlisle; Darent Valley Hospital, Dartford; Darlington Memorial Hospital, Darlington; Deeside Community Hospital, Deeside; Denbigh Community Hospital, Denbigh; Derbyshire Healthcare NHS Foundation Trust, Derby; Derriford Hospital, Plymouth; Diana, Princess of Wales Hospital, Grimsby; Dilke Memorial Hospital, Cinderford; Dolgellau & Barmouth District Hospital Site, Dolgellau; Doncaster - Tickhill Road Site, Doncaster; Doncaster Royal Infirmary, Doncaster; Dorset County Hospital, Dorchester; Dumfries & Galloway Royal Infirmary, Dumfries; Ealing Hospital, Southall; East Surrey Hospital, Surrey; Eastbourne District General Hospital, Eastbourne; Eryri Hospital, Caernarfon; Fairfield General Hospital, Bury; Fieldhead Hospital, Wakefield; Forest Close, Sheffield; Forest Lodge, Sheffield; Forth Valley Royal Hospital, Larbert; Frimley Park Hospital, Camberley; Fulbourn Hospital, Cambridge; Furness General Hospital, Barrow-in-Furness; George Eliot Hospital - Acute Services, Nuneaton; Glangwili Hospital Child Health Section, Carmarthen; Glenrothes Hospital, Glenrothes; Gloucestershire Royal Hospital, Gloucester; Golden Jubilee National Hospital, Clydebank; Grantham & District Hospital, Grantham; Great Ormond Street Hospital Central London Site, London; Grenoside Grange, Sheffield; Hairmyres Hospital, Glasgow; Hammersmith Hospital, London; Harefield Hospital, Uxbridge; Harplands Hospital, Stoke-on-Trent; Harrogate District Hospital, Harrogate; Hellesdon Hospital, Norwich; Hereford County Hospital, Hereford; Hillingdon Hospital, Uxbridge; Hinchingbrooke Hospital, Huntingdon; Hollins Park, Warrington; Holywell Community Hospital, Holywell; Homerton University Hospital, London; Huddersfield Royal Infirmary, Huddersfield; Hull Royal Infirmary, Hull; Ipswich Hospital, Ipswich; James Paget University Hospital, Great Yarmouth; John Radcliffe Hospital, Oxford; Kent & Canterbury Hospital, Kent; Keswick Hospital, Keswick; Kettering General Hospital, Kettering; King's College Hospital (Denmark Hill), London; King's Mill Hospital, Sutton-in-Ashfield; Kings Court 2, Worcester; Kingston Hospital, Kingston upon Thames; Lantern Centre, Preston; Leeds General Infirmary, Leeds; Leicester Royal Infirmary, Leicester; Leicestershire Partnership NHS Trust Mental Health Services, Leicester; Leighton Hospital, Crewe; Lincoln County Hospital, Lincoln; Lincolnshire Community Health Services Unit 11, Sleaford; Lincolnshire Partnership NHS Foundation Trust, Sleaford; Lister Hospital, Stevenage; Liverpool Heart and Chest Hospital NHS Trust HQ, Liverpool; Liverpool Women's Hospital, Liverpool; Livewell Southwest, Plymouth; Llandudno General Hospital Site, Llandudno; Lorn and Islands Hospital, Oban; Luton & Dunstable Hospital, Luton; Lynfield Mount Hospital, Bradford; Macclesfield District General Hospital, Macclesfield; Manchester Royal Infirmary, Manchester; Medway Maritime Hospital, Gillingham; Michael Carlisle Centre, Sheffield; Midhurst Community Hospital, Midhurst; Milton Keynes Hospital, Milton Keynes; Mold Community Hospital; Monklands District General Hospital; Moorgreen Hospital; Morriston Hospital; Moseley Hall Hospital; Musgrove Park Hospital; New Cross Hospital; Ninewells Hospital; Noahs Ark Childrens Hospital for Wales; Norfolk & Norwich University Hospital; North Devon District Hospital; North Lincs - Great Oaks Inpatient Unit; North Manchester General Hospital; North Middlesex Hospital; North Tyneside General Hospital; Northampton General Hospital (Acute); Northern General Hospital; Northumbria Specialist Emergency Care Hospital; Northwick Park Hospital; Norwich Community Hospital; Nottingham University Hospitals NHS Trust - City Campus, Nottingham; Nottingham University Hospitals NHS Trust - Queen's Medical Centre Campus, Nottingham; PHOSP, University of Leicester, Leicester; Penn Hospital; Penrith Hospital; Peterborough City Hospital; Pilgrim Hospital; Pinderfields General Hospital; Poole General Hospital, Poole; Prince Charles Hospital Site; Prince Philip Hospital; Princess Alexandra Hospital, Harlow; Princess Royal Hospital, Haywards Heath; Queen Alexandra Hospital; Queen Elizabeth Hospital, Gateshead; Queen Elizabeth Hospital, London; Queen Elizabeth Hospital, Birmingham; Queen Elizabeth The Queen Mother Hospital, Margate; Queen Elizabeth University Hospital, Glasgow; Queen's Hospital, Romford; RNI Community Hospital; Raigmore Hospital;

Robert Jones & Agnes Hunt Orthopaedic Hospital; Rotherham District General Hospital; Rotherham Older People's Mental Health Services; Royal Albert Edward Infirmary; Royal Berkshire Hospital; Royal Blackburn Hospital; Royal Bolton Hospital; Royal Bournemouth General Hospital, Bournemouth; Royal Bournemouth Hospital Bcsc, Bournemouth; Royal Brompton Hospital; Royal Cornwall Hospital (Treliske); Royal Derby Hospital; Royal Devon & Exeter Hospital (Wonford); Royal Free Hospital; Royal Gwent Hospital, Newport; Royal Hallamshire Hospital; Royal Hampshire County Hospital; Royal Hospital for Sick Children (Edinburgh); Royal Infirmary of Edinburgh at Little France; Royal Lancaster Infirmary; Royal Liverpool University Hospital; Royal Manchester Children's Hospital; Royal Oldham Hospital; Royal Orthopaedic Hospital; Royal Papworth Hospital (Papworth Everard); Royal Preston Hospital; Royal Shrewsbury Hospital; Royal Stoke University Hospital; Royal Surrey County Hospital; Royal Sussex County Hospital; Royal United Hospital; Russells Hall Hospital; Ruthin Community Hospital; Salford Royal; Salisbury District Hospital; Sandwell General Hospital; Scarborough General Hospital; Scunthorpe General Hospital; Sheffield Children's Hospital; Shropshire Community Health NHS Trust HQ; South Tyneside District Hospital; Southampton General Hospital; Southend Hospital; Southern Health & Social Care Trust; Southmead Hospital; Southport & Formby District General Hospital; Springfield University Hospital; St George's Hospital; St George's Hospital (Tooting); St Helier Hospital; St James's University Hospital; St John's Hospital; St Marks Hospital; St Mary's Health Campus; St Mary's Hospital; St Mary's Hospital (HQ); St Michael's Hospital; St Nicholas Hospital (Newcastle Upon Tyne); St Peter's Hospital, Surrey; St Richard's Hospital; St Thomas' Hospital; Stepping Hill Hospital; Stockdale House; Stoke Mandeville Hospital; Stroud General Hospital; Sunderland Royal Hospital; Sussex Partnership NHS Foundation Trust, Worthing; Tameside General Hospital; Tees, Esk, Wear Valley NHS Trust (Durham); Tewkesbury General Hospital; The Christie NHS Foundation Trust, Manchester; The Great Western Hospital; The James Cook University Hospital; The Longley Centre; The Maidstone Hospital; The Mount, Leeds; The Queen Elizabeth Hospital; The Royal Glamorgan Hospital; The Royal London Hospital, London; The Royal Marsden Hospital (London); The Royal Marsden Hospital (Surrey); The Royal Victoria Infirmary; The Tunbridge Wells Hospital; The Walton Centre NHS Foundation Trust; The Whittington Hospital; Torbay Hospital; Trafford General Hospital; Trengweath Mental Health Unit, Redruth; Trust Head Office; Trust Headquarters; University College Hospital; University College London Hospitals NHS Foundation Trust HQ; University Hospital Aintree; University Hospital Ayr; University Hospital Coventry; University Hospital Crosshouse; University Hospital Lewisham; University Hospital of North Durham; University Hospital of North Tees; University Hospital of Wales; University of Edinburgh, Edinburgh; Urgent Care Centre; Victoria Hospital; Victoria Hospital W'orne; Walsall Manor Hospital, Walsall; Walton Hospital; Wansbeck Hospital; Warrington Hospital; Warwick Hospital; Watford General Hospital; West Cumberland Hospital; West Middlesex University Hospital; West Suffolk Hospital; Western Community Hospital; Western General Hospital; Westminster Memorial Hospital; Westmorland General Hospital; Weston General Hospital; Wexham Park Hospital; Weymouth Community Hospital; Whiston Hospital; William Harvey Hospital (Ashford); Wishaw General Hospital; Withybush General Hospital; Wonford House; Worcestershire Royal Hospital, Worcester; Worthing Hospital, Worthing; Wotton Lawn Hospital, Gloucester; Wrexham Maelor Hospital, Wrexham; Wycombe Hospital, High Wycombe; Wythenshawe Hospital, Manchester; Yeovil District Hospital, Yeovil; York Hospital, York; Ysbyty Alltwen, Gwynedd; Ysbyty Cwm Cynon, Mountain Ash; Ysbyty Cwm Rhondda, Tonypandy; Ysbyty Glan Clwyd, Bodelwyddan; Ysbyty Gwynedd, Bangor; Ysbyty Penrhos Stanley, Holyhead.

#### United States of America

Allegheny General Hospital, Pittsburgh; Avera McKennan Hospital & University Health Center, South Dakota; Baylor All Saints Medical Centre, Fort Worth; Baylor Scott & White Health, Temple; Baylor University Medical Centre, Dallas; Baystate MC, Springfield; Beth Israel Deaconess, Boston; Beth Israel Deaconess Medical Center, Boston; Brigham and Women's Hospital, Boston; Brooke Army Medical Centre, San Antonio; Carilion Clinic, Roanoke; Cedars-Sinai MC, Los Angeles; Cleveland Clinic, Weston; Cleveland Clinic Foundation, Cleveland; Cleveland Clinic, Ohio, Ohio, OH; Columbia University, New York; Denver Health MC, Colorado; Duke University MC, North Carolina; Emory University Healthcare System, Atlanta; Harborview MC, Washington; Hartford HealthCare, Hartford; Hennepin County MC, Minneapolis; Henry Ford Health System, Detroit; Houston Methodist Hospital, Texas; INOVA Alexandria Hospital, Alexandria, Virginia; INOVA Fair Oak Hospital, Chantilly, Virginia; INOVA Fairfax Heart Hospital, Annandale, Virginia; INOVA Fairfax Medical Center, Fairfax, Virginia; INOVA Fairfax Women & Children Hospital, Annandale, Virginia; INOVA Loudoun Hospital, Virginia; INOVA Mount Vernon Hospital, Hybla Valley, Virginia; Intermountain Medical Center, Utah; Johns Hopkins, Baltimore; Lancaster General Health, Pennsylvania; Lankenau Institute of Medical Research, Wynnewood; Legacy Emanuel Medical Center, Portland; Louisiana State University MC, Louisiana; Maine Health, Portland; Massachusetts General Hospital, Massachusetts; Mayo Clinic School of Medicine, Arizona; McLeod Healthcare System, Florence; MedStar Washington Hospital Centre, Washington; Medical College of Wisconsin, Wisconsin; Medical University of South Carolina, South Carolina; Montefiore MC, New York; Montefiore MC North,

New York; Montefiore MC Weiler, New York; Mount Sinai Medical Center, Miami; National Jewish Health / St Joseph, Colorado; Nationwide Children's Hospital, Columbus; Northwell Health, New York; Ochsner Clinic Foundation, New Orleans; Ohio State East Hospital, Columbus; Ohio State University, Columbus; Oklahoma Heart Institute, Oklahoma; Oregon Health and Science University, Portland; Perelman School of Medicine at the University of Pennsylvania, Philadelphia; Piedmont Atlanta Hospital, Atlanta, Georgia; Presbyterian Hospital Services, Albuquerque; Providence Saint John's Health Centre, Santa Monica; Rochester General Hospital, New York; Rush University Medical Center, Chicago; Sentara Norfolk General Hospital, Norfolk; St Christopher's Hospital for Children, Philadelphia; St Vincent, Minnesota; Stanford University, Palo Alto; Stanford University Hospital, California; Swedish Hospital Cherry Hill, Washington; Swedish Hospital First Hill, Washington; Temple University Hospital, Pennsylvania; The Christ Hospital, Ohio; The Heart Hospital Baylor Plano, Plano; The Mount Sinai Hospital, New York; Tufts Medical Centre, Boston; UH Cleveland Hospital, Cleveland; UPMC, Pittsburgh; UPMC Mercy, Pittsburgh; UPMC Shadyside, Pennsylvania; US NHLBI PETAL Network, Boston; UT Southwestern, Dallas; University of Alabama at Birmingham Hospital, Birmingham; University of Arizona, Arizona; University of California - San Francisco (UCSF), San Francisco; University of California Davis, California; University of California Ronald Reagan MC, California; University of California SF, California; University of California SF Fresno, California; University of California San Francisco - Fresno, Fresno; University of Chicago, Chicago; University of Cincinnati, Cincinnati; University of Cincinnati MC, Cincinnati; University of Colorado Hospital, Colorado; University of Florida, Gainesville; University of Florida HSC Shands, Gainesville; University of Iowa, Iowa City; University of Kansas Medical Center, Kansas; University of Kentucky, Kentucky; University of Maryland, Baltimore; University of Michigan MC, Michigan; University of Michigan Schools of Medicine & Public Health, Ann Arbor; University of Mississippi MC, Mississippi; University of Nebraska Medical Center, Omaha; University of Oklahoma Health Sciences Center, Oklahoma; University of Texas HSC Houston, Texas; University of Utah, Salt Lake City; University of Utah HSC, Utah; University of Virginia MC; University of Washington MC, Washington; University of Washington Medical Center - Northwest, Seattle; Vanderbilt University MC, Tennessee; Virginia Commonwealth University, Richmond; Wake Forest Baptist Health, North Carolina; Washington University in St. Louis, St Louis, Missouri.

Viet Nam

Hospital for Tropical Diseases, Ho Chi Minh City.