icnarc intensive care national audit & research centre
25 years and counting...

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ICNARC report on COVID-19 in critical care:

England, Wales and Northern Ireland

2 October 2020

This report presents analyses of data on patients critically ill with confirmed COVID-19 reported to ICNARC up to 4pm on 1 October 2020 from critical care units participating in the Case Mix Programme (the national clinical audit covering all NHS adult, general intensive care and combined intensive care/high dependency units in England, Wales and Northern Ireland, plus some additional specialist and non-NHS critical care units).

Due to the increasing number of recent admissions, data are reported separately for patients critically ill with confirmed COVID-19 at or after the start of critical care:

- admitted from 1 September 2020 to date; and
- admitted up to 31 August 2020.

Please note that adult critical care units in Scotland, paediatric intensive care units and neonatal intensive care units do not participate in the Case Mix Programme.

Reporting process

Critical care units participating in the Case Mix Programme are asked to:

- log a case with ICNARC by submitting demographic data as soon as they have an admission with confirmed COVID-19;
- resubmit data, including first 24-hour physiology, as soon as possible after the end of the first 24 hours in critical care;
- resubmit data for the whole critical care stay, including critical care outcome and organ support, when the patient leaves critical care; and
- submit final data when the patient leaves acute hospital.

ICNARC have logged data for 564 admissions of 527 patients critically ill with confirmed COVID-19, either at or after the start of critical care admitted from 1 September 2020 to date in England, Wales and Northern Ireland. Of these, data covering the first 24 hours of critical care have been submitted to ICNARC for 443 patients (Figure 1). Of the 527 total patients, 211 have outcomes reported and 316 patients were last reported as still receiving critical care. These patients are compared with a cohort of 10,877 patients with confirmed COVID-19 admitted up to 31 August 2020.

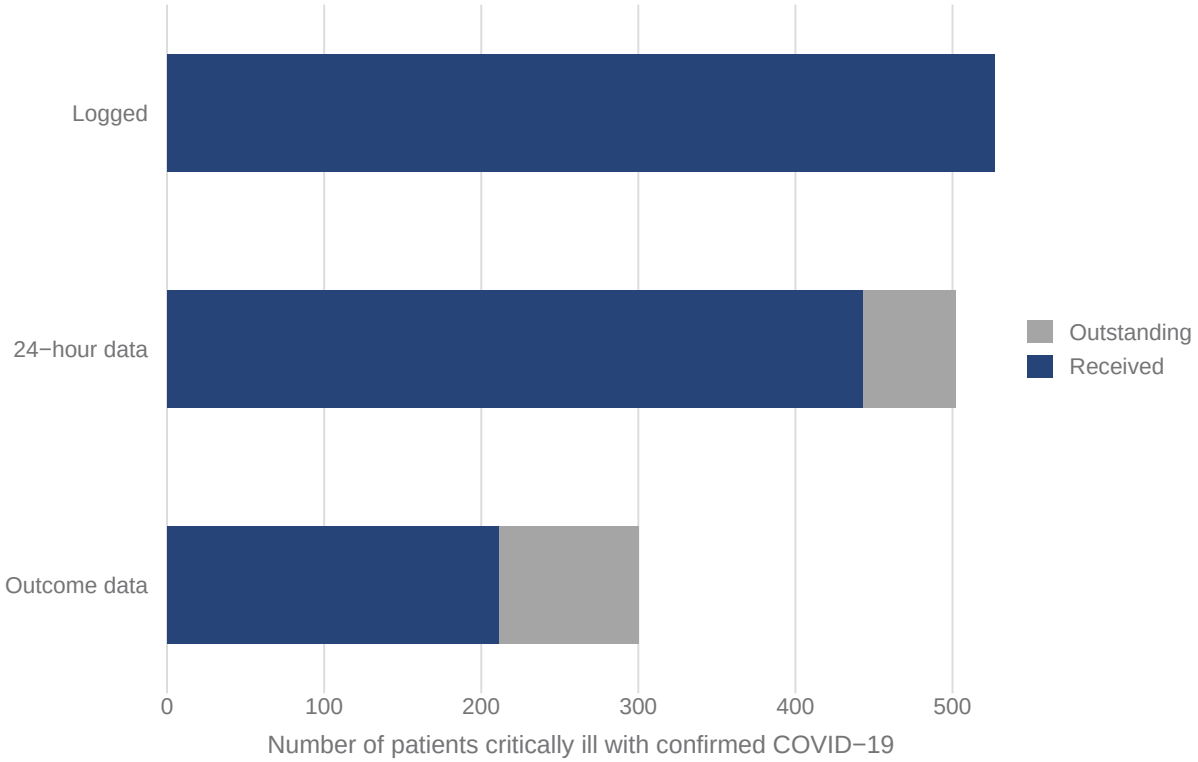


Figure 1. Numbers of critically ill patients with confirmed COVID-19 admitted from 1 September 2020 with data included in this report and outstanding *

* Please note that 24-hour data are considered outstanding when a case was logged at least 48 hours previously and outcome data are considered outstanding when 24-hour data have been received and at least 10 days have elapsed since the start of critical care.

Of the 527 patients critically ill with confirmed COVID-19 admitted from 1 September 2020 to date, the largest numbers were admitted in the North West, Midlands, and North East And Yorkshire regions (Figure 2).

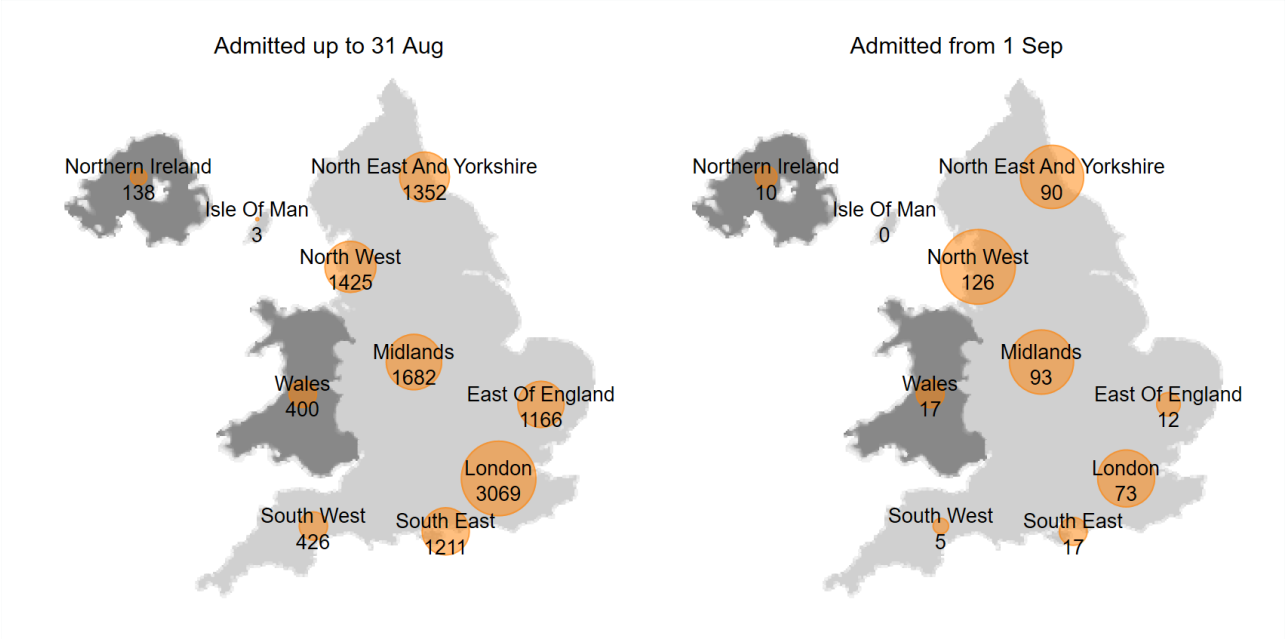


Figure 2. Geographical distribution of patients critically ill with confirmed COVID-19

The numbers of new patients, cumulative numbers of patients and numbers of patients in critical care by date are shown in Figures 3-6. Please note that these figures are affected by a variable lag time for submission of data.

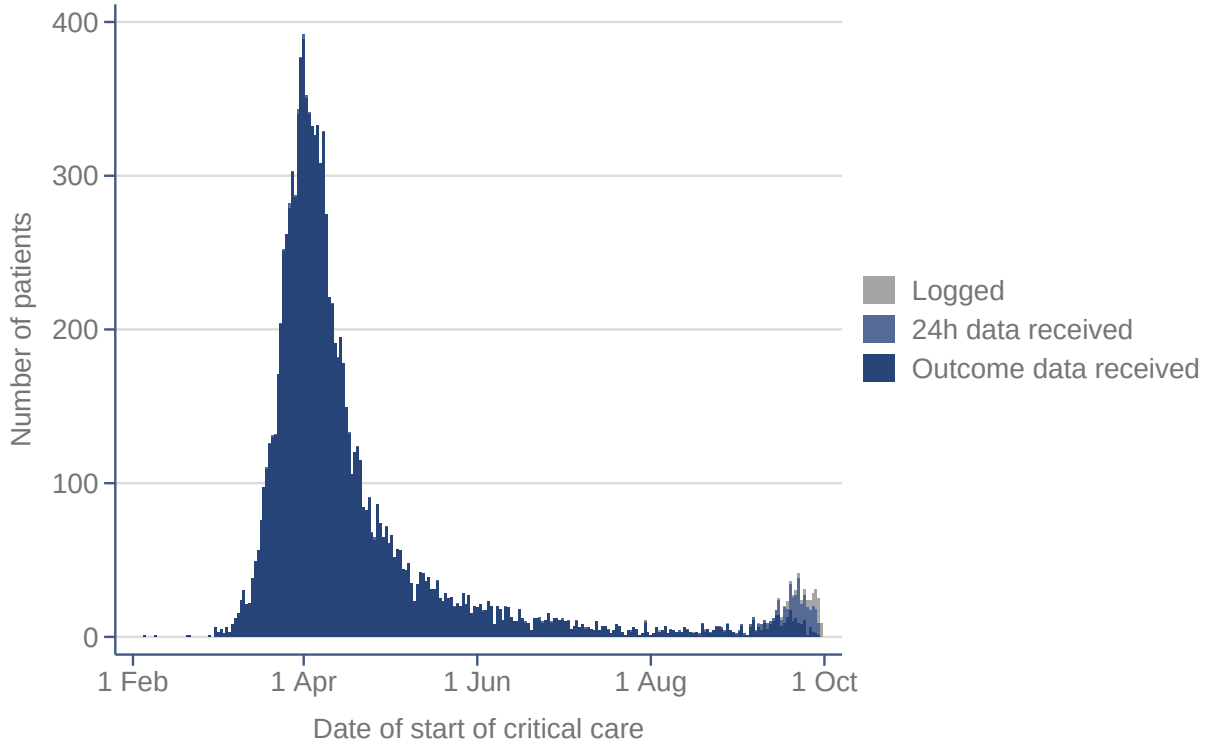


Figure 3. Number of new patients critically ill with confirmed COVID-19 by date of start of critical care over the entire epidemic

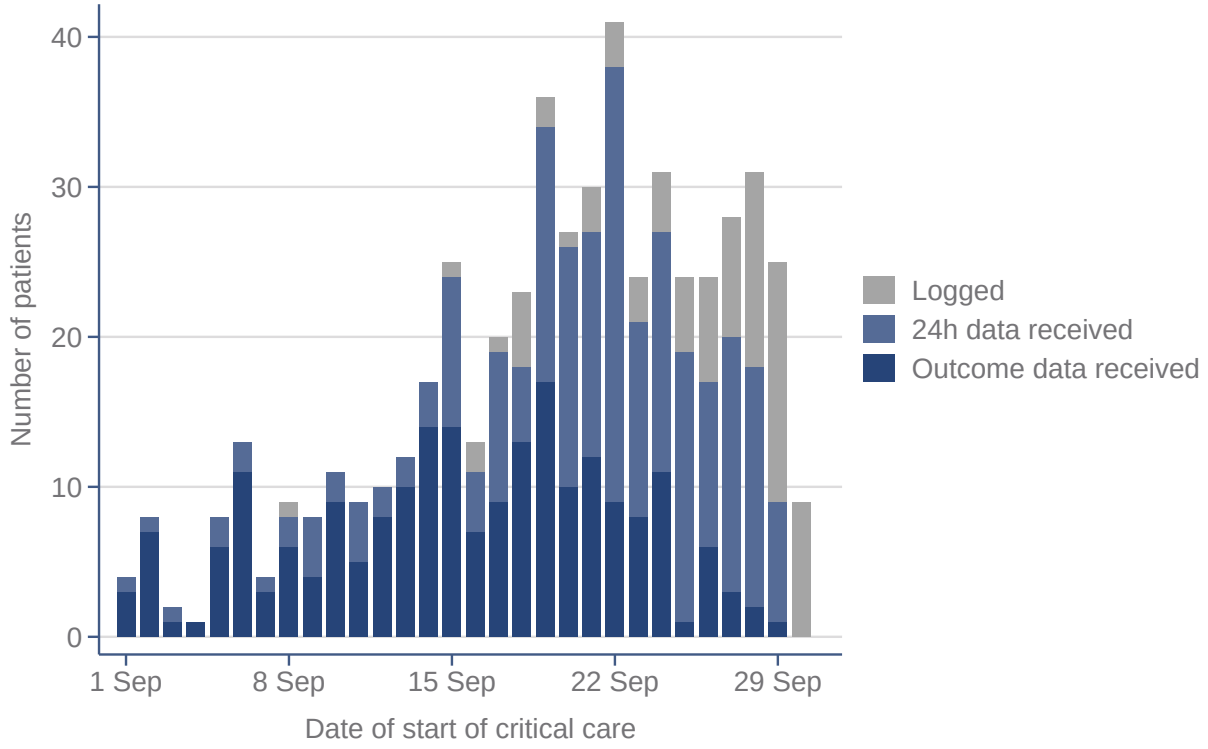


Figure 4. Number of new patients critically ill with confirmed COVID-19 admitted from 1 September 2020 by date of start of critical care

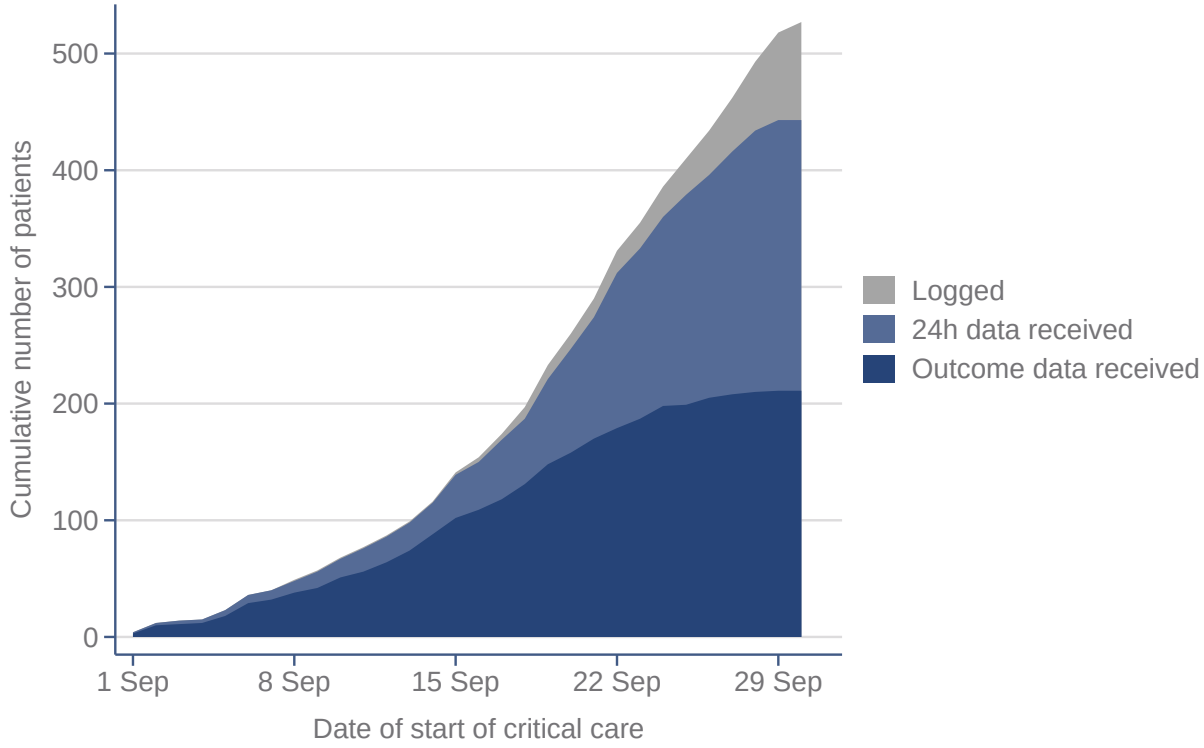


Figure 5. Cumulative number of patients critically ill with confirmed COVID-19 admitted from 1 September 2020 by date of start of critical care

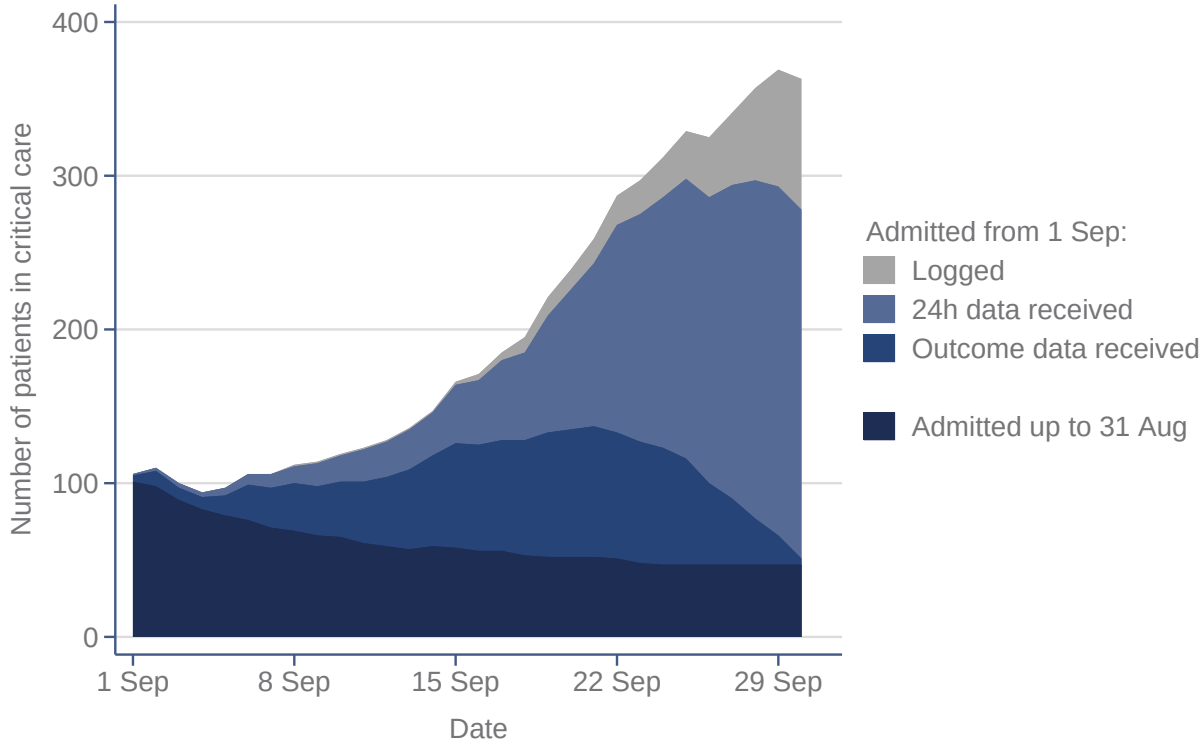


Figure 6. Total number of patients critically ill with confirmed COVID-19 from 1 September 2020 by date *

* Please note patients whose outcome data have not been received are assumed to remain in critical care as of 1 October 2020.

Characteristics of patients critically ill with confirmed COVID-19 admitted from 1 September 2020 to date are summarised in Tables 1-3 and compared with patients admitted up to 31 August 2020.

Table 1. Patient characteristics: demographics

Demographics	Patients with confirmed COVID-19	
	Admitted from 1 Sep (N=527)	Admitted up to 31 Aug (N=10,877)
Age at admission (years) [N=527]		
Mean (SD)	58.6 (14.8)	58.8 (12.7)
Median (IQR)	60 (49, 70)	60 (51, 68)
Sex, n (%) [N=527]		
Female	151 (28.7)	3255 (29.9)
Male	376 (71.3)	7616 (70.1)
Ethnicity, n (%) [N=480]		
White	296 (61.7)	6914 (66.1)
Mixed	3 (0.6)	191 (1.8)
Asian	121 (25.2)	1665 (15.9)
Black	34 (7.1)	1000 (9.6)
Other	26 (5.4)	689 (6.6)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=518]		
1 (least deprived)	55 (10.6)	1540 (14.4)
2	50 (9.7)	1726 (16.1)
3	73 (14.1)	2071 (19.3)
4	134 (25.9)	2596 (24.2)
5 (most deprived)	206 (39.8)	2791 (26.0)
Body mass index *, n (%) [N=442]		
<18.5	2 (0.5)	79 (0.8)
18.5-<25	92 (20.8)	2636 (25.5)
25-<30	141 (31.9)	3545 (34.3)
30-<40	154 (34.8)	3248 (31.4)
≥40	53 (12.0)	826 (8.0)

* Please see Definitions on page 17.

Table 2. Patient characteristics: medical history

Medical history	Patients with confirmed COVID-19	
	Admitted from 1 Sep (N=527)	Admitted up to 31 Aug (N=10,877)
Dependency prior to admission to acute hospital, n (%) [N=448]		
Able to live without assistance in daily activities	398 (88.8)	9628 (89.4)
Some assistance with daily activities	50 (11.2)	1101 (10.2)
Total assistance with all daily activities	0 (0.0)	40 (0.4)
Very severe comorbidities *, n (%) [N=465]		
Cardiovascular	8 (1.7)	71 (0.7)
Respiratory	12 (2.6)	126 (1.2)
Renal	7 (1.5)	187 (1.7)
Liver	0 (0.0)	50 (0.5)
Metastatic disease	5 (1.1)	59 (0.5)
Haematological malignancy	7 (1.5)	211 (2.0)
Immunocompromise	23 (4.9)	386 (3.6)
CPR within previous 24h, n (%) [N=479]		
In the community	5 (1.0)	51 (0.5)
In hospital	2 (0.4)	75 (0.7)
Prior hospital length of stay [N=514]		
Mean (SD)	1.9 (4.1)	2.5 (6.2)
Median (IQR)	1 (0, 2)	1 (0, 3)
Currently or recently pregnant, n (% of females aged 16-49) [N=50]		
Currently pregnant	6 (12.0)	29 (3.7)
Recently pregnant (within 6 weeks)	4 (8.0)	41 (5.2)
Not known to be pregnant	40 (80.0)	715 (91.1)

* Please see Definitions on page 17.

Table 3. Patient characteristics: indicators of acute severity

Indicators of acute severity	Patients with confirmed COVID-19 and 24h data received	
	Admitted from 1 Sep (N=443)	Admitted up to 31 Aug (N=10,877)
Mechanically ventilated within first 24h *, n (%) [N=396]	102 (25.8)	6237 (58.2)
APACHE II Score [N=432]		
Mean (SD)	13.8 (5.5)	15.1 (5.3)
Median (IQR)	13 (10, 17)	15 (11, 18)
PaO_2 /FiO_2 ratio † (kPa), median (IQR) [N=398]	13.9 (10.3, 19.5)	15.8 (11.3, 22.0)
PaO_2 /FiO_2 ratio †, n (%) [N=398]		
$<$ 13.3 kPa ($<$ 100 mmHg)	179 (45.0)	3775 (36.9)
13.3-26.6 kPa (100-200 mmHg)	166 (41.7)	4894 (47.8)
$\geq$ 26.7 kPa ($\geq$ 200 mmHg)	53 (13.3)	1560 (15.3)

* Please see Definitions on page 17. Indicators of acute severity are based on data from the first 24 hours of critical care. † Derived from the arterial blood gas with the lowest PaO_2 during the first 24 hours of critical care.

The distribution of age and sex is presented in Figure 7.

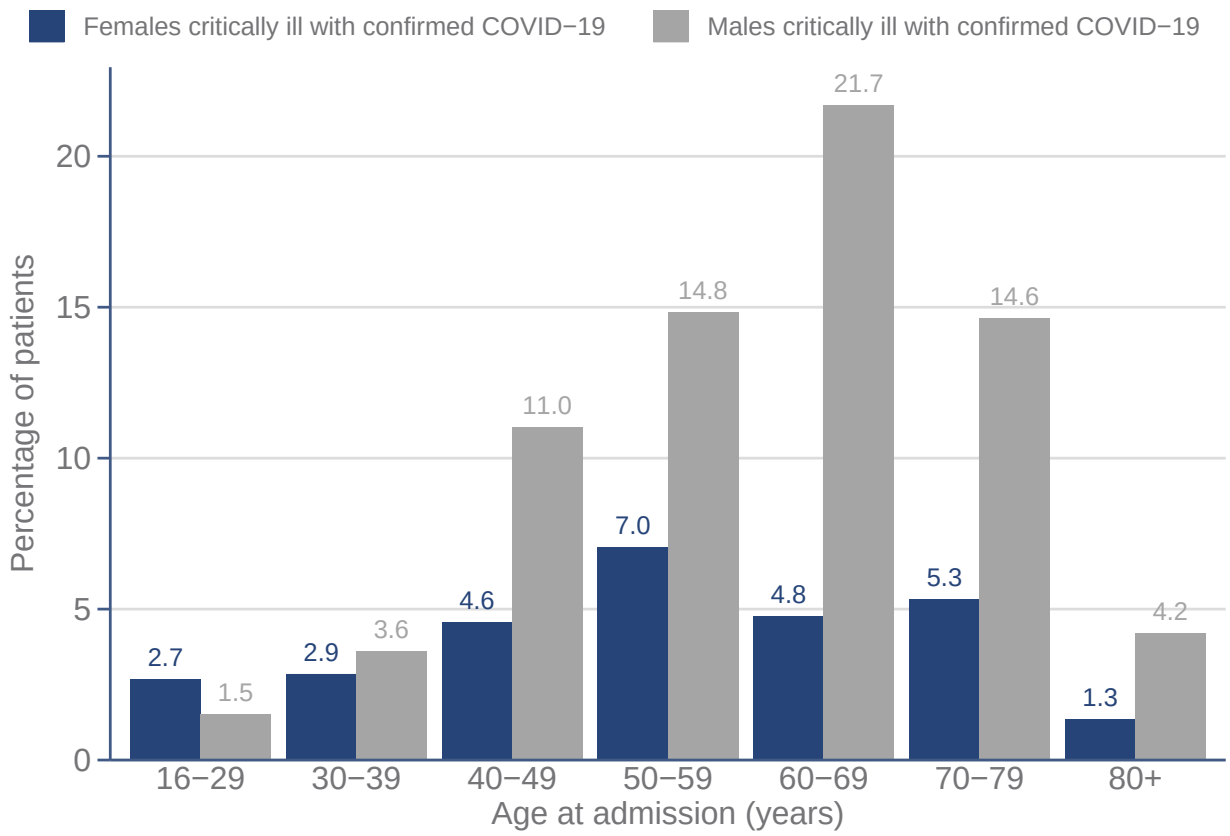


Figure 7. Age and sex distribution of patients critically ill with confirmed COVID-19 admitted from 1 September 2020

The distribution of ethnicity, matched on 2011 census ward for location of patients critically ill with COVID-19, is presented in Figure 8.

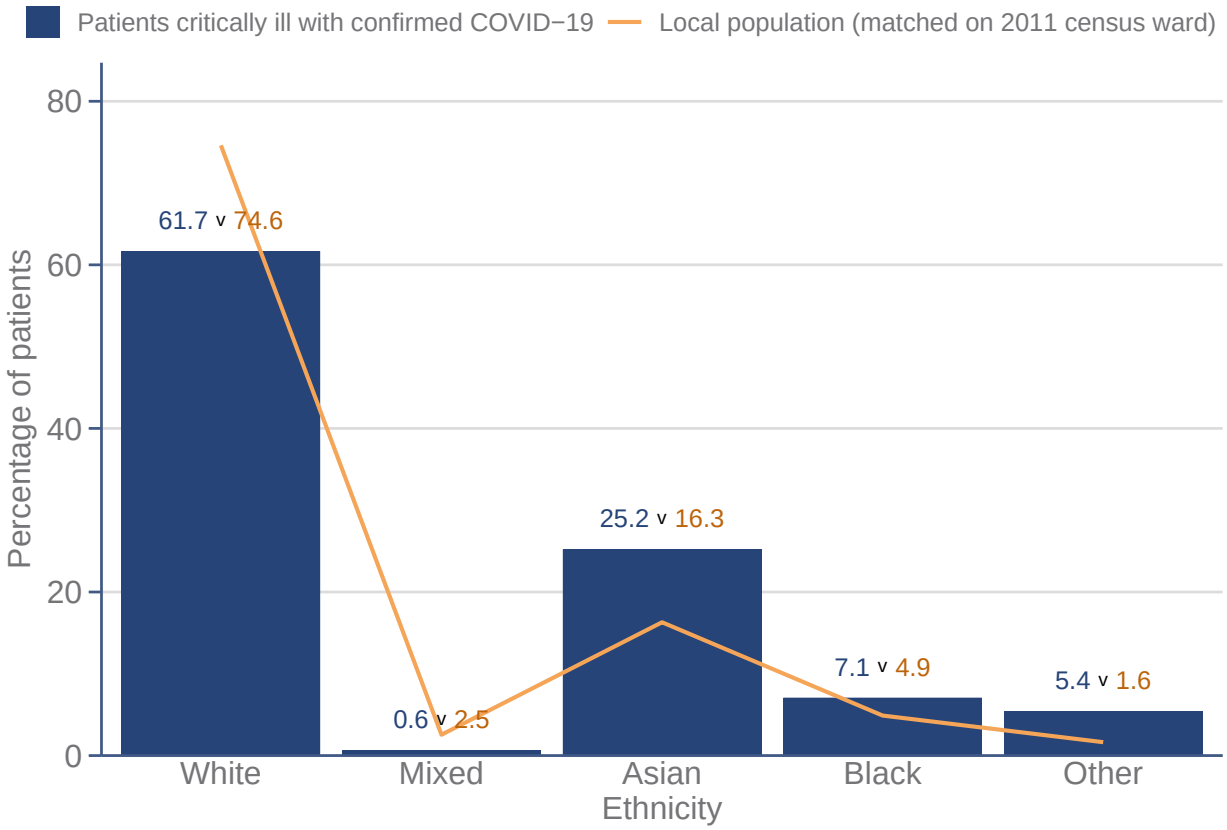


Figure 8. Ethnicity distribution of patients critically ill with confirmed COVID-19 admitted from 1 September 2020 compared with the local population (linked to 2011 census ward)

The distribution of Index of Multiple Deprivation (IMD) is presented in Figure 9.

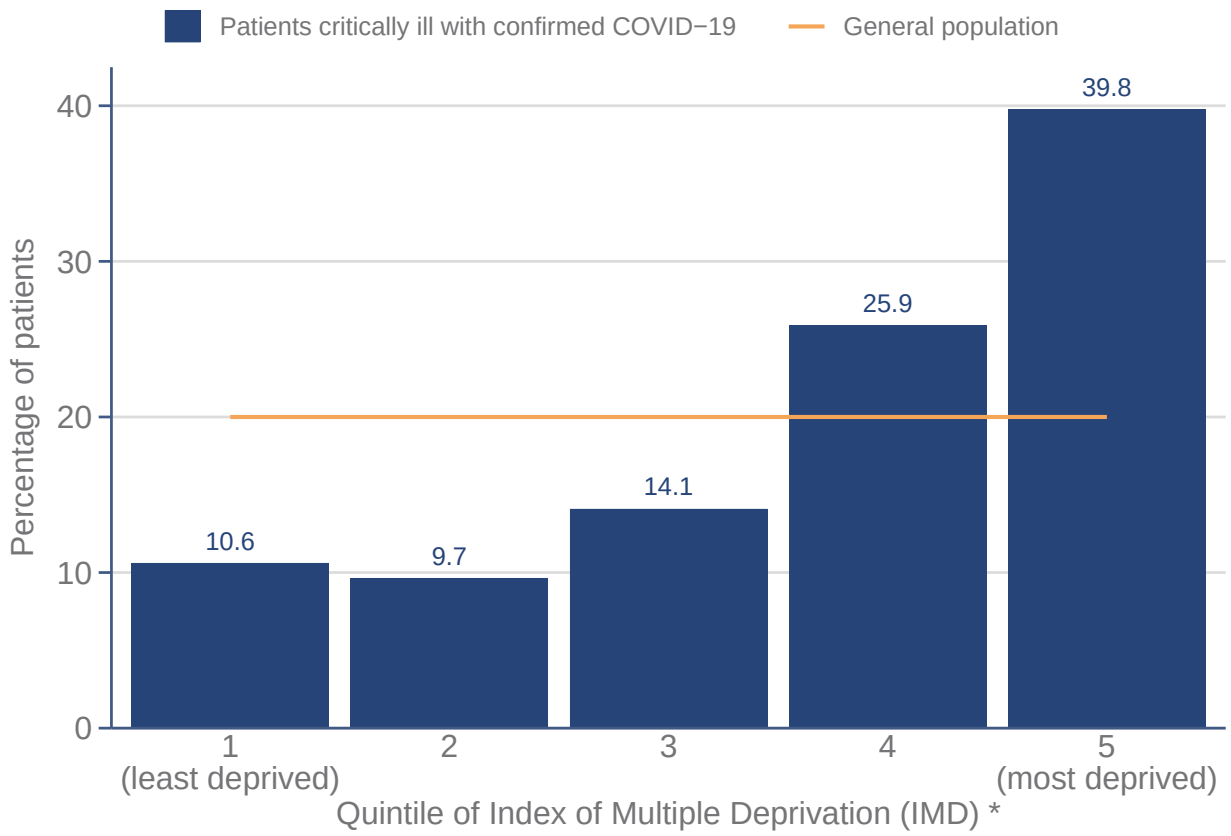


Figure 9. Index of Multiple Deprivation (IMD) * distribution of patients critically ill with confirmed COVID-19 admitted from 1 September 2020 compared with the general population

* Please see Definitions on page 17.

The distribution of body mass index (BMI), compared with an age- and sex-matched population (from the Health Survey for England 2018), is presented in Figure 10.

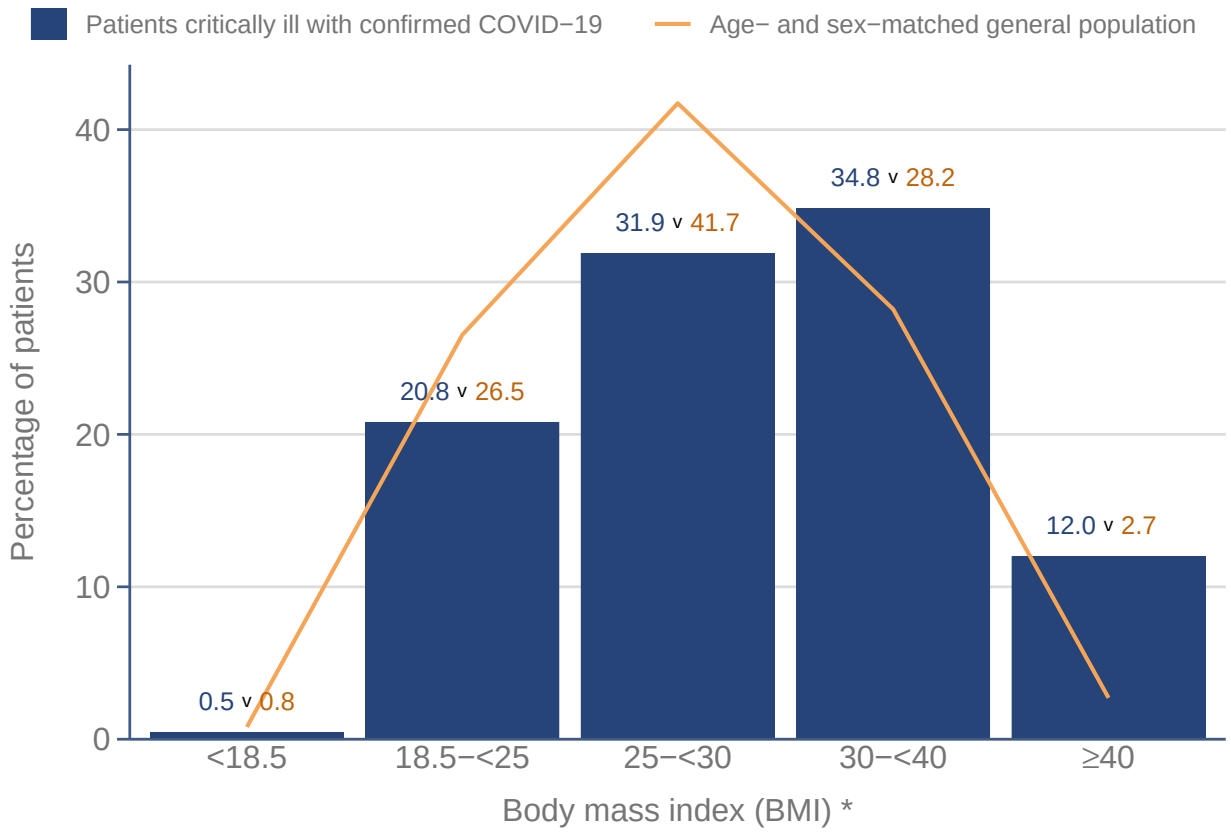


Figure 10. Body mass index (BMI) * distribution of patients critically ill with confirmed COVID-19 admitted from 1 September 2020 compared with the age- and sex-matched general population (Health Survey for England 2018)

* Please see Definitions on page 17.

Critical care outcomes have been received for 211 (of 527) patients. Of these, 44 have died and 167 have been discharged from critical care (Figures 11-13). The remaining 316 were last reported to still be receiving critical care.

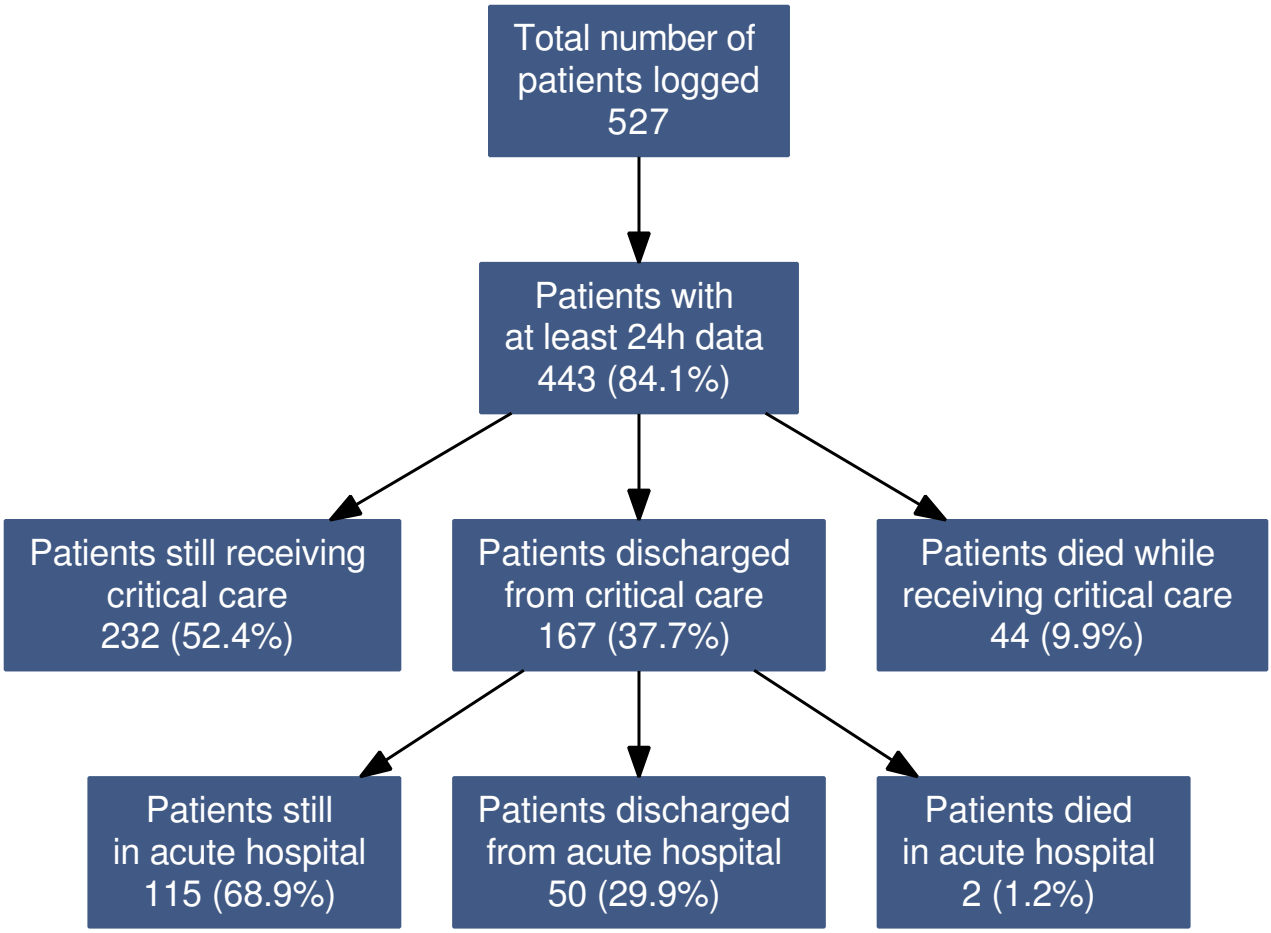


Figure 11. Critical care and acute hospital outcomes for patients admitted from 1 September 2020 with at least 24h data received

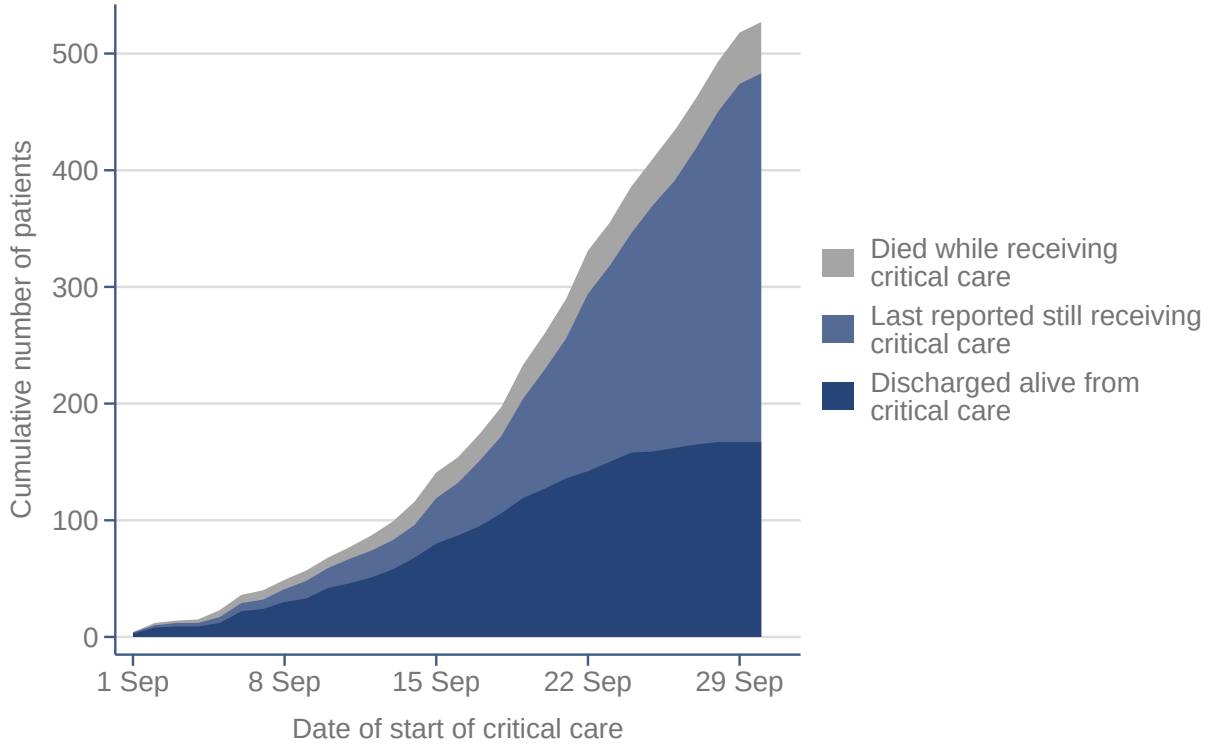
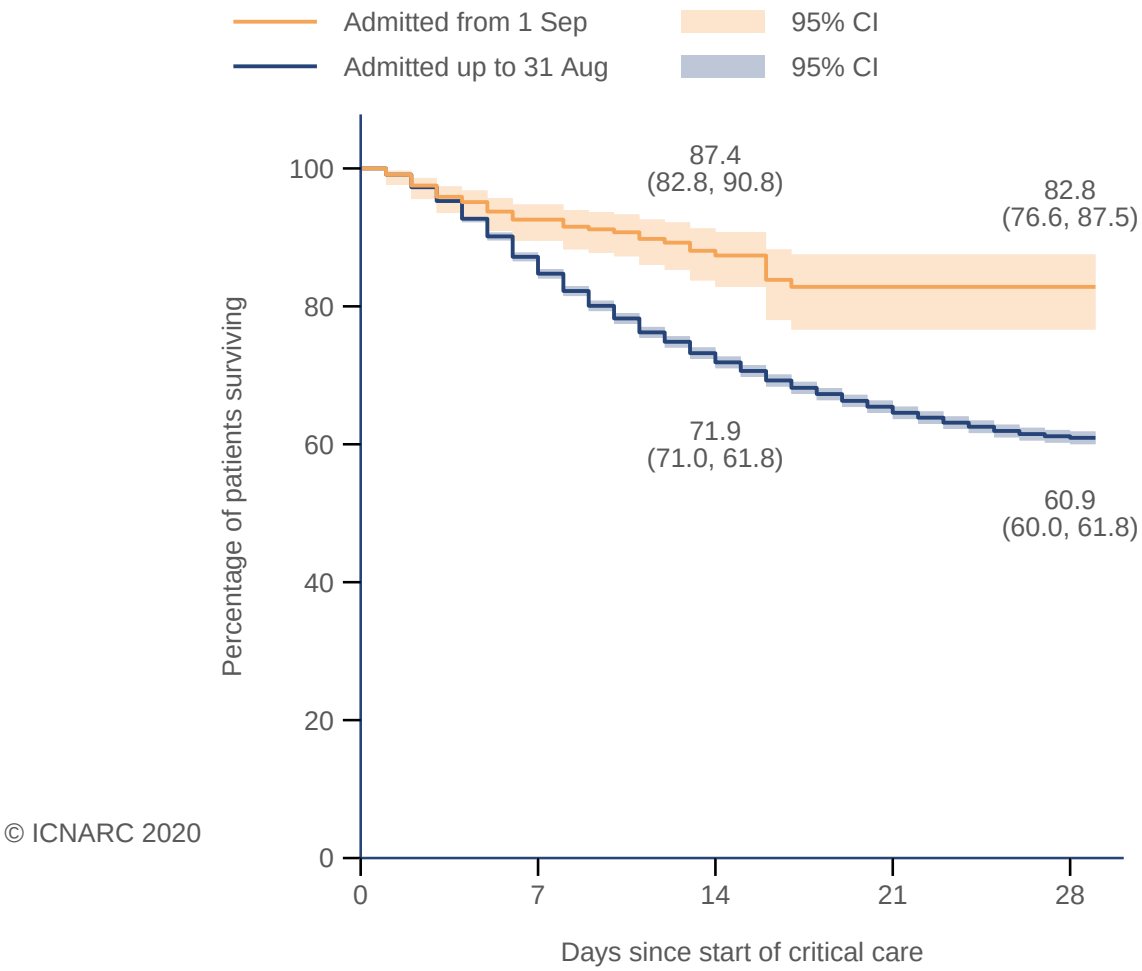


Figure 12. Cumulative outcomes for patients admitted from 1 September 2020 by date of start of critical care *

* Please note that patients whose outcome data have not been received are assumed to remain in critical care as of 1 October 2020.



Admitted from 1 Sep					
At risk	443	270	109	37	4
Died (in hospital)	0	30	41	46	46
Censored	0	143	293	360	393
Admitted up to 31 Aug					
At risk	10872	9205	7800	7000	6598
Died (in hospital)	0	1659	3055	3849	4242
Censored	0	8	17	23	32

Figure 13. In-hospital survival to 28 days following admission to critical care

Kaplan-Meier survival analysis. Patients last reported to be still receiving critical care censored on the most recent date of data submission by the treating unit. Patients discharged from acute hospital within 28 days assumed to survive to 28 days. Please note that these survival curves are not adjusted for differences in patient characteristics (see Tables 1-3).

Critical care outcome, duration of critical care and organ support for patients critically ill with confirmed COVID-19 admitted from 1 September 2020 to date for whom outcomes have been received are summarised in Table 4 and compared with patients admitted up to 31 August 2020.

Table 4. Critical care outcome, duration of critical care and organ support

	Patients with confirmed COVID-19 and outcome received	
Critical care outcome	**Admitted from 1 Sep (N=211)**	**Admitted up to 31 Aug (N=10,812)**
Outcome at end of critical care, n (%) [N=527]		
Discharged	167 (31.7)	6539 (60.1)
Died	44 (8.3)	4273 (39.3)
Still receiving critical care	316 (60.0)	65 (0.6)
Duration of critical care		
Duration of critical care (days) †, median (IQR) [N=210]		
Survivors	5 (3, 7)	12 (5, 28)
Non-survivors	4 (1.5, 9)	9 (5, 16)
Organ support (Critical Care Minimum Dataset) *		
Receipt of organ support, at any point, n (%) [N=208]		
Advanced respiratory support	43 (20.7)	7786 (72.1)
Basic respiratory support	175 (84.1)	7367 (68.2)
Advanced cardiovascular support	27 (13.0)	3306 (30.6)
Basic cardiovascular support	181 (87.0)	10063 (93.1)
Renal support	10 (4.8)	2889 (26.7)
Liver support	0 (0.0)	112 (1.0)
Neurological support	2 (1.0)	979 (9.1)
Duration of organ support (calendar days), median (IQR) [N=208]		
Advanced respiratory support	4 (1, 9)	13 (7, 24)
Total (advanced + basic) respiratory support	5 (3, 8)	11 (5, 22)
Advanced cardiovascular support	2 (1, 3)	3 (2, 6)
Total (advanced + basic) cardiovascular support	5 (3, 8)	11 (5, 22)
Renal support	2.5 (2, 4)	8 (3, 15)

Please note that the results for patients admitted from 1 September 2020 are biased towards patients with shorter lengths of stay in critical care prior to discharge or death, i.e. those who died or recovered quickly. * Please see Definitions on page 17. † Duration of critical care is the total over all critical care admissions for the the same patient and excludes any time spent outside critical care areas (e.g. prior to any readmissions).

Ethnicity is recorded using the ethnic category codes from the 2001 census and grouped as:

- White: White – British; White – Irish; White – any other
- Mixed: Mixed – white and black Caribbean; Mixed – white and black African; Mixed – white and Asian; Mixed – any other
- Asian: Asian or Asian British – Indian; Asian or Asian British – Pakistani; Asian or Asian British – Bangladeshi; Asian or Asian British – any other
- Black: Black or black British – Caribbean; Black or black British – African; Black or black British – any other
- Other: Other ethnic group – Chinese; Any other ethnic group
- Not stated or not recorded

Index of Multiple Deprivation (IMD) is based on the patient's usual residential postcode (assigned at the level of Lower Layer Super Output Area) according to:

- English Index of Multiple Deprivation 2019 for postcodes in England
- Welsh Index of Multiple Deprivation 2019 for postcodes in Wales
- Northern Ireland Multiple Deprivation Measure 2017 for postcodes in Northern Ireland

Body mass index is calculated as the weight in kilograms divided by the height in metres squared. Weight and height values may have been measured or estimated.

Dependency prior to admission to acute hospital is assessed as the best description for the dependency of the patient in the two weeks prior to admission to acute hospital and prior to the onset of the acute illness, i.e. "usual" dependency. It is assessed according to the amount of personal assistance they receive with daily activities (bathing, dressing, going to the toilet, moving in/out of bed/chair, continence and eating).

Very severe comorbidities must have been evident within the six months prior to critical care and documented at or prior to critical care:

- Cardiovascular: symptoms at rest
- Respiratory: shortness of breath with light activity or home ventilation
- Renal: renal replacement therapy for end-stage renal disease
- Liver: biopsy-proven cirrhosis, portal hypertension or hepatic encephalopathy
- Metastatic disease: distant metastases
- Haematological malignancy: acute or chronic leukaemia, multiple myeloma or lymphoma
- Immunocompromise: chemotherapy, radiotherapy or daily high dose steroid treatment in previous six months, HIV/AIDS or congenital immune deficiency

Mechanical ventilation during the first 24 hours was identified by the recording of a ventilated respiratory rate, indicating that all or some of the breaths or a portion of the breaths (pressure support) were delivered by a mechanical device. This usually indicates invasive ventilation; BPAP (bilevel positive airway pressure) would meet this definition but CPAP (continuous positive airway pressure) does not.

Organ support is recorded as the number of calendar days (00:00-23:59) on which the support was received at any time, defined as:

- Advanced respiratory: invasive ventilation, BPAP via trans-laryngeal tube or tracheostomy, CPAP via trans-laryngeal tube, extracorporeal respiratory support
- Basic respiratory: >50% oxygen by face mask, close observation due to potential for acute deterioration, physiotherapy/suction to clear secretions at least two-hourly, recently extubated after a period of mechanical ventilation, mask/hood CPAP/BPAP, non-invasive ventilation, CPAP via a tracheostomy, intubated to protect airway
- Advanced cardiovascular: multiple IV/rhythm controlling drugs (at least one vasoactive), continuous observation of cardiac output, intra-aortic balloon pump, temporary cardiac pacemaker
- Basic cardiovascular: central venous catheter, arterial line, single IV vasoactive/ rhythm controlling drug
- Renal: acute renal replacement therapy, renal replacement therapy for chronic renal failure where other organ support is received
- Liver: management of coagulopathy and/or portal hypertension for acute on chronic hepatocellular failure or primary acute hepatocellular failure
- Neurological: central nervous system depression sufficient to prejudice airway, invasive neurological monitoring, continuous IV medication to control seizures, therapeutic hypothermia

Publications

The following publications, based on these data, are in press or preprint:

- Richards-Belle A, Orzechowska I, Doidge J, Thomas K, Harrison DA, Koelewyn A, Christian MD, Shankar-Hari M, Rowan KM, Gould DW. Critical care outcomes, for the first 200 patients with confirmed COVID-19, in England, Wales and Northern Ireland: a report from the ICNARC Case Mix Programme. *J Intensive Care Soc*, in press.
- Ferrando-Vivas P, Doidge J, Thomas K, Gould DW, Mouncey P, Shankar-Hari M, Young JD, Rowan KM, Harrison DA. Prognostic Factors for 30-day Mortality in Critically Ill Patients with Coronavirus Disease 2019: An Observational Cohort Study. *Crit Care Med*, in press.
- Richards-Belle A, Orzechowska I, Gould DW, Thomas K, Doidge JC, Mouncey PR, Christian MD, Shankar-Hari M, Harrison DA, Rowan KM. COVID-19 in critical care: epidemiology of the first epidemic wave across England, Wales and Northern Ireland. *Intensive Care Med*, in press.
- Doidge JC, Mouncey PR, Thomas K, Gould DW, Ferrando-Vivas P, Shankar-Hari M, Harrison DA, Rowan KM. Trends in intensive care for patients with COVID-19 in England, Wales and Northern Ireland. *Preprints* 2020; 2020080267; doi:10.20944/preprints202008.0267.v2

Acknowledgement

Please acknowledge the source of these data in all future presentations (oral and/or written) as follows:

"These data derive from the ICNARC Case Mix Programme Database. The Case Mix Programme is the national clinical audit of patient outcomes from adult critical care coordinated by the Intensive Care National Audit Research Centre (ICNARC). For more information on the representativeness and quality of these data, please contact ICNARC."

