

ICNARC report on COVID-19 in critical care

10 April 2020

This report contains data on patients critically ill with confirmed COVID-19 reported to ICNARC up to 4pm on 09 April 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). 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:

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

The same data are reported for an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) during the years 2017-19.

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Participation and population coverage

Critical care unit participation

Total number of units:	284
Units with at least one patient notified:	229
Units with zero patients:	37
Units with uncertain participation:	18

Admissions to critical care

To date, ICNARC have been notified of 4690 admissions by critical care units in England, Wales and Northern Ireland with confirmed COVID-19, either at or after admission to critical care. Of these, early data covering the first 24 hours in the critical care unit have been submitted to ICNARC for 4292 admissions for 3883 patients (Figure 1 and Figure 2). Of the 3883 patients, 871 patients have died, 818 patients have been discharged alive from critical care and 2194 patients were last reported as still receiving critical care (Figure 3). The largest number of patients (1428) are being managed by the three London Operational Delivery Networks (Figure 4). Please note that Figure 2 and Figure 3 are affected by a variable lag time for submission of data of about 1-3 days (shaded grey).

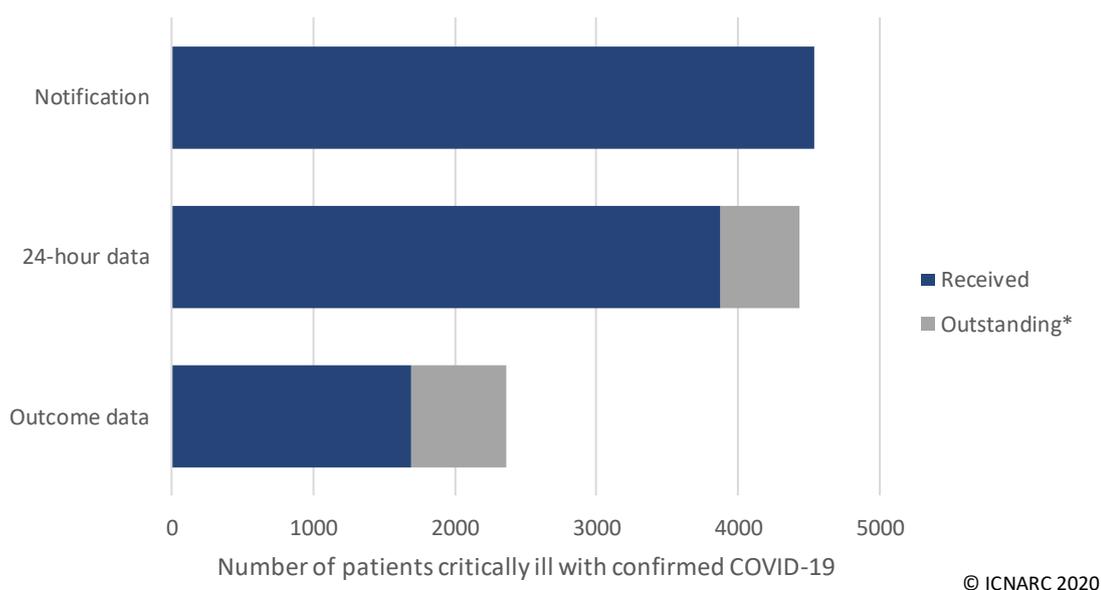
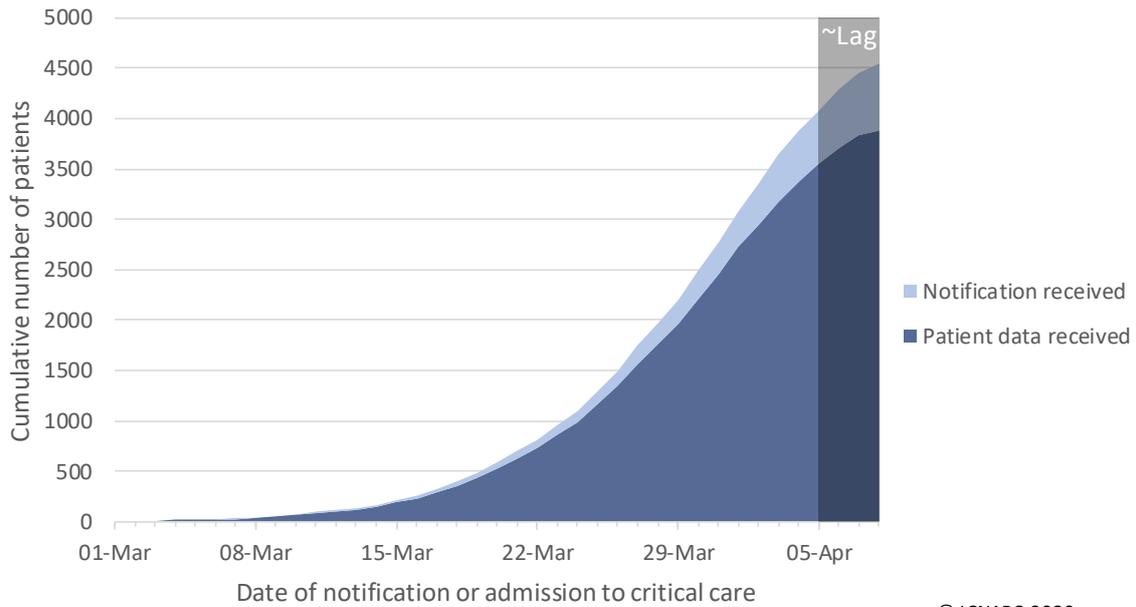


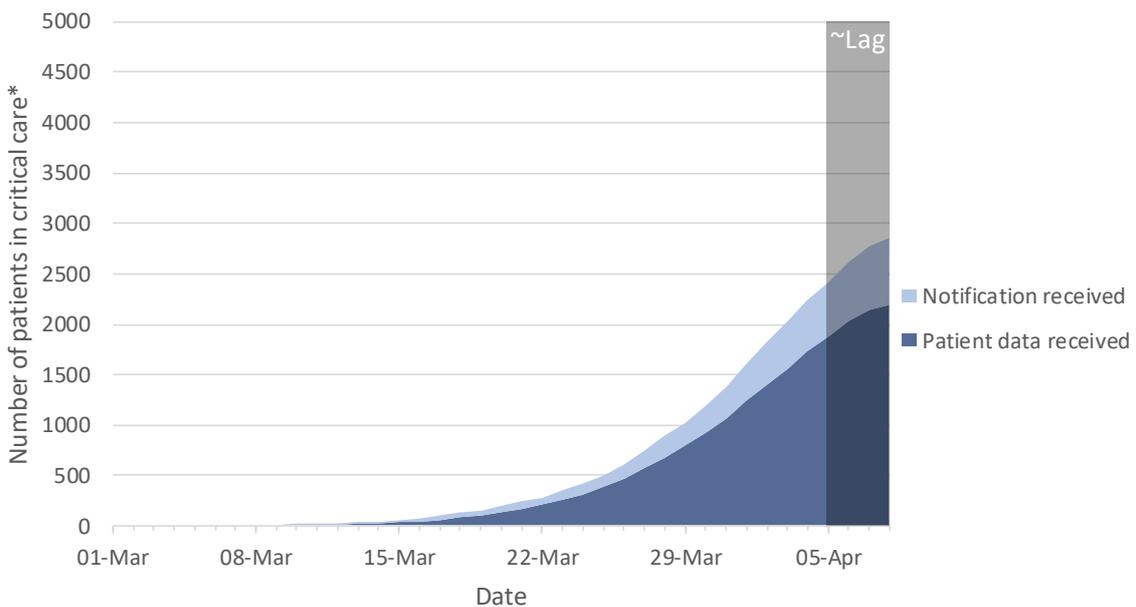
Figure 1 Numbers of patients with data included in this report and outstanding*

*24-hour data are considered outstanding where ICNARC was notified of the admission at least 48 hours previously; outcome data are considered outstanding when at least 10 days have passed from the date of admission and we have not received confirmation within the past 48 hours that the patient was still receiving critical care.



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Figure 2 Cumulative number of patients critically ill with confirmed COVID-19 by date of notification or admission to critical care



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Figure 3 Number of patients currently critically ill with confirmed COVID-19, by date*

*Note: Patients for whom no outcomes have been received are assumed to remain in critical care as of 08 April 2020.

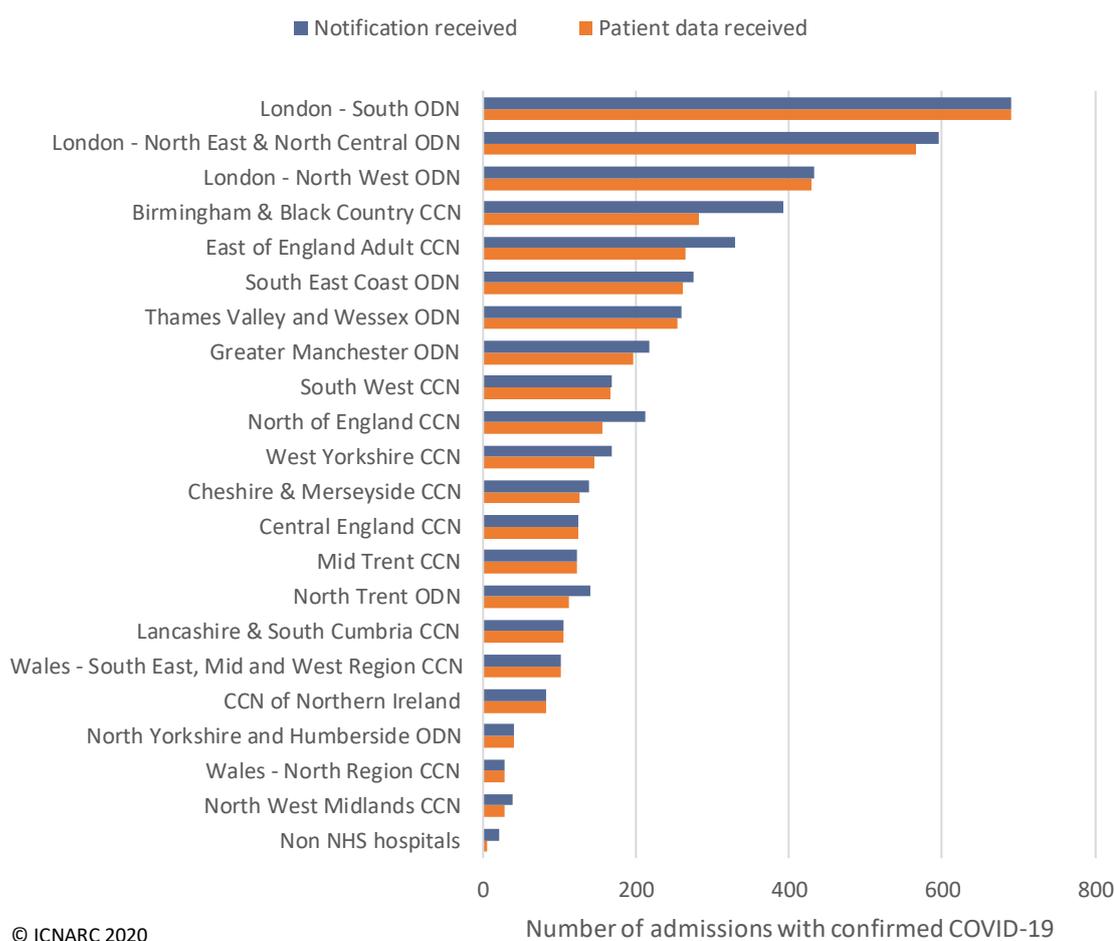


Figure 4 Admissions by Critical Care Network

ODN: Organisational Delivery Network; CCN: Critical Care Network.

Characteristics of patients

Characteristics of patients critically ill with confirmed COVID-19 are summarised in Table 1 and Table 2 and compared with an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) during the years 2017-19. The distribution of age and sex is presented in Figure 5, the distribution of ethnicity is presented in Figure 6 and the distribution of body mass index (BMI) is presented in Figure 7.

Characteristics for patients critically ill with confirmed COVID-19 who received advanced respiratory support at any point during critical care, and who received basic respiratory support only at any point during critical care, are summarised in Table 3. Definitions of respiratory support are provided on page 16.

Table 1 Patient characteristics: Demographics and medical history

Demographics	Patients with confirmed COVID-19 and 24h data (N=3883)	Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5782)
Age at admission (years) [N=3882]		
Mean (SD)	59.8 (12.7)	58.0 (17.4)
Median (IQR)	61 (52, 69)	61 (48, 71)
Sex, n (%) [N=3879]		
Female	1068 (27.5)	2641 (45.7)
Male	2811 (72.5)	3141 (54.3)
Currently or recently pregnant, n (% of females) [N=1005]		
Currently pregnant	10 (1.0)	58 (2.2)
Recently pregnant (within 6 weeks)	13 (1.3)	29 (1.1)
Not known to be pregnant	982 (97.7)	2554 (96.7)
Ethnicity, n (%) [N=3370]		
White	2236 (66.4)	4951 (88.4)
Mixed	44 (1.3)	52 (0.9)
Asian	486 (14.4)	325 (5.8)
Black	402 (11.9)	155 (2.8)
Other	202 (6.0)	117 (2.1)
Body mass index, n (%) [N=3265]		
<18.5	21 (0.6)	310 (5.5)
18.5-<25	842 (25.8)	1933 (34.2)
25-<30	1144 (35.0)	1691 (29.9)
30-<40	1023 (31.3)	1330 (23.5)
40+	235 (7.2)	394 (7.0)
Medical history		
Dependency prior to admission to acute hospital, n (%) [N=3516]		
Able to live without assistance in daily activities	3276 (93.2)	4244 (73.6)
Some assistance with daily activities	237 (6.7)	1392 (24.1)
Total assistance with all daily activities	3 (0.1)	134 (2.3)
Very severe comorbidities*, n (%) [N=3606]		
Cardiovascular	9 (0.2)	78 (1.4)
Respiratory	27 (0.7)	295 (5.1)
Renal	51 (1.4)	120 (2.1)
Liver	7 (0.2)	54 (0.9)
Metastatic disease	12 (0.3)	68 (1.2)
Haematological malignancy	34 (0.9)	268 (4.6)
Immunocompromise	96 (2.7)	503 (8.7)
Prior hospital length of stay		
Mean (SD)	2.1 (7.6)	3.1 (13.4)
Median (IQR)	1 (0, 2)	1 (0, 2)
CPR within previous 24h, n (%) [N=3664]		
In the community	18 (0.5)	21 (0.6)
In hospital	16 (0.4)	85 (2.3)

* See Definitions on page 16

Table 2 Patient characteristics: Indicators of acute severity*

Indicator	Patients with confirmed COVID-19 and 24h data (N=3883)	Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5782)
Mechanically ventilated within first 24h, n (%) [N=3883]	2291 (59.0)	2482 (43.0)
APACHE II Score [N=3447]		
Mean (SD)	14.2 (5.2)	17.2 (6.3)
Median (IQR)	14 (11, 17)	17 (13, 21)
PaO ₂ /FiO ₂ ratio (kPa), median (IQR) [N=3214]	16.6 (11.8, 22.3)	18.0 (11.6, 26.4)
PaO ₂ /FiO ₂ ratio, n (%) [N=3214]		
< 13.3 kPa (< 100 mmHg)	1047 (32.6)	1819 (33.3)
13.3-26.6 kPa (100-200 mmHg)	1705 (53.0)	2318 (42.4)
≥ 26.7 kPa (≥ 200 mmHg)	462 (14.4)	1328 (24.3)

* See Definitions on page 16. Based on data from the first 24 hours following commencement of management by the critical care team

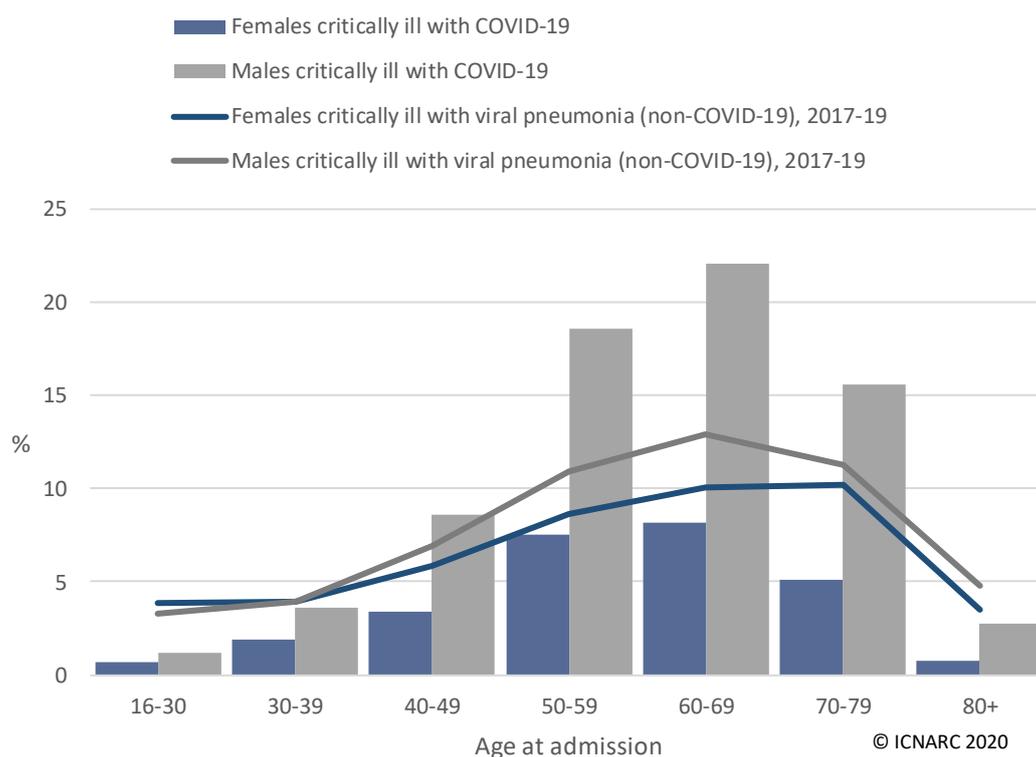


Figure 5 Age and sex distribution of patients critically ill with confirmed COVID-19

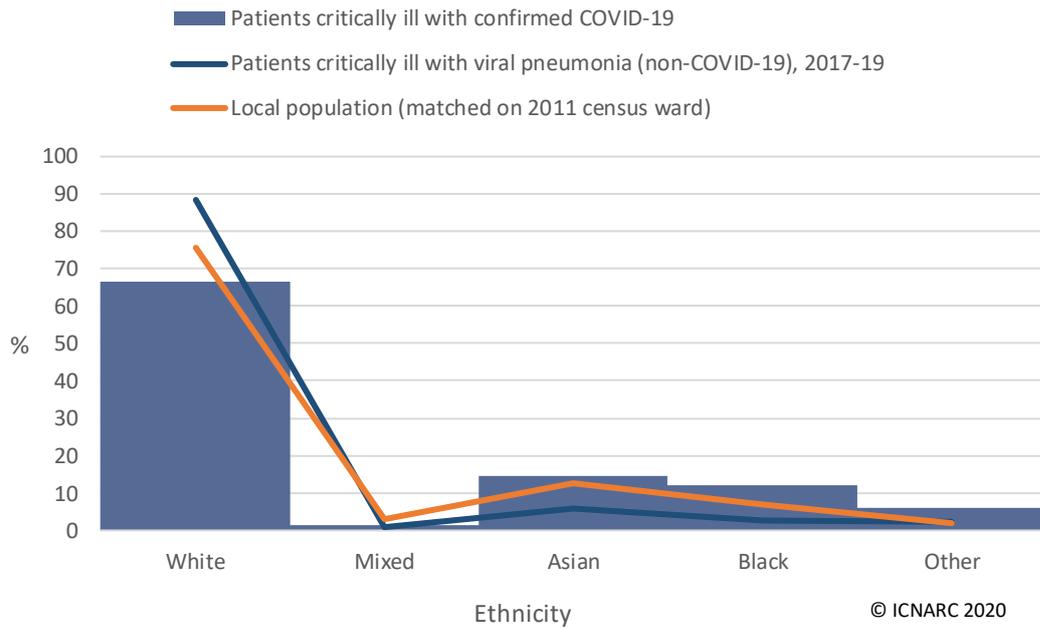


Figure 6 Ethnicity distribution of patients critically ill with confirmed COVID-19

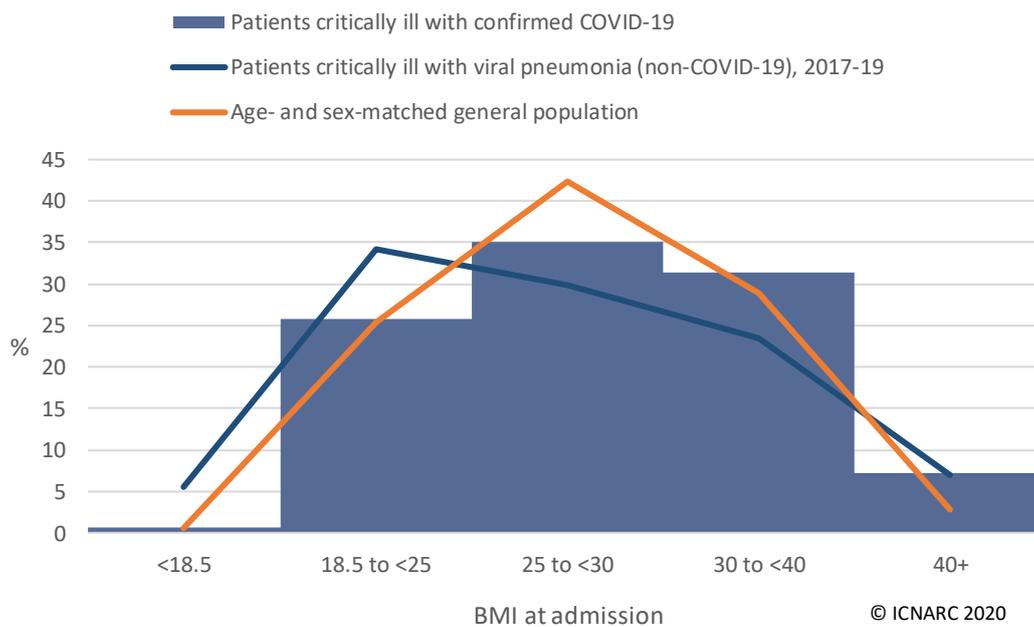


Figure 7 BMI distribution of patients critically ill with confirmed COVID-19

Table 3 Patient characteristics: Demographics and medical history, by type of respiratory support received*

Demographics	Patients receiving advanced respiratory support (N=1053)	Patients receiving only basic respiratory support (N=444)
Age at admission (years) [N=1497]		
Mean (SD)	61.9 (13.2)	60.9 (14.3)
Median (IQR)	64 (55, 72)	62 (51, 73)
Sex, n (%) [N=1496]		
Female	284 (27.0)	135 (30.4)
Male	768 (73.0)	309 (69.6)
Currently or recently pregnant, n (% of females) [N=411]		
Currently pregnant	2 (0.7)	0 (0.0)
Recently pregnant (within 6 weeks)	4 (1.4)	1 (0.8)
Not known to be pregnant	272 (97.8)	132 (99.2)
Ethnicity, n (%) [N=1341]		
White	623 (66.8)	309 (75.7)
Mixed	8 (0.9)	4 (1.0)
Asian	123 (13.2)	44 (10.8)
Black	128 (13.7)	34 (8.3)
Other	51 (5.5)	17 (4.2)
Body mass index, n (%) [N=1343]		
<18.5	9 (1.0)	4 (1.0)
18.5-<25	231 (24.6)	111 (27.5)
25-<30	341 (36.3)	151 (37.5)
30-<40	279 (29.7)	100 (24.8)
40+	80 (8.5)	37 (9.2)
Medical history		
Dependency prior to admission to acute hospital, n (%) [N=1431]		
Able to live without assistance in daily activities	900 (90.3)	375 (86.4)
Some assistance with daily activities	95 (9.5)	59 (13.6)
Total assistance with all daily activities	2 (0.2)	0 (0.0)
Very severe comorbidities*, n (%) [N=1446]		
Cardiovascular	2 (0.2)	2 (0.5)
Respiratory	8 (0.8)	5 (1.1)
Renal	19 (1.9)	11 (2.5)
Liver	3 (0.3)	0 (0.0)
Metastatic disease	4 (0.4)	3 (0.7)
Haematological malignancy	7 (0.7)	12 (2.7)
Immunocompromise	27 (2.7)	16 (3.7)
Prior hospital length of stay [N=1491]		
Mean (SD)	2.0 (5.8)	3.2 (11.4)
Median (IQR)	1 (0, 2)	1 (0, 3)
CPR within previous 24h, n (%) [N=1478]		
In the community	8 (0.2)	2 (0.1)
In hospital	12 (0.3)	0 (0.0)

* See Definitions on page 16. Patients receiving no respiratory support excluded due to small numbers.

Table 4 Patient characteristics: Indicators of acute severity, by type of respiratory support received*

Indicator	Patients receiving advanced respiratory support (N=1053)	Patients receiving only basic respiratory support (N=444)
Mechanically ventilated within first 24h, n (%) [N=1497]	858 (81.5)	---
APACHE II Score [N=1424]		
Mean (SD)	15.6 (5.3)	13.7 (4.6)
Median (IQR)	15 (12, 19)	14 (11, 17)
PaO ₂ /FiO ₂ ratio† (kPa), median (IQR) [N=1359]	16.3 (11.3, 22.8)	18.0 (13.2, 23.7)
PaO ₂ /FiO ₂ ratio†, n(%) [N=1359]		
< 13.3 kPa (< 100 mmHg)	350 (35.6)	102 (27.1)
13.3-26.6 kPa (100-200 mmHg)	480 (48.9)	214 (56.8)
≥ 26.7 kPa (≥ 200 mmHg)	152 (15.5)	61 (16.2)

* See Definitions on page 16. Patients receiving no respiratory support excluded due to small numbers. Based on data from the first 24 hours following commencement of management by the critical care team. †Derived from the arterial blood gas with the lowest PaO₂ from the first 24 hours.

Outcomes, length of stay and organ support

Critical care unit outcomes have been received for only 1689 (of 3883) patients, of whom 871 patients have died and 818 have been discharged alive from critical care (Figure 8 and Figure 9). Length of stay in critical care and duration of organ support in critical care are summarised in Table 5 and compared with an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) during the years 2017-19. Receipt and duration of organ support are summarised graphically in Figure 10 and in Figure 11, respectively.

Please note that Figure 9 will be biased towards longer lengths of stay in critical care due to the time lag in notification of a patients' discharge or death, while Table 5, Figure 10 and Figure 11 will be biased towards patients with shorter lengths of stay in critical care due to the emerging nature of the UK epidemic. Figure 8 and Figure 9 assume that patients are still in critical care unless ICNARC has been notified otherwise, and Table 5, Figure 10 and Figure 11 include only those patients who have died or have been discharged from critical care.

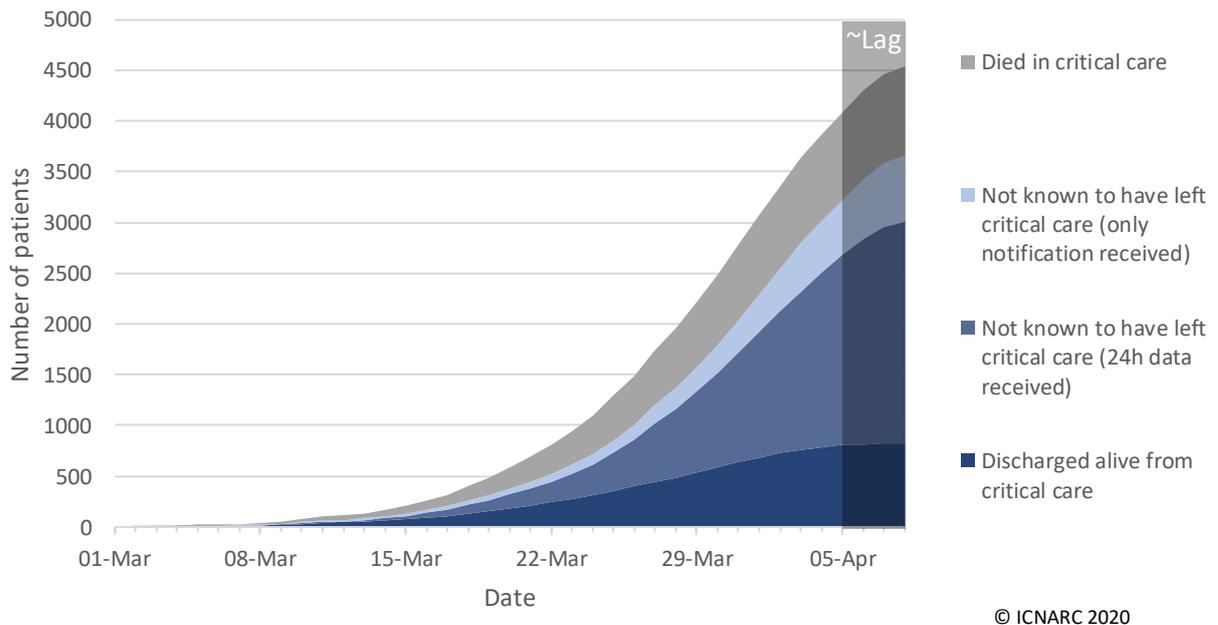


Figure 8 Cumulative patient outcomes, by date

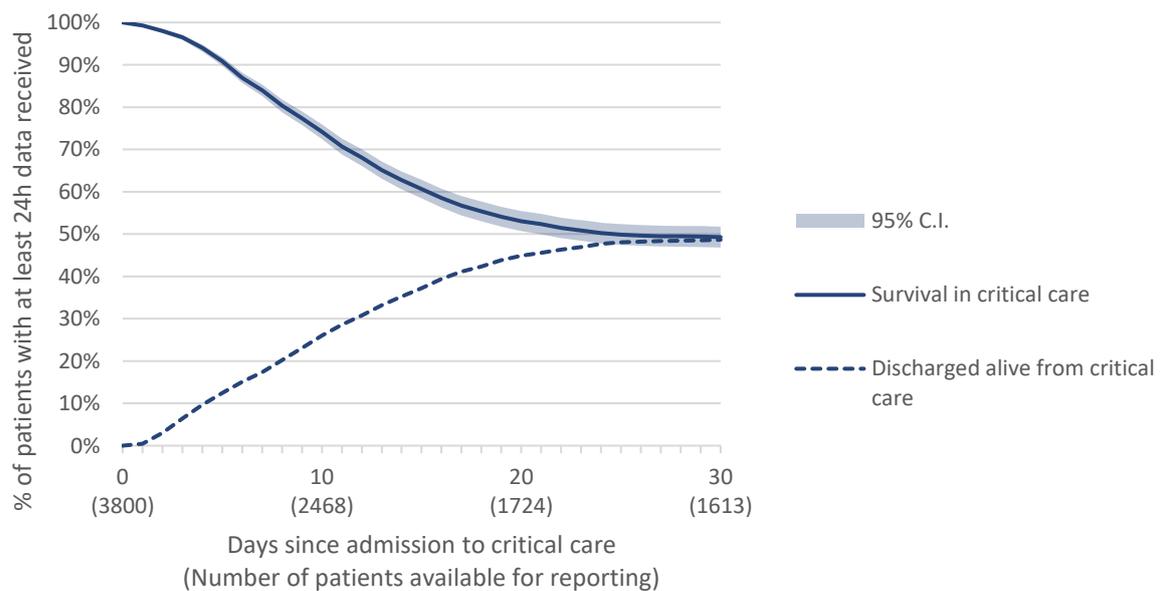


Figure 9 30-day survival among patients with at least 24h data received

Note: Due to the time lag in notification of patients' discharge or death, this figure is expected to be biased towards *longer* lengths of stay in critical care. Patients who are still in critical care are included only for the period in which they are known to have been in critical care, i.e. from their date of admission until yesterday. The numbers of patients available for reporting (in brackets) are the number of patients who are known to have either died or been discharged on or before that time point plus the number of patients known to have been still in critical care beyond that time point. Due to the emerging nature of the UK epidemic, the total number of patients available for reporting becomes smaller at longer lengths of follow-up. Compared with the survival statistics presented in Table 5 and Table 6, this approach makes better use of all available data, including data about patients who are still in critical care.

Table 5 Outcome, length of stay and organ support* for patients admitted to critical care with confirmed COVID-19

Critical care unit outcome	Patients with confirmed COVID-19 and critical care outcome reported (N=1689)	Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5367)
Outcome at end of critical care, n (%)		
Alive	818 (48.4)	4184 (78.0)
Dead	871 (51.6)	1183 (22.0)
Length of stay		
Length of stay in critical care (days), median (IQR)		
Survivors	4 (2, 8)	6 (3, 12)
Non-survivors	6 (3, 9)	6 (2, 13)
Organ support (Critical Care Minimum Dataset)*		
Receipt of organ support, at any point, n (%)		
Advanced respiratory support	1053 (67.7)	2529 (47.1)
Basic respiratory support	820 (52.7)	4375 (81.5)
Advanced cardiovascular support	394 (25.3)	1178 (21.9)
Basic cardiovascular support	1410 (90.6)	4978 (92.8)
Renal support	294 (18.9)	902 (16.8)
Liver support	5 (0.3)	44 (0.8)
Neurological support	67 (4.3)	292 (5.4)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	7 (4, 10)	9 (4, 17)
Total (advanced + basic) respiratory support	6 (4, 9)	6 (3, 12)
Advanced cardiovascular support	3 (1, 4)	3 (2, 5)
Total (advanced + basic) cardiovascular support	6 (4, 10)	6 (3, 12)
Renal support	4 (3, 7)	6 (3, 11)

Note: Owing to the emerging nature of the epidemic, the sample of patients with COVID-19 represented in this table is biased towards patients with *shorter* lengths of stay in critical care prior to discharge or death (i.e. those who died or recovered quickly). This does not apply to the comparison patients with viral pneumonia (non-COVID-19), 2017-19. * See Definitions on page 16.

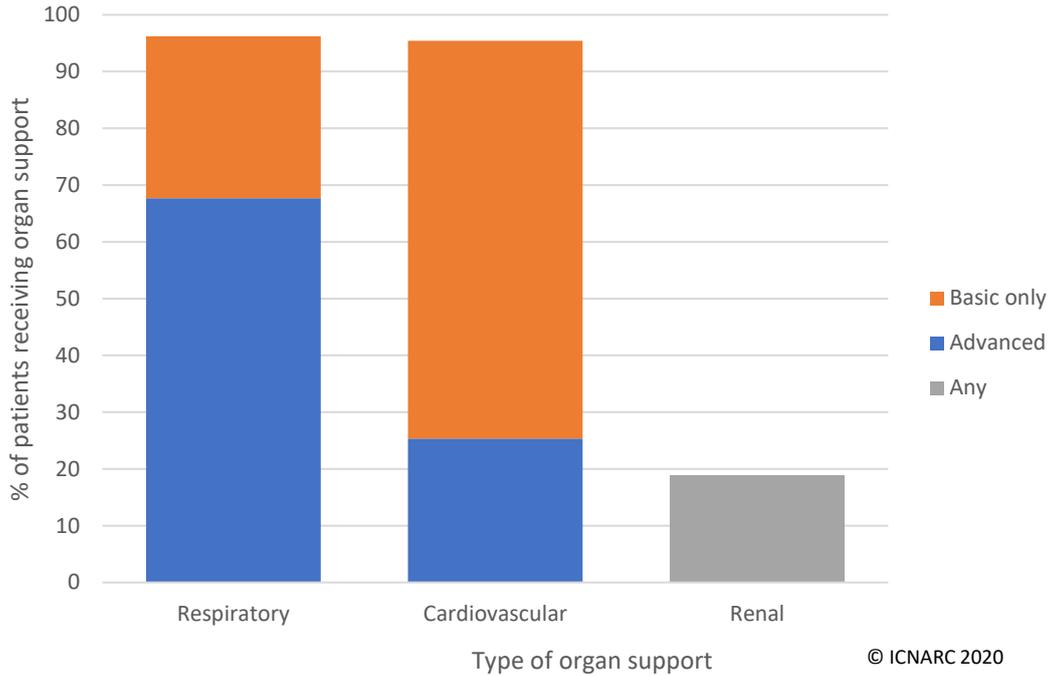


Figure 10 Percentage of patients receiving organ support*

Note: Owing to the emerging nature of the epidemic, the sample of patients with COVID-19 represented in this table is biased towards patients with *shorter* lengths of stay in critical care prior to discharge or death (i.e. patients who died or recovered quickly). * See Definitions on page 16.

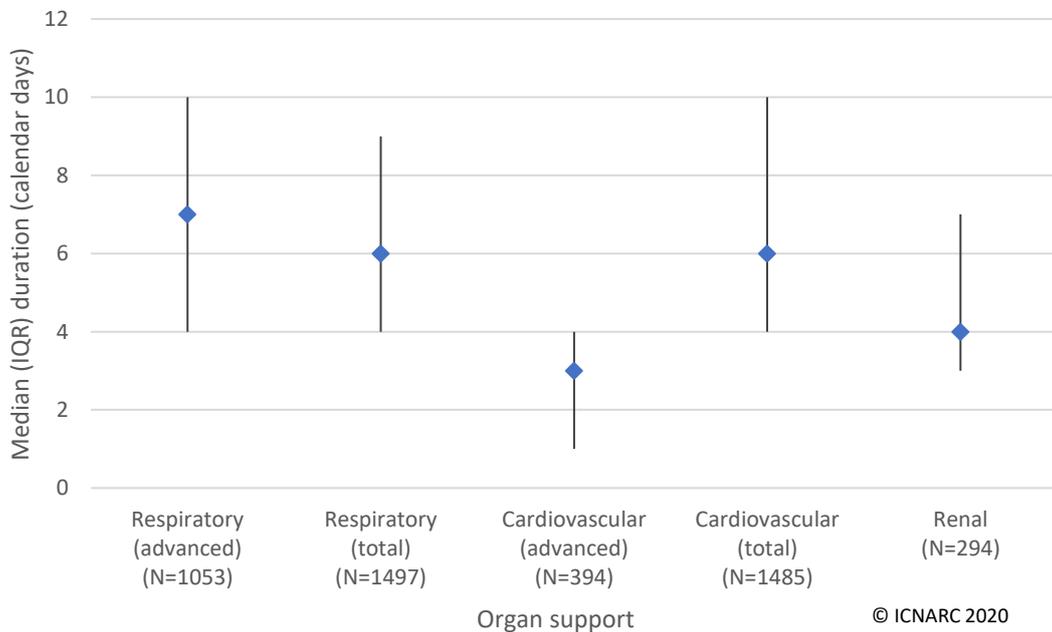


Figure 11 Duration of organ support* received

Plot presents median and interquartile range, in calendar days. Owing to the emerging nature of the epidemic, the sample of patients with COVID-19 represented in this table is biased towards patients with *shorter* lengths of stay in critical care prior to discharge or death (i.e. patients who died or recovered quickly). * See Definitions on page 16.

Outcomes by patient subgroups

Figure 12 presents 30-day survival for patients that received advanced respiratory support, at any point, during critical care compared with those that received basic respiratory support only, at any point, during critical care. Critical care outcomes for patients that received advanced respiratory support at any point during critical care compared with those that received basic respiratory support only at any point during critical care are summarised in Table 6.

Critical care outcomes for patients critically ill with COVID-19 across major patient subgroups are summarised in Table 7 and compared with an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) during the years 2017-19.

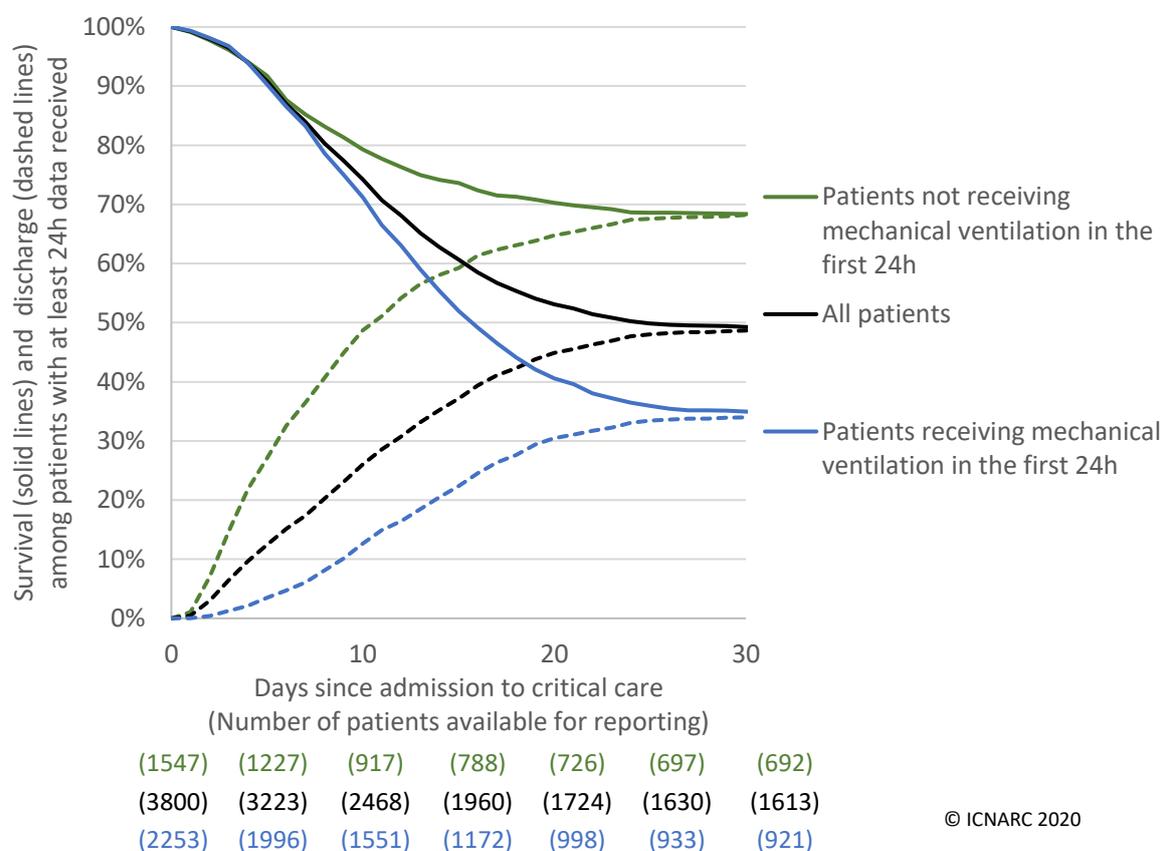


Figure 12 30-day survival, by mechanical ventilation during the first 24 hours

Patients who are still in critical care are included only for the period in which they are known to have been in critical care, i.e. from their date of admission until yesterday. The numbers of patients available for reporting (in brackets) are the number of patients who are known to have either died or been discharged on or before that time point plus the number of patients known to have been still in critical care beyond that time point. Due to the emerging nature of the UK epidemic, the total number of patients available for reporting becomes smaller at longer lengths of follow-up. Compared with the survival statistics presented in Table 5 and Table 6, this approach makes better use of all available data, including data about patients who are still in critical care.

Table 6 Critical care outcomes, by type of respiratory support received*

Critical care unit outcome	Patients receiving advanced respiratory support* (N=1053)	Patients receiving only basic respiratory support* (N=444)
Outcome at end of critical care, n (%)		
Alive	355 (33.7)	358 (80.6)
Dead	698 (66.3)	86 (19.4)
Length of stay		
Length of stay in critical care (days), median (IQR)		
Survivors	8 (5, 12)	3 (2, 5)
Non-survivors	6 (4, 9)	3 (2, 5)
Organ support (Critical Care Minimum Dataset)*		
Receipt of organ support, at any point, n (%)		
Advanced respiratory support	1053 (100.0)	- -
Basic respiratory support	376 (35.7)	444 (100.0)
Advanced cardiovascular support	384 (36.5)	8 (1.8)
Basic cardiovascular support	973 (92.4)	413 (93.0)
Renal support	277 (26.3)	13 (2.9)
Liver support	5 (0.5)	0 (0.0)
Neurological support	62 (5.9)	5 (1.1)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	7 (4, 10)	- -
Total (advanced + basic) respiratory support	8 (5, 11)	4 (2, 5)
Advanced cardiovascular support	3 (1, 4.5)	2 (1, 3.5)
Total (advanced + basic) cardiovascular support	8 (5, 11)	4 (3, 5)
Renal support	4 (3, 7)	2 (2, 4)

* See Definitions on page 16. Patients receiving no respiratory support excluded due to small numbers.

Table 7 Outcome by patient subgroups

Patient subgroup	Patients with confirmed COVID-19 and critical care outcome reported		Patients with viral pneumonia (non-COVID-19), 2017-19
	Discharged alive from critical care	Died in critical care	Died in critical care
	n (%)	n (%)	(%)
Age at admission (years)			
16-39	102 (76.7)	31 (23.3)	(7.5)
40-49	131 (74.0)	46 (26.0)	(12.6)
50-59	208 (58.9)	145 (41.1)	(19.7)
60-69	211 (43.6)	273 (56.4)	(26.2)
70-79	136 (31.3)	298 (68.7)	(31.6)
80+	29 (27.1)	78 (72.9)	(31.5)
Sex			
Female	252 (53.7)	217 (46.3)	(19.6)
Male	566 (46.4)	653 (53.6)	(24.1)
Body mass index			
<25	225 (54.0)	192 (46.0)	(23.5)
25-<30	272 (50.6)	266 (49.4)	(23.4)
30-<40	193 (46.0)	227 (54.0)	(19.4)
40+	53 (43.1)	70 (56.9)	(15.3)
Assistance required with daily activities			
No	715 (50.5)	700 (49.5)	(19.9)
Yes	66 (37.3)	111 (62.7)	(28.0)
Any very severe comorbidities*			
No	744 (49.8)	749 (50.2)	(19.3)
Yes	48 (38.1)	78 (61.9)	(33.9)
Respiratory support**†			
Basic only	358 (80.6)	86 (19.4)	(11.3)
Advanced	355 (33.7)	698 (66.3)	(35.1)

Note: Owing to the emerging nature of the epidemic, the sample of patients with COVID-19 represented in this table is biased towards patients with *shorter* lengths of stay in critical care prior to discharge or death (i.e. those who died or recovered quickly). This does not apply to the comparison patients with viral pneumonia (non-COVID-19), 2017-19. * See Definitions on page 16. † Patients receiving no respiratory support excluded due to small numbers.

Definitions

Patients are classified as either:

- Notification received only: ICNARC has received a notification of the patient's admission to critical care but has not received any patient data from the first 24 hours or beyond
- 24h data received only: ICNARC has received patient data relating to the first 24 hours in critical care but has not yet been notified of the patient's critical care outcome
- Critical care outcome data received: ICNARC has received submission of data relating to the patient's critical care outcome (e.g. survival, length of stay, duration of organ support) (Please note: to ensure that data are as complete and up-to-date as possible, we have begun transitioning to allow units to submit a reduced set of minimum outcome data, less than is ordinarily included in the full Case Mix Programme)
- Final outcome data received: Data have been updated with outcomes at ultimate discharge from hospital (Please note: this data is currently limited for patients with COVID-19 and not included in this report)

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 6 months, HIV/AIDS or congenital immune deficiency

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

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.”