icnarc | intensive care national audit & research centre

25 years and counting...

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ICNARC report on COVID-19 in critical care
07 September 2020

This report presents analyses of data on patients critically ill with confirmed COVID-19 admitted to 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) up to 31 August 2020 and reported to ICNARC up to 4pm on 04 September 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:

- 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 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.

The same data are reported for an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) admitted between 1 January 2017 and 31 December 2019.

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Participation and population coverage

Critical care unit participation

Total number of units: <u>289</u>
    Units with at least one patient notified: 265
    Units with zero patients: 22
    Units with uncertain participation: 2

Admissions to critical care

To date, ICNARC have been notified of 13,710 admissions for critical care with confirmed COVID-19, either at or after the start of critical care, in England, Wales and Northern Ireland. Of these, early data covering the first 24 hours of critical care have been submitted to ICNARC for 13,358 admissions for 10,834 patients (Figure 1). Of the 10,834 patients, 10,704 have outcomes reported and 130 patients were last reported as still receiving critical care.

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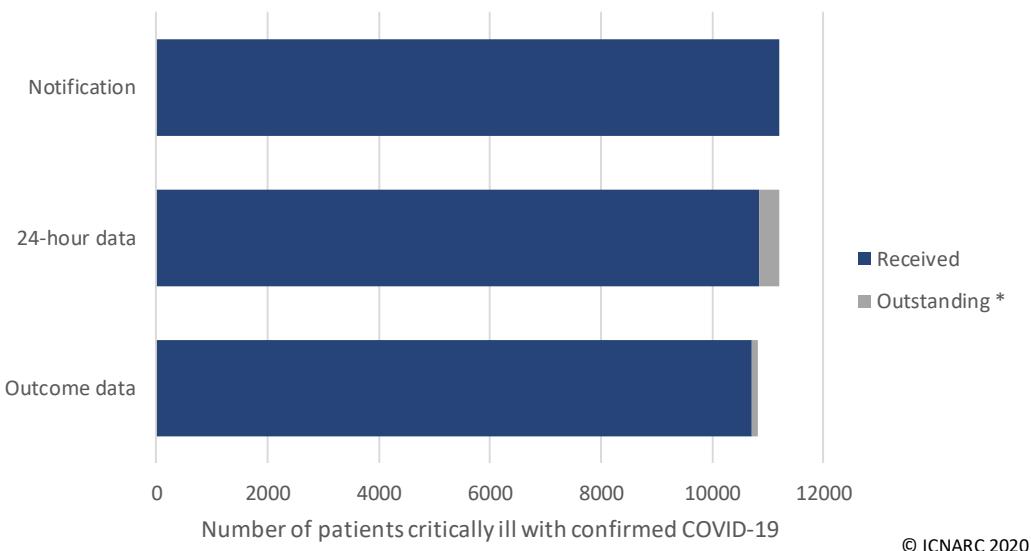
Figure 1   Numbers of patients with data included in this report and outstanding *

* Please note that 24-hour data are considered outstanding where ICNARC was notified of the admission 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 210 new patients included in the report for the first time (since the previous report on 31 July 2020), 110 were admitted to critical care during August 2020. Of the 110 patients with a start of critical care during August, the largest numbers were admitted in the North West, North East And Yorkshire and Midlands regions (Figure 2).
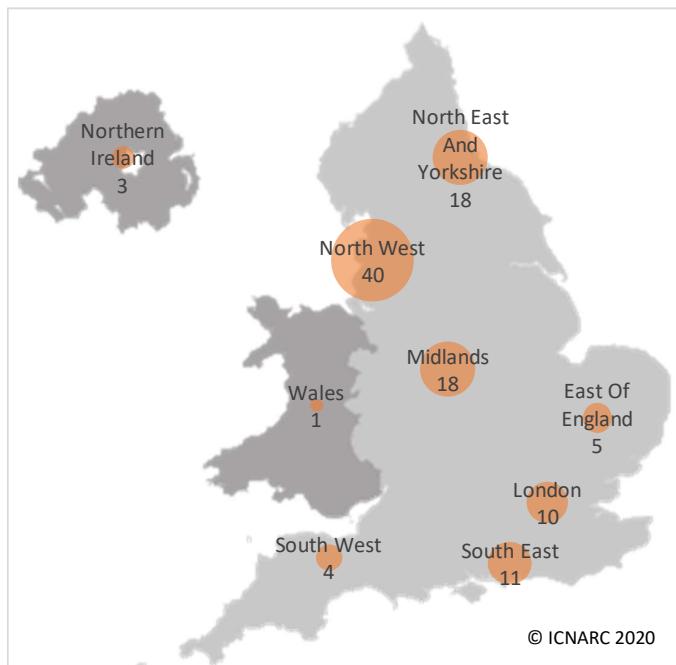
Figure 2   Patients with a start of critical care during August 2020 by region

The numbers of new patients, cumulative numbers of patients and number of patients in critical care by date are shown in Figures 3-5. The largest numbers of patients (3053) have been managed by the three London Operational Delivery Networks (Figure 6). Please note that Figures 3-5 are affected by a variable lag time for submission of data (shaded grey).
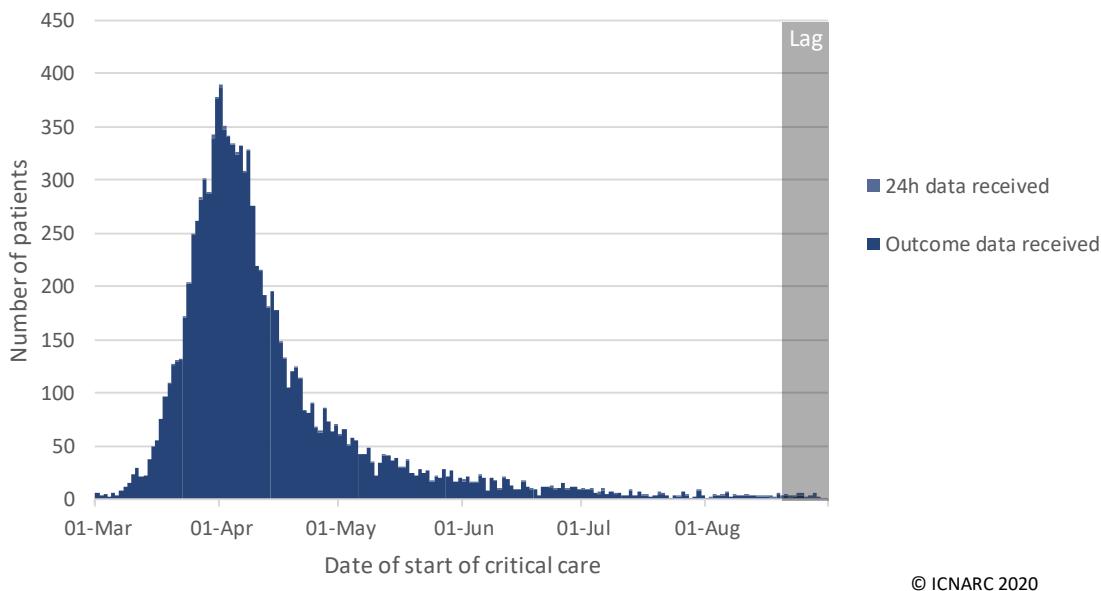
Figure 3 **Number of new patients critically ill with confirmed COVID-19 by date of start of critical care**
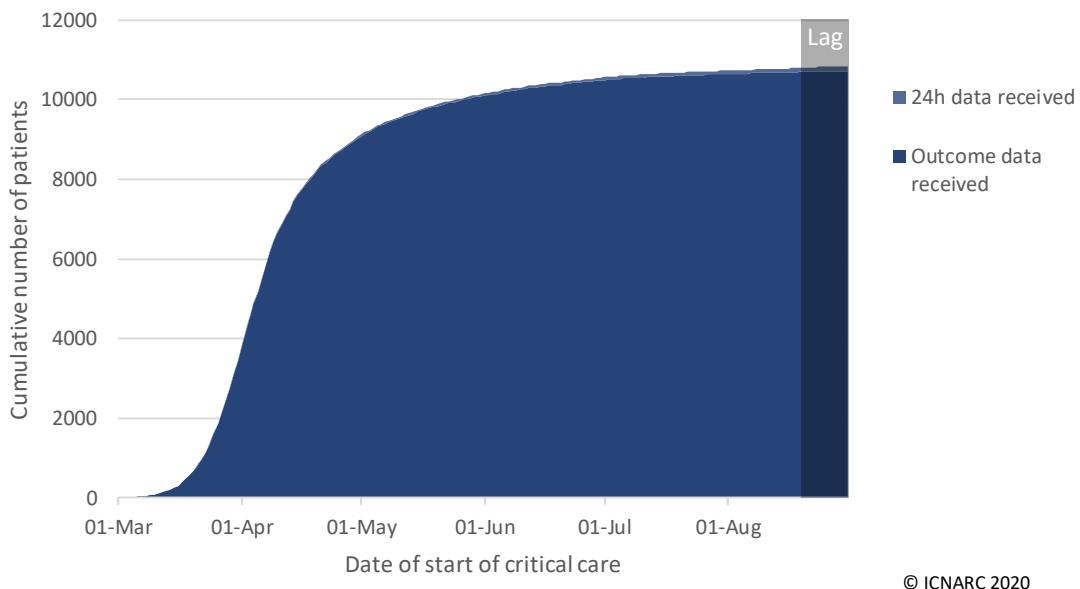
Figure 4 **Cumulative number of patients critically ill with confirmed COVID-19 by date of start of critical care**

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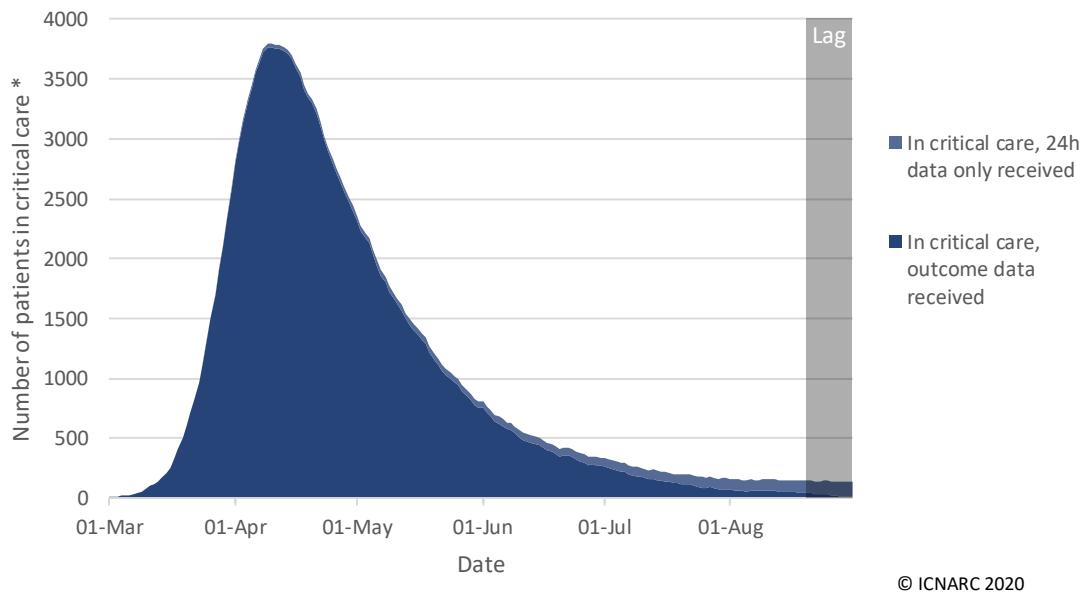
Figure 5   Total number of patients critically ill with confirmed COVID-19 by date *

* Please note that patients whose outcome data have not been received are assumed to remain in critical care as of 31 August 2020.

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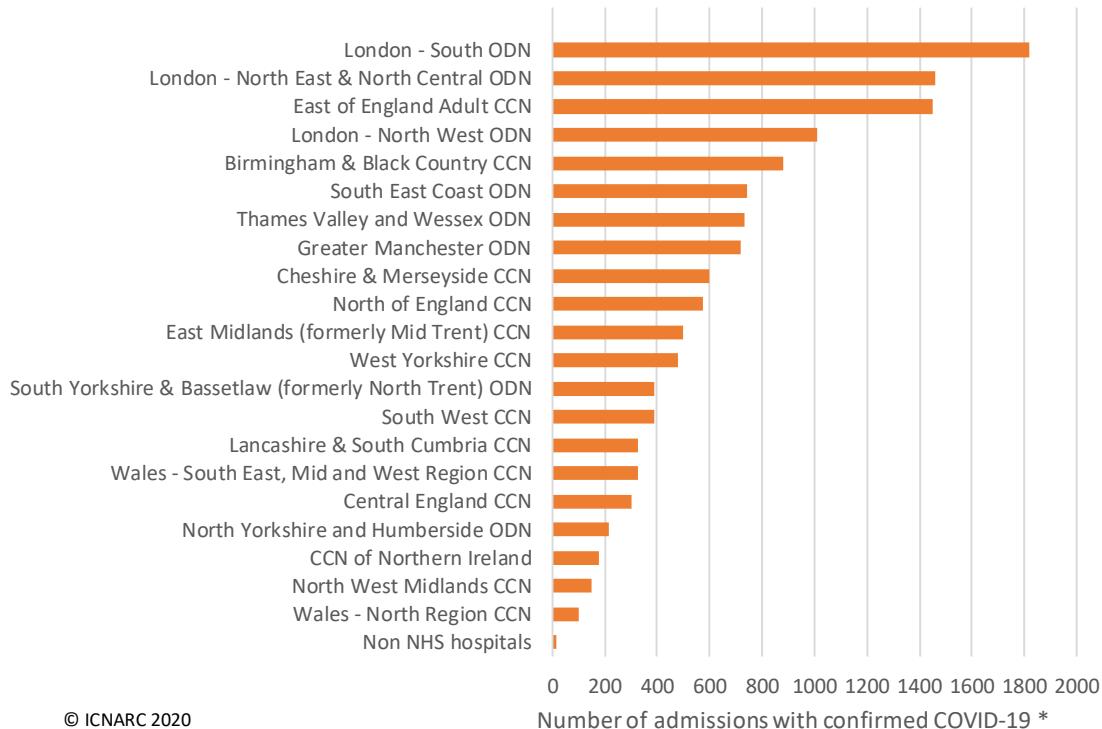
**Figure 6   Number of admissions critically ill with confirmed COVID-19
by Critical Care Network ***

ODN: Organisational Delivery Network; CCN: Critical Care Network. * Please note that this figure represents the number of admissions (i.e. includes transfers between units and readmissions) and NOT the number of patients.

Patient characteristics

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) admitted between 1 January 2017 and 31 December 2019.

Table 1   Patient characteristics: demographics

Demographics	Patients with confirmed COVID-19 and 24h data (N=10834)	Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5782)
Age at admission (years) [N=10824]		
Mean (SD)	58.8 (12.7)	58.0 (17.4)
Median (IQR)	60 (51, 68)	61 (48, 71)
Sex, n (%) [N=10827]		
Female	3237 (29.9)	2641 (45.7)
Male	7590 (70.1)	3141 (54.3)
Currently or recently pregnant, n (% of females aged 16-49) [N=776]		
Currently pregnant	29 (3.7)	56 (7.4)
Recently pregnant (within 6 weeks)	40 (5.2)	29 (3.8)
Not known to be pregnant	707 (91.1)	674 (88.8)
Ethnicity *, n (%) [N=10418]		
White	6885 (66.1)	4951 (88.4)
Mixed	190 (1.8)	52 (0.9)
Asian	1657 (15.9)	325 (5.8)
Black	995 (9.6)	155 (2.8)
Other	691 (6.6)	117 (2.1)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=9988]		
1 (least deprived)	1421 (14.2)	873 (15.3)
2	1599 (16.0)	999 (17.5)
3	1944 (19.5)	1115 (19.5)
4	2383 (23.9)	1232 (21.6)
5 (most deprived)	2641 (26.4)	1489 (26.1)
Body mass index *, n (%) [N=10282]		
<18.5	79 (0.8)	310 (5.5)
18.5-<25	2625 (25.5)	1933 (34.2)
25-<30	3525 (34.3)	1691 (29.9)
30-<40	3231 (31.4)	1330 (23.5)
40+	822 (8.0)	394 (7.0)

* Please see Definitions on page 41.

Table 2   Patient characteristics: medical history and indicators of acute severity *

Medical history	Patients with confirmed COVID-19 and 24h data (N=10834)	Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5782)
Dependency prior to admission to acute hospital *, n (%) [N=10714]		
Able to live without assistance in daily activities	9580 (89.4)	4244 (73.6)
Some assistance with daily activities	1094 (10.2)	1392 (24.1)
Total assistance with all daily activities	40 (0.4)	134 (2.3)
Very severe comorbidities *, n (%) [N=10722]		
Cardiovascular	68 (0.6)	78 (1.4)
Respiratory	128 (1.2)	295 (5.1)
Renal	183 (1.7)	120 (2.1)
Liver	51 (0.5)	54 (0.9)
Metastatic disease	59 (0.6)	68 (1.2)
Haematological malignancy	208 (1.9)	268 (4.6)
Immunocompromise	382 (3.6)	503 (8.7)
Prior hospital length of stay [N=10831]		
Mean (SD)	2.5 (6.3)	2.7 (13.0)
Median (IQR)	1 (0, 3)	1 (0, 2)
CPR within previous 24h, n (%) [N=10818]		
In the community	56 (0.5)	21 (0.4)
In hospital	76 (0.7)	85 (1.5)
Indicator of acute severity		
Mechanically ventilated within first 24h *, n (%) [N=10666]	6213 (58.3)	2482 (43.0)
APACHE II Score [N=10754]		
Mean (SD)	15.1 (5.3)	17.2 (6.3)
Median (IQR)	15 (11, 18)	17 (13, 21)
PaO_2/FiO_2 ratio † (kPa), median (IQR) [N=10180]	15.8 (11.3, 22.0)	18.0 (11.6, 26.4)
PaO_2/FiO_2 ratio †, n (%) [N=10180]		
≤ 13.3 kPa (≤ 100 mmHg)	3758 (36.9)	1819 (33.3)
> 13.3 and ≤ 26.7 kPa (> 100 and ≤ 200 mmHg)	4871 (47.8)	2318 (42.4)
> 26.7 kPa (> 200 mmHg)	1551 (15.2)	1328 (24.3)

* Please see Definitions on page 41. 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. The distribution of ethnicity, matched on 2011 census ward for location of patients critically ill with COVID-19, is presented in Figure 8.
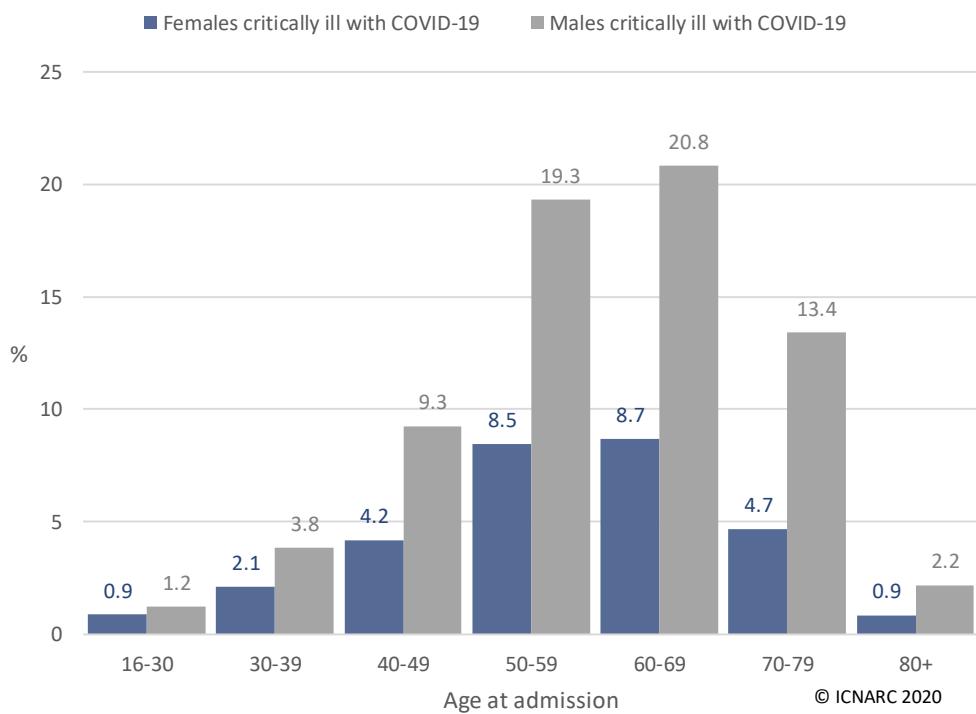
Figure 7   Age and sex distribution of patients critically ill with confirmed COVID-19
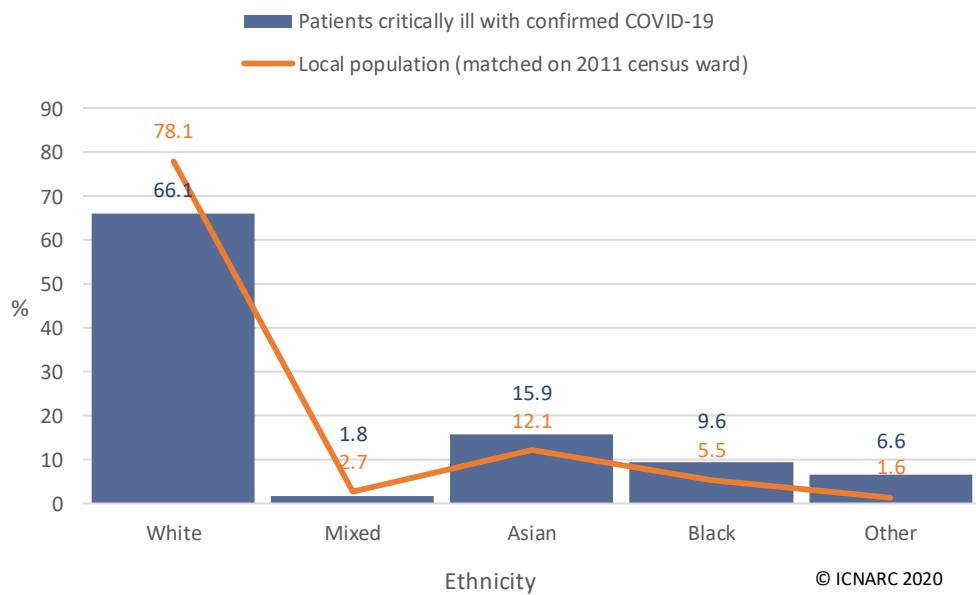
Figure 8   Ethnicity distribution of patients critically ill with confirmed COVID-19

The distribution of Index of Multiple Deprivation (IMD) is presented in Figure 9. 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.
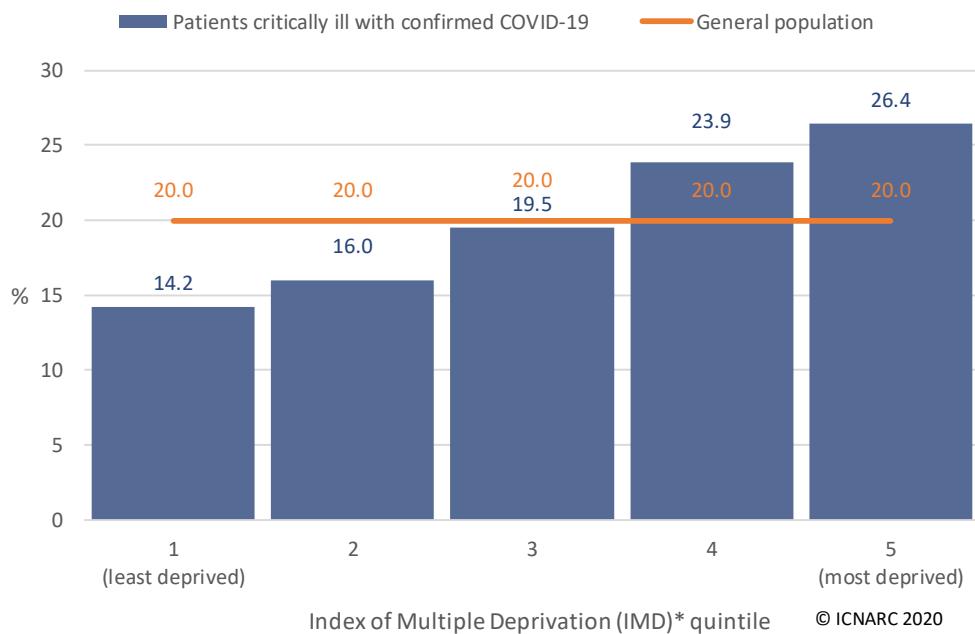
Figure 9   Index of Multiple Deprivation (IMD) * distribution of patients critically ill with confirmed COVID-19

* Please see Definitions on page 41.
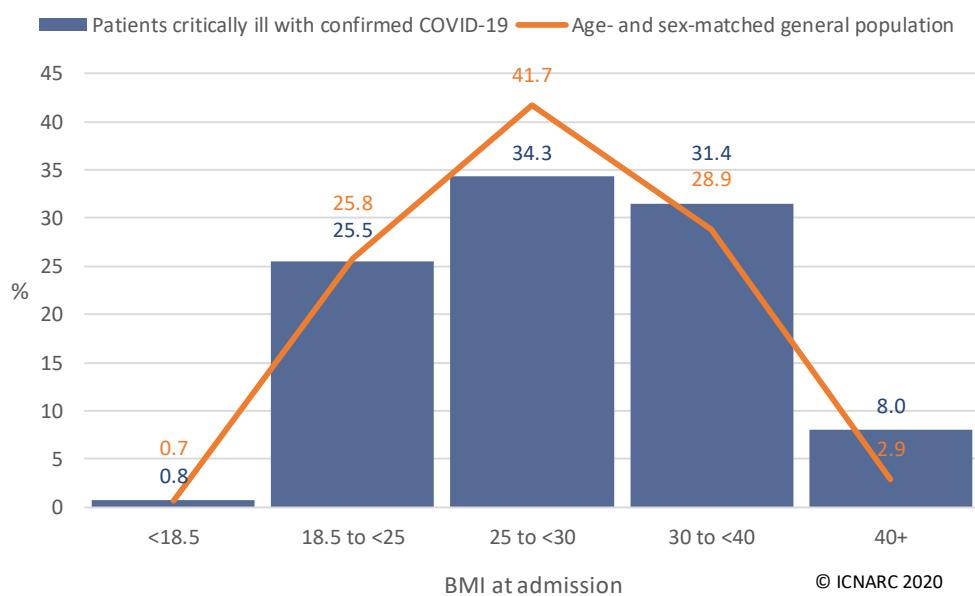
Figure 10 BMI distribution of patients critically ill with confirmed COVID-19

Characteristics of patients critically ill with confirmed COVID-19 by ethnicity, for patients of white ethnicities compared with patients of all non-white ethnicities combined (mixed, Asian, black or other), are summarised in Table 3 and Table 4.

Table 3   Patient characteristics: demographics by ethnicity *

Demographics	Patients of white ethnicity (N=6885)	Patients of non-white ethnicity (N=3533)
Age at admission (years) [N=10408]		
Mean (SD)	60.6 (12.5)	55.5 (12.4)
Median (IQR)	62 (53, 70)	57 (48, 64)
Sex, n (%) [N=10411]		
Female	2077 (30.2)	1043 (29.6)
Male	4806 (69.8)	2485 (70.4)
Currently or recently pregnant, n (% of females) [N=752]		
Currently pregnant	12 (2.8)	16 (5.0)
Recently pregnant (within 6 weeks)	13 (3.0)	26 (8.1)
Not known to be pregnant	406 (94.2)	279 (86.9)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=9638]		
1 (least deprived)	1111 (17.5)	256 (7.8)
2	1171 (18.4)	371 (11.3)
3	1278 (20.1)	594 (18.1)
4	1315 (20.7)	970 (29.5)
5 (most deprived)	1475 (23.2)	1097 (33.4)
Body mass index *, n (%) [N=9895]		
<18.5	54 (0.8)	23 (0.7)
18.5-<25	1515 (23.2)	992 (29.5)
25-<30	2182 (33.4)	1220 (36.3)
30-<40	2176 (33.3)	940 (28.0)
40+	605 (9.3)	188 (5.6)

* Please see Definitions on page 41. Patients with ethnicity recorded as 'not stated' excluded.

Table 4   Patient characteristics: medical history and indicators of acute severity by ethnicity *

Medical history	Patients of white ethnicity (N=6885)	Patients of non-white ethnicity (N=3533)
Dependency prior to admission to acute hospital *, n (%) [N=10311]		
Able to live without assistance in daily activities	5995 (87.9)	3230 (92.4)
Some assistance with daily activities	795 (11.7)	252 (7.2)
Total assistance with all daily activities	27 (0.4)	12 (0.3)
Very severe comorbidities *, n (%) [N=10317]		
Cardiovascular	57 (0.8)	8 (0.2)
Respiratory	99 (1.5)	21 (0.6)
Renal	82 (1.2)	97 (2.8)
Liver	36 (0.5)	12 (0.3)
Metastatic disease	49 (0.7)	8 (0.2)
Haematological malignancy	158 (2.3)	38 (1.1)
Immunocompromise	275 (4.0)	88 (2.5)
Prior hospital length of stay [N=10416]		
Mean (SD)	2.6 (6.1)	2.2 (6.5)
Median (IQR)	1 (0, 3)	1 (0, 3)
CPR within previous 24h, n (%) [N=10405]		
In the community	35 (0.5)	15 (0.2)
In hospital	41 (0.6)	26 (0.4)
Indicator of acute severity		
Mechanically ventilated within first 24h *, n (%) [N=10262]	3679 (54.3)	2286 (65.7)
APACHE II Score [N=10344]		
Mean (SD)	15.1 (5.2)	15.0 (5.4)
Median (IQR)	15 (12, 18)	15 (11, 18)
PaO_2/FiO_2 ratio † (kPa), median (IQR) [N=9796]	16.0 (11.3, 22.4)	15.4 (11.3, 21.5)
PaO_2/FiO_2 ratio †, n (%) [N=9796]		
≤ 13.3 kPa (≤ 100 mmHg)	2350 (36.6)	1254 (37.2)
> 13.3 and ≤ 26.7 kPa (> 100 and ≤ 200 mmHg)	3069 (47.7)	1639 (48.7)
> 26.7 kPa (> 200 mmHg)	1010 (15.7)	474 (14.1)

* Please see Definitions on page 41. Patients with ethnicity recorded as 'not stated' excluded. 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 from the first 24 hours of critical care.

Characteristics of patients critically ill with confirmed COVID-19 who received advanced respiratory support at any point during critical care and those who received basic respiratory support only are summarised in Table 5 and Table 6. Characteristics of patients critically ill with confirmed COVID-19 who received renal support at any point during critical care and those who did not receive renal support are summarised in Table 7 and Table 8. Most patients who received renal support (95.0%) also received advanced respiratory support.

Table 5   Patient characteristics: demographics by receipt of respiratory support *

Demographics	Patients receiving advanced respiratory support (N=7702)	Patients receiving only basic respiratory support (N=2736)
Age at admission (years) [N=10429]		
Mean (SD)	58.6 (11.9)	59.4 (14.3)
Median (IQR)	60 (51, 67)	60 (50, 70)
Sex, n (%) [N=10431]		
Female	2152 (28.0)	932 (34.1)
Male	5544 (72.0)	1803 (65.9)
Currently or recently pregnant, n (% of females aged 16-49) [N=739]		
Currently pregnant	15 (3.0)	11 (4.8)
Recently pregnant (within 6 weeks)	27 (5.3)	10 (4.3)
Not known to be pregnant	466 (91.7)	210 (90.9)
Ethnicity *, n (%) [N=10049]		
White	4653 (62.8)	1986 (75.1)
Mixed	144 (1.9)	40 (1.5)
Asian	1256 (17.0)	341 (12.9)
Black	804 (10.9)	160 (6.1)
Other	549 (7.4)	116 (4.4)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=9628]		
1 (least deprived)	945 (13.4)	425 (16.4)
2	1103 (15.7)	442 (17.0)
3	1424 (20.3)	454 (17.5)
4	1726 (24.5)	569 (21.9)
5 (most deprived)	1834 (26.1)	706 (27.2)
Body mass index *, n (%) [N=9903]		
<18.5	42 (0.6)	27 (1.1)
18.5-<25	1845 (24.9)	649 (26.2)
25-<30	2573 (34.7)	837 (33.7)
30-<40	2409 (32.5)	720 (29.0)
40+	553 (7.5)	248 (10.0)

* Please see Definitions on page 41. Patients receiving no respiratory support excluded due to small numbers.

Table 6   Patient characteristics: medical history and indicators of acute severity by receipt of respiratory support *

Medical history	Patients receiving advanced respiratory support (N=7702)	Patients receiving only basic respiratory support (N=2736)
Dependency prior to admission to acute hospital *, n (%) [N=10333]		
Able to live without assistance in daily activities	7021 (92.1)	2249 (83.1)
Some assistance with daily activities	594 (7.8)	434 (16.0)
Total assistance with all daily activities	11 (0.1)	24 (0.9)
Very severe comorbidities *, n (%) [N=10338]		
Cardiovascular	22 (0.3)	39 (1.4)
Respiratory	46 (0.6)	75 (2.8)
Renal	94 (1.2)	70 (2.6)
Liver	29 (0.4)	18 (0.7)
Metastatic disease	24 (0.3)	26 (1.0)
Haematological malignancy	126 (1.7)	75 (2.8)
Immunocompromise	226 (3.0)	134 (4.9)
Prior hospital length of stay [N=10437]		
Mean (SD)	2.2 (5.4)	2.9 (7.1)
Median (IQR)	1 (0, 3)	1 (0, 3)
CPR within previous 24h, n (%) [N=10430]		
In the community	48 (0.4)	6 (0.2)
In hospital	70 (0.6)	3 (0.1)
Indicator of acute severity		
Mechanically ventilated within first 24h *, n (%) [N=10301]	6006 (79.0)	---
APACHE II Score [N=10375]		
Mean (SD)	15.4 (5.1)	14.2 (5.5)
Median (IQR)	15 (12, 18)	14 (10, 17)
PaO_2/FiO_2 ratio † (kPa), median (IQR) [N=9868]	15.0 (10.8, 21.0)	17.5 (12.5, 24.0)
PaO_2/FiO_2 ratio †, n(%) [N=9868]		
≤ 13.3 kPa (≤ 100 mmHg)	3033 (40.4)	686 (29.2)
> 13.3 and ≤ 26.7 kPa (> 100 and ≤ 200 mmHg)	3530 (47.0)	1240 (52.7)
> 26.7 kPa (> 200 mmHg)	952 (12.7)	427 (18.1)

* Please see Definitions on page 41. Patients receiving no respiratory support excluded due to small numbers. 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 from the first 24 hours of critical care.

Table 7   Patient characteristics: demographics by receipt of renal support *

Demographics	Patients receiving any renal support (N=2850)	Patients not receiving any renal support (N=7844)
Age at admission (years) [N=10685]		
Mean (SD)	59.1 (11.0)	58.7 (13.3)
Median (IQR)	60 (52, 67)	60 (50, 68)
Sex, n (%) [N=10687]		
Female	656 (23.0)	2537 (32.4)
Male	2192 (77.0)	5302 (67.6)
Currently or recently pregnant, n (% of females aged 16-49) [N=764]		
Currently pregnant	3 (2.0)	26 (4.3)
Recently pregnant (within 6 weeks)	4 (2.6)	36 (5.9)
Not known to be pregnant	146 (95.4)	549 (89.9)
Ethnicity *, n (%) [N=10285]		
White	1618 (59.1)	5191 (68.8)
Mixed	47 (1.7)	139 (1.8)
Asian	465 (17.0)	1161 (15.4)
Black	412 (15.0)	570 (7.6)
Other	198 (7.2)	484 (6.4)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=9861]		
1 (least deprived)	326 (12.5)	1084 (15.0)
2	397 (15.2)	1184 (16.3)
3	565 (21.6)	1354 (18.7)
4	641 (24.5)	1714 (23.7)
5 (most deprived)	685 (26.2)	1911 (26.4)
Body mass index *, n (%) [N=10150]		
<18.5	15 (0.5)	62 (0.8)
18.5-<25	629 (22.7)	1952 (26.4)
25-<30	944 (34.1)	2539 (34.4)
30-<40	965 (34.9)	2228 (30.2)
40+	216 (7.8)	600 (8.1)

* Please see Definitions on page 41. Includes 180 patients requiring chronic renal replacement therapy for end stage renal disease prior to critical care; outcomes for these patients are similar.

Table 8   Patient characteristics: medical history and indicators of acute severity by receipt of renal support *

Medical history	Patients receiving any renal support (N=2850)	Patients not receiving any renal support (N=7844)
Dependency prior to admission to acute hospital *, n (%) [N=10586]		
Able to live without assistance in daily activities	2603 (91.9)	6863 (88.5)
Some assistance with daily activities	222 (7.8)	858 (11.1)
Total assistance with all daily activities	6 (0.2)	34 (0.4)
Very severe comorbidities *, n (%) [N=10591]		
Cardiovascular	11 (0.4)	55 (0.7)
Respiratory	17 (0.6)	109 (1.4)
Renal	144 (5.1)	36 (0.5)
Liver	6 (0.2)	44 (0.6)
Metastatic disease	13 (0.5)	46 (0.6)
Haematological malignancy	47 (1.7)	159 (2.0)
Immunocompromise	90 (3.2)	287 (3.7)
Prior hospital length of stay [N=10692]		
Mean (SD)	2.3 (5.3)	2.5 (6.5)
Median (IQR)	1 (0, 3)	1 (0, 3)
CPR within previous 24h, n (%) [N=10685]		
In the community	11 (0.2)	44 (0.6)
In hospital	18 (0.3)	58 (0.8)
Indicator of acute severity		
Mechanically ventilated within first 24h *, n (%) [N=10547]	2151 (76.2)	3993 (51.7)
APACHE II Score [N=10627]		
Mean (SD)	17.0 (5.6)	14.4 (5.0)
Median (IQR)	16 (13, 20)	14 (11, 17)
PaO_2/FiO_2 ratio † (kPa), median (IQR) [N=10058]	14.3 (10.4, 20.0)	16.4 (11.7, 23.0)
PaO_2/FiO_2 ratio †, n(%) [N=10058]		
≤ 13.3 kPa (≤ 100 mmHg)	1226 (44.3)	2497 (34.3)
> 13.3 and ≤ 26.7 kPa (> 100 and ≤ 200 mmHg)	1241 (44.8)	3564 (48.9)
> 26.7 kPa (> 200 mmHg)	303 (10.9)	1227 (16.8)

* Please see Definitions on page 41. Includes 180 patients requiring chronic renal replacement therapy for end stage renal disease prior to critical care; outcomes for these patients are similar. 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 from the first 24 hours of critical care.

Critical care outcomes have been received for 10,704 (of 10,834) patients, of whom 4240 patients have died and 6464 have been discharged alive from critical care (Figures 11-13). Overall in-hospital survival is illustrated in Figure 14. Duration of critical care and receipt and duration of organ support in critical care are summarised in Table 9 and compared with an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) admitted between 1 January 2017 and 31 December 2019. Receipt and duration of organ support are summarised graphically in Figure 15 and in Figure 16, respectively. Of the 6464 patients discharged from critical care, 282 (4.4%) were last reported to be still in an acute hospital setting and 314 (4.9%) died before being discharged from hospital (Figure 11).

Please note that Figure 13 is biased towards longer lengths of stay in critical care due to the time lag in notification of a patients' discharge or death, while Table 9 and Figures 15 and 16 are biased towards patients with shorter lengths of stay in critical care due to the ongoing nature of the UK epidemic. Figure 12 and Figure 13 assume that patients are still in critical care unless ICNARC has been notified otherwise, and Table 9 and Figures 15 and 16 include only those patients who have either died or been discharged from critical care.
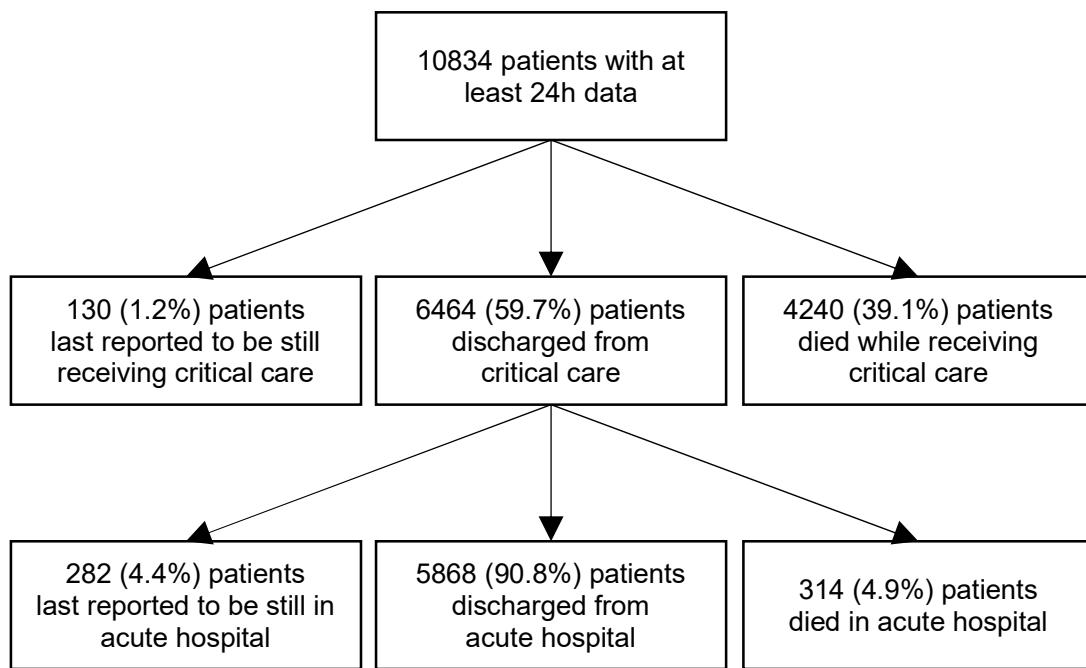
Figure 11 Critical care and acute hospital outcomes among patients with at least 24h data received
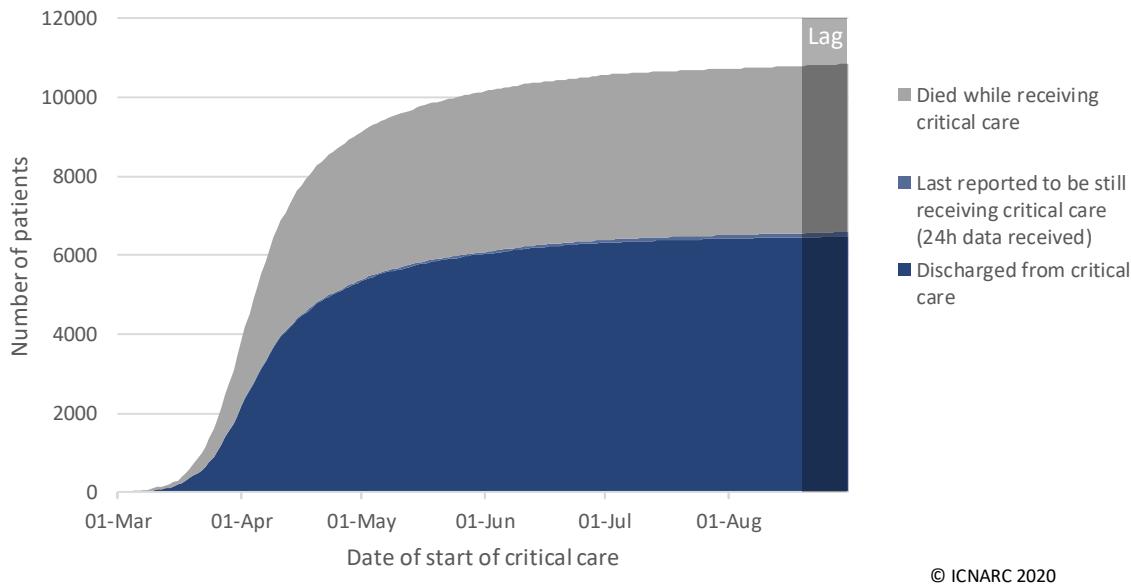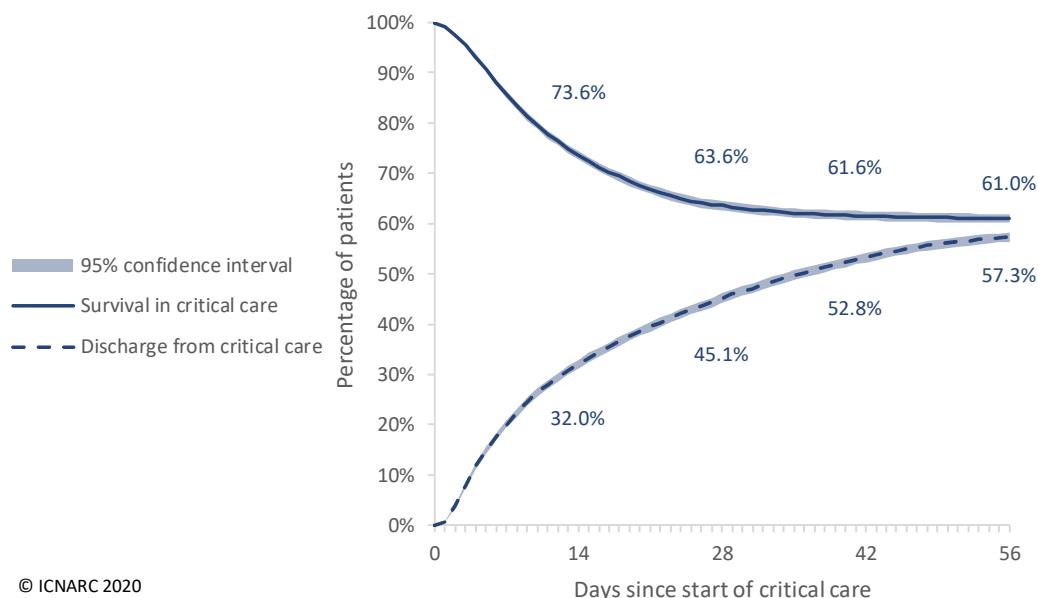
Figure 12 Cumulative outcomes by date of start of critical care *
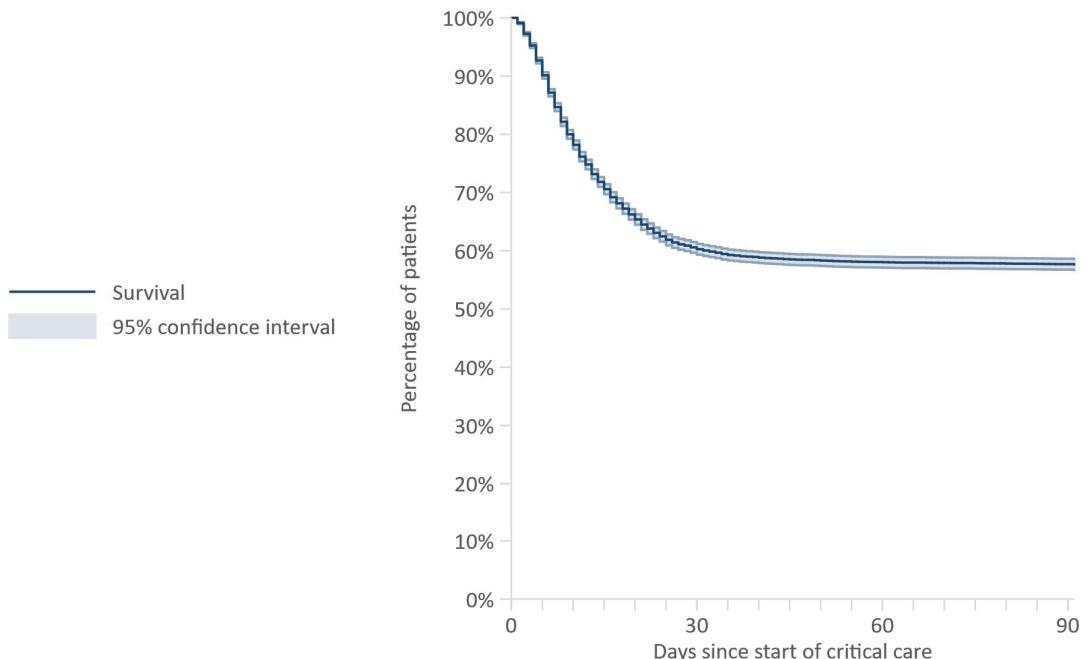
* Please note that patients whose outcome data have not been received are assumed to remain in critical care as of 04 September 2020.

	0	14	28	42	56
Died while receiving critical care	0	2840	3910	4128	4178
Still receiving critical care	10797	4472	1985	886	398
Discharged from critical care	0	3442	4845	5716	6140
Censored	0	43	57	67	81

Figure 13 Survival and discharge among patients with at least 24h data received

Please note that 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 04 September 2020. Due to the ongoing 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 Tables 9, 13 and 14, this approach makes better use of all available data, including data about patients who are still in critical care.

At risk	10834	6463	6121	6003
Died (in hospital)	0	4246	4514	4552
Censored	0	125	199	279

Figure 14 In-hospital survival to 90 days following admission to critical care

Please note that due to the time lag in notification of patients' discharge or death, this figure is expected to be biased towards *longer* survival times. Patients who have been discharged from acute hospital within 90 days are assumed to survive to 90 days.

Table 9   Outcome, duration of critical care and organ support *

Critical care outcomes among patients who have been discharged or died	Patients with COVID-19 and outcome reported (N=10704)	Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5626)
Outcome at end of critical care, n (%)		
Discharged	6464 (60.4)	4423 (78.6)
Died	4240 (39.6)	1203 (21.4)
Duration of critical care		
Duration of critical care † (days), median (IQR)		
Survivors	12 (5, 28)	6 (3, 13)
Non-survivors	9 (5, 16)	6 (3, 13)
Organ support (Critical Care Minimum Dataset) *		
Receipt of organ support, at any point, n (%)		
Advanced respiratory support	7702 (72.0)	2721 (48.4)
Basic respiratory support	7285 (68.1)	4527 (80.5)
Advanced cardiovascular support	3255 (30.4)	1261 (22.4)
Basic cardiovascular support	9947 (93.0)	5219 (92.8)
Renal support	2850 (26.7)	957 (17.0)
Liver support	109 (1.0)	53 (0.9)
Neurological support	973 (9.1)	320 (5.7)
Combinations of advanced respiratory, advanced cardiovascular and renal support, n (%):		
Advanced respiratory support only	3326 (31.1)	1257 (22.3)
Advanced cardiovascular support only	53 (0.5)	79 (1.4)
Renal support only	128 (1.2)	116 (2.1)
Advanced respiratory and advanced cardiovascular support only	1667 (15.6)	640 (11.4)
Advanced respiratory and renal support only	1188 (11.1)	299 (5.3)
Advanced cardiovascular and renal support only	14 (0.1)	17 (0.3)
Advanced respiratory, advanced cardiovascular and renal support	1521 (14.2)	525 (9.3)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	13 (7, 23)	9 (4, 17)
Total (advanced + basic) respiratory support	11 (5, 22)	6 (3, 12)
Advanced cardiovascular support	3 (2, 6)	3 (2, 5)
Total (advanced + basic) cardiovascular support	11 (5, 22)	6 (3, 12)
Renal support	8 (3, 15)	6 (3, 12)

Please note that owing to the ongoing nature of the epidemic, the sample of patients with confirmed 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. * Please see Definitions on page 41. † Duration of critical care is from original admission to critical care until final unit outcome and includes any time spent outside critical care areas (e.g. prior to any readmissions).
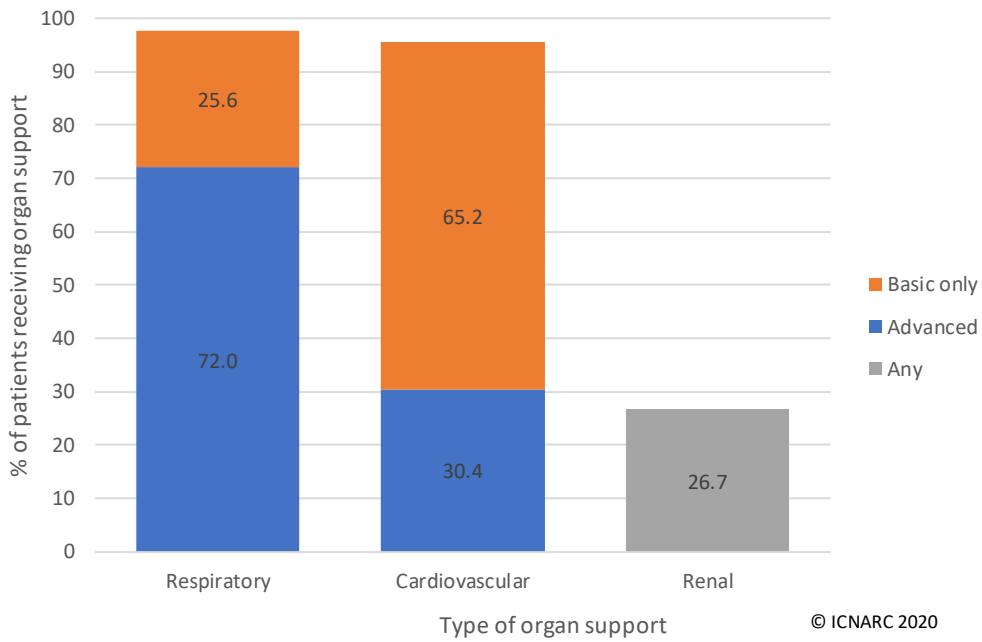
Figure 15   Percentage of patients receiving organ support *

Please note that owing to the ongoing nature of the epidemic, the sample of patients with confirmed COVID-19 represented in this figure 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. * Please see Definitions on page 41.
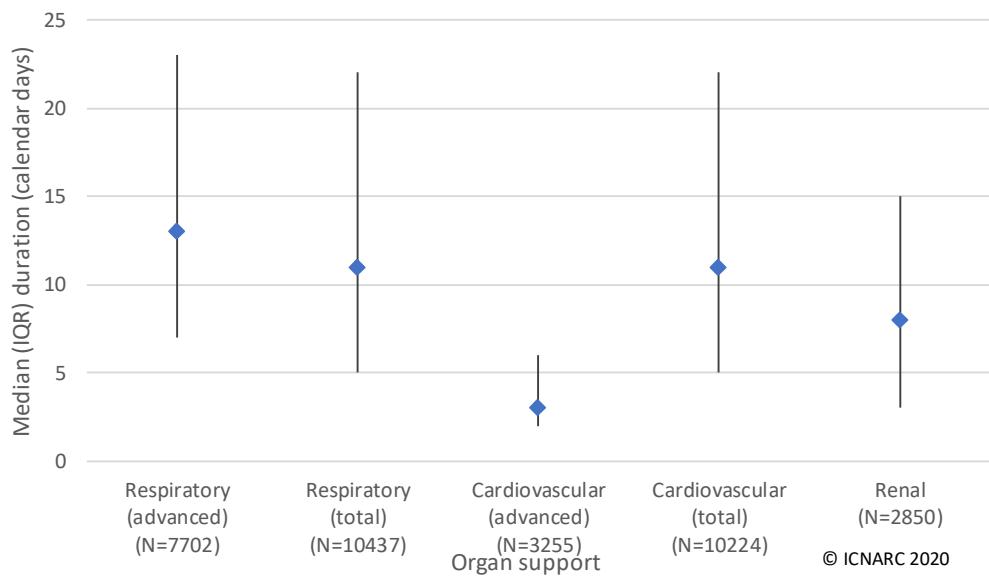
Figure 16   Duration of organ support received *

This Figure presents median and interquartile range, in calendar days. Please note that owing to the ongoing nature of the epidemic, the sample of patients with confirmed COVID-19 represented in this figure 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. * Please see Definitions on page 41.

The median length of stay in hospital prior to the start of critical care, duration of critical care, and subsequent length of stay in hospital following discharge from critical care are summarised in Figure 17. Among patients who died in acute hospital following discharge from critical care, 21.6% were reported to have been discharged from critical care for palliative care. A total of 1378 inter-hospital critical care transfers for 1157 patients have been reported, as well as 284 readmissions for 269 patients (Figure 18).
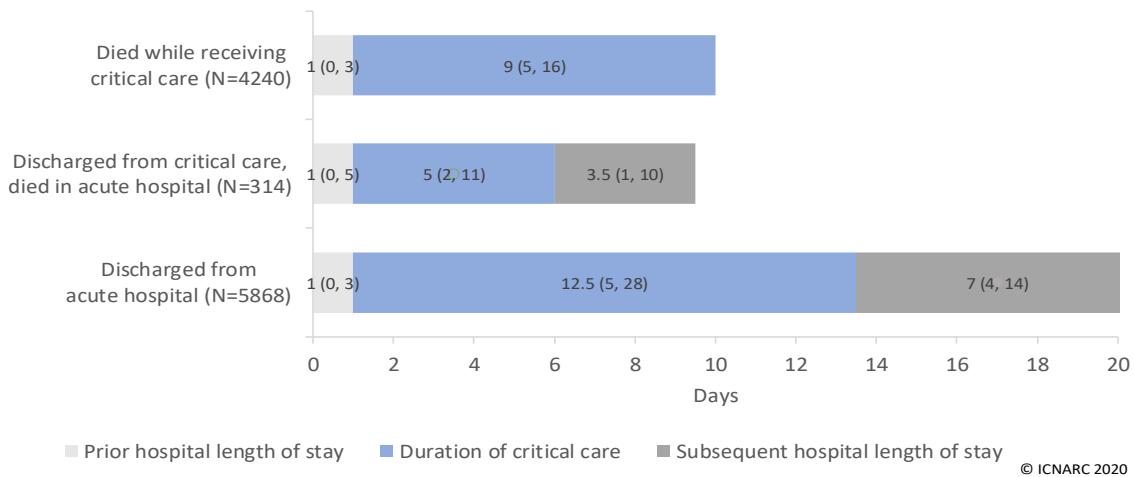
Figure 17 **Median lengths of stay among patients with hospital outcome data received**

The numbers within each bar are the median and interquartile range, in days. Please note that owing to the ongoing nature of the epidemic, the sample of patients with confirmed COVID-19 represented in this figure is biased towards patients with *shorter* lengths of stay in acute hospital prior to discharge or death, i.e. patients who died or recovered more quickly.
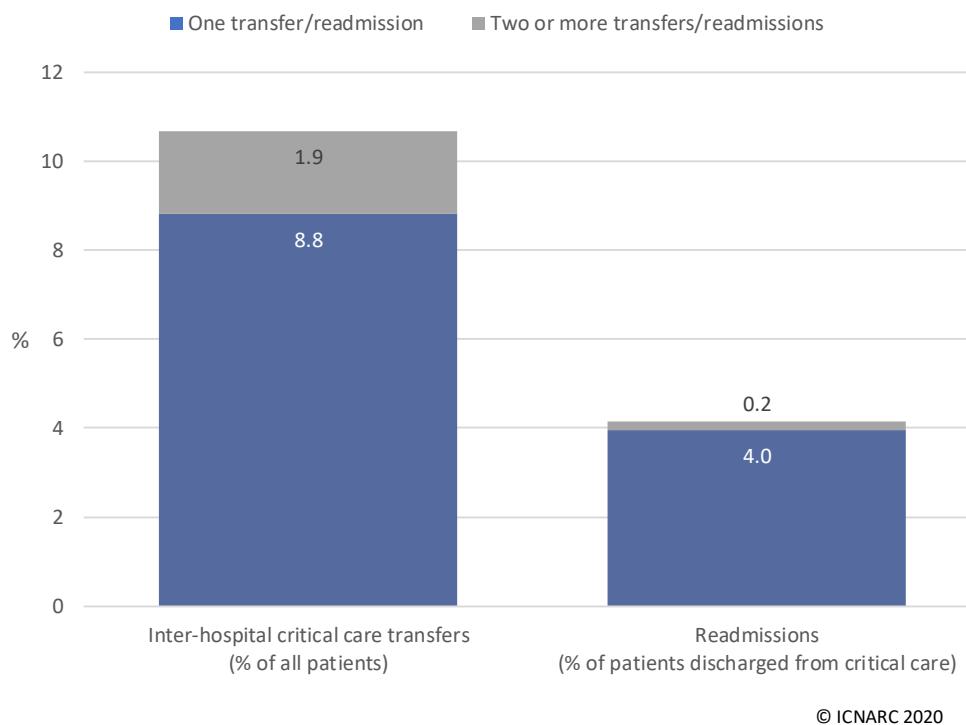
Figure 18 **Inter-hospital critical care transfers and readmissions**

Critical care outcomes for patients critically ill with confirmed COVID-19 across major patient subgroups are summarised in Table 10 and compared with an historic cohort of patients critically ill with viral pneumonia (non-COVID-19) admitted between 1 January 2017 and 31 December 2019.

Table 10   Outcome by patient characteristics

Patient characteristic	Patients with COVID-19 and outcome reported (N=10704)		Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5782)
	Discharged alive from critical care	Died in critical care	Died in critical care
	n (%)	n (%)	(%)
Age at admission (years)			
16-39	734 (84.9)	131 (15.1)	(7.1)
40-49	1131 (78.4)	311 (21.6)	(12.1)
50-59	1982 (66.7)	991 (33.3)	(19.1)
60-69	1689 (53.5)	1467 (46.5)	(25.7)
70-79	786 (40.7)	1145 (59.3)	(31.2)
80+	137 (41.8)	191 (58.2)	(30.8)
Sex			
Female	2079 (65.0)	1118 (35.0)	(19.1)
Male	4381 (58.4)	3119 (41.6)	(23.3)
Ethnicity *			
White	4175 (61.3)	2640 (38.7)	(21.7)
Mixed	109 (58.6)	77 (41.4)	(14.0)
Asian	922 (56.6)	707 (43.4)	(19.4)
Black	572 (58.2)	410 (41.8)	(12.4)
Other	451 (66.1)	231 (33.9)	(18.6)
Index of Multiple Deprivation (IMD) quintile *			
1 (least deprived)	880 (62.3)	533 (37.7)	(22.3)
2	968 (61.2)	613 (38.8)	(22.6)
3	1161 (60.4)	761 (39.6)	(22.5)
4	1421 (60.3)	935 (39.7)	(20.1)
5 (most deprived)	1600 (61.6)	999 (38.4)	(20.3)
Body mass index			
<25	1586 (59.6)	1074 (40.4)	(23.1)
25-<30	2034 (58.3)	1453 (41.7)	(22.5)
30-<40	2033 (63.6)	1164 (36.4)	(18.9)
40+	535 (65.6)	281 (34.4)	(13.6)
Assistance required with daily activities			
No	5816 (61.4)	3659 (38.6)	(19.4)
Yes	593 (52.9)	528 (47.1)	(27.2)
Any very severe comorbidities *			
No	5978 (61.4)	3754 (38.6)	(18.8)
Yes	436 (50.2)	433 (49.8)	(32.8)

Please note that owing to the ongoing 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. * Please see Definitions on page 41.

Critical care outcomes for patients of white ethnicities compared with patients of non-white ethnicities are summarised in Table 11.

Table 11   Outcome, duration of critical care and organ support by ethnicity *

Critical care unit outcomes among patients who have been discharged or died	Patients of white ethnicity (N=6815)	Patients of non-white ethnicity (N=3479)
Outcome at end of critical care, n (%)		
Alive	4175 (61.3)	2054 (59.0)
Dead	2640 (38.7)	1425 (41.0)
Duration of critical care		
Duration of critical care † (days), median (IQR)		
Survivors	11 (4, 26)	15 (6, 32)
Non-survivors	8 (4, 15)	10 (5, 17)
Organ support (Critical Care Minimum Dataset)*		
Receipt of organ support, at any point, n (%)		
Advanced respiratory support	4653 (68.3)	2753 (79.2)
Basic respiratory support	4762 (69.9)	2267 (65.2)
Advanced cardiovascular support	1943 (28.5)	1177 (33.9)
Basic cardiovascular support	6263 (92.0)	3310 (95.2)
Renal support	1618 (23.8)	1122 (32.3)
Liver support	49 (0.7)	51 (1.5)
Neurological support	582 (8.5)	354 (10.2)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	13 (7, 23)	14 (8, 25)
Total (advanced + basic) respiratory support	10 (5, 21)	13 (6, 25)
Advanced cardiovascular support	3 (2, 6)	3 (2, 7)
Total (advanced + basic) cardiovascular support	10 (5, 21)	13 (6, 25)
Renal support	8 (3, 15)	8 (3, 16)

Please note that owing to the ongoing 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. * Please see Definitions on page 41. Patients with ethnicity reported as 'not stated' excluded. † Duration of critical care is from original admission to critical care until final unit outcome and includes any time spent outside critical care areas (e.g. prior to any readmissions).

Figure 19 presents 30-day survival for patients critically ill with confirmed COVID-19 who received mechanical ventilation during the first 24 hours of critical care compared with patients who did not.

Critical care outcomes 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 are summarised in Table 13. Critical care outcomes for patients critically ill with confirmed COVID-19 who received renal support at any point during critical care and who did not receive renal support are summarised in Table 14.

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(4461)	(4441)	(4435)	(4433)	(4431)
(6184)	(6167)	(6162)	(6158)	(6148)
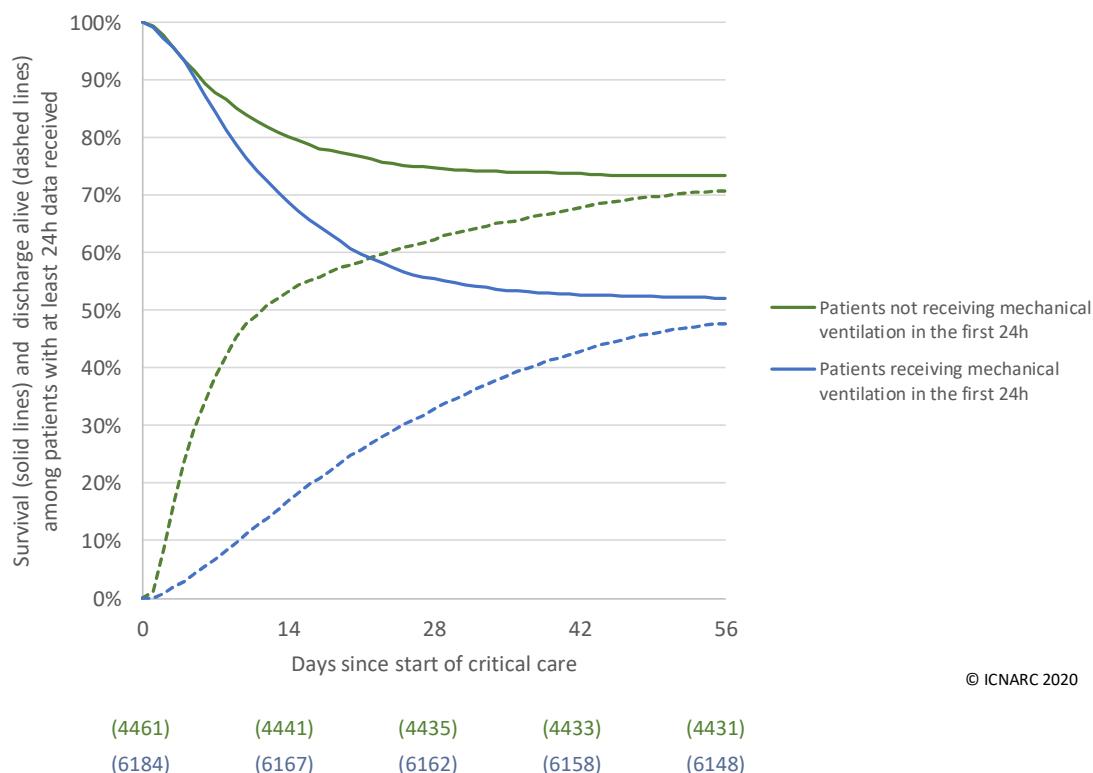
Figure 19 Survival and discharge by mechanical ventilation during the first 24 hours *

* Please see Definitions on page 41. 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 start of critical care until 04 September 2020. 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 ongoing 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 Tables 9, 13 and 14, this approach makes better use of all available data, including data about patients who are still in critical care.

Table 12   Outcome by combinations of organ support *

Organ support received *	Patients with COVID-19 and outcome reported (N=10704)		Patients with viral pneumonia (non-COVID-19), 2017-19 (N=5782)
	Discharged alive from critical care	Died in critical care	Died in critical care
	n (%)	n (%)	(%)
Any respiratory support			
Basic only	2199 (80.4)	537 (19.6)	(11.2)
Advanced	4018 (52.2)	3684 (47.8)	(33.3)
Any renal support	1233 (43.2)	1618 (56.8)	(46.1)
Combinations of advanced respiratory, advanced cardiovascular and renal support:			
Advanced respiratory support only	2124 (63.9)	1202 (36.1)	(18.7)
Advanced respiratory and advanced cardiovascular support only	763 (45.8)	904 (54.2)	(40.2)
Advanced respiratory and renal support only	576 (48.5)	612 (51.5)	(38.8)
Advanced respiratory, advanced cardiovascular and renal support	555 (36.5)	966 (63.5)	(56.6)

Please note that owing to the ongoing 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. * Please see Definitions on page 41.

Table 13   Outcome, duration of critical care and organ support by receipt of respiratory support *

Critical care outcomes among patients who have been discharged or died	Patients receiving advanced respiratory support * (N=7702)	Patients receiving only basic respiratory support * (N=2736)
Outcome at end of critical care, n (%)		
Discharged	4018 (52.2)	2199 (80.4)
Died	3684 (47.8)	537 (19.6)
Duration of critical care		
Duration of critical care † (days), median (IQR)		
Survivors	23 (13, 37)	4 (2, 7)
Non-survivors	10 (6, 17)	4 (2, 7)
Organ support (Critical Care Minimum Dataset) *		
Receipt of organ support, at any point, n (%)		
Basic respiratory support	4549 (59.1)	2736 (100.0)
Advanced cardiovascular support	3188 (41.4)	50 (1.8)
Basic cardiovascular support	7425 (96.4)	2307 (84.3)
Renal support	2708 (35.2)	108 (3.9)
Liver support	105 (1.4)	3 (0.1)
Neurological support	944 (12.3)	25 (0.9)
Duration of organ support (calendar days), median (IQR)		
Total (advanced + basic) respiratory support	15 (8, 26)	4 (3, 7)
Advanced cardiovascular support	3 (2, 6)	2 (1, 4)
Total (advanced + basic) cardiovascular support	16 (9, 26)	5 (3, 7)
Renal support	8 (4, 15)	3 (2, 6)

Please note that owing to the ongoing 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. * Please see Definitions on page 41. Patients receiving no respiratory support excluded due to small numbers. † Duration of critical care is from original admission to critical care until final unit outcome and includes any time spent outside critical care areas (e.g. prior to any readmissions).

Table 14 Outcome, duration of critical care and organ support by receipt of renal support *

Critical care outcomes among patients who have been discharged or died	Patients receiving any renal support * (N=2850)	Patients not receiving any renal support * (N=7844)
Outcome at end of critical care, n (%)		
Discharged	1232 (43.2)	5227 (66.6)
Died	1618 (56.8)	2617 (33.4)
Duration of critical care		
Duration of critical care † (days), median (IQR)		
Survivors	32 (19, 46)	9 (4, 21)
Non-survivors	13 (7, 20)	7 (4, 13)
Organ support (Critical Care Minimum Dataset) *		
Receipt of organ support, at any point, n (%)		
Advanced respiratory support	2708 (95.0)	4993 (63.7)
Basic respiratory support	1580 (55.4)	5704 (72.7)
Advanced cardiovascular support	1534 (53.8)	1720 (21.9)
Basic cardiovascular support	2747 (96.4)	7199 (91.8)
Liver support	73 (2.6)	36 (0.5)
Neurological support	399 (14.0)	574 (7.3)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	18 (10, 29)	11 (6, 20)
Total (advanced + basic) respiratory support	19 (11, 32)	9 (4, 18)
Advanced cardiovascular support	4 (2, 7)	3 (1, 5)
Total (advanced + basic) cardiovascular support	19 (11, 32)	9 (5, 18)

Please note that owing to the ongoing 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. * Please see Definitions on page 41. Includes 180 patients requiring chronic renal replacement therapy for end stage renal disease prior to critical care; outcomes for these patients are similar. † Duration of critical care is from original admission to critical care until final unit outcome and includes any time spent outside critical care areas (e.g. prior to any readmissions).

Critical care outcomes 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 across major patient subgroups are summarised in Table 15. Critical care outcomes for patients critically ill with confirmed COVID-19 who received renal support at any point during critical care and who did not receive renal support across major patient subgroups are summarised in Table 16.

Table 15 Outcome by receipt of respiratory support * and patient characteristics

Patient characteristic	Patients receiving advanced respiratory support * (N=7702)		Patients receiving only basic respiratory support * (N=2736)	
	Discharged alive from critical care	Died in critical care	Discharged alive from critical care	Died in critical care
	n (%)	n (%)	n (%)	n (%)
Age at admission (years)				
16-39	427 (77.6)	123 (22.4)	264 (97.1)	8 (2.9)
40-49	757 (72.7)	284 (27.3)	339 (92.9)	26 (7.1)
50-59	1310 (58.7)	922 (41.3)	629 (90.6)	65 (9.4)
60-69	1093 (45.2)	1324 (54.8)	536 (79.5)	138 (20.5)
70-79	399 (29.9)	934 (70.1)	344 (62.5)	206 (37.5)
80+	28 (23.1)	93 (76.9)	86 (47.8)	94 (52.2)
Sex				
Female	1214 (56.4)	938 (43.6)	763 (81.9)	169 (18.1)
Male	2801 (50.5)	2743 (49.5)	1435 (79.6)	368 (20.4)
Ethnicity *				
White	2437 (52.4)	2216 (47.6)	1575 (79.3)	411 (20.7)
Mixed	73 (50.7)	71 (49.3)	34 (85.0)	6 (15.0)
Asian	624 (49.7)	632 (50.3)	269 (78.9)	72 (21.1)
Black	419 (52.1)	385 (47.9)	135 (84.4)	25 (15.6)
Other	326 (59.4)	223 (40.6)	109 (94.0)	7 (6.0)
Index of Multiple Deprivation (IMD) quintile				
1 (least deprived)	499 (52.8)	446 (47.2)	341 (80.2)	84 (19.8)
2	581 (52.7)	522 (47.3)	354 (80.1)	88 (19.9)
3	758 (53.2)	666 (46.8)	361 (79.5)	93 (20.5)
4	898 (52.0)	828 (48.0)	468 (82.2)	101 (17.8)
5 (most deprived)	991 (54.0)	843 (46.0)	554 (78.5)	152 (21.5)
Body mass index				
<25	964 (51.1)	923 (48.9)	530 (78.4)	146 (21.6)
25-<30	1279 (49.7)	1294 (50.3)	684 (81.7)	153 (18.3)
30-<40	1360 (56.5)	1049 (43.5)	611 (84.9)	109 (15.1)
40+	312 (56.4)	241 (43.6)	209 (84.3)	39 (15.7)
Assistance required with daily activities				
No	3705 (52.8)	3316 (47.2)	1917 (85.2)	332 (14.8)
Yes	279 (46.1)	326 (53.9)	264 (57.6)	194 (42.4)
Any very severe comorbidities *				
No	3801 (53.1)	3354 (46.9)	1975 (83.7)	386 (16.3)
Yes	185 (39.2)	287 (60.8)	209 (59.7)	141 (40.3)

Please note that owing to the ongoing 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. * Please see Definitions on page 41. Patients receiving no respiratory support excluded due to small numbers.

Table 16   Outcome by receipt of renal support * and patient characteristics

Patient characteristic	Patients receiving any renal support * (N=2850)		Patients not receiving any renal support * (N=7844)	
	Discharged alive from critical care	Died in critical care	Discharged alive from critical care	Died in critical care
	n (%)	n (%)	n (%)	n (%)
Age at admission (years)				
16-39	90 (62.5)	54 (37.5)	643 (89.3)	77 (10.7)
40-49	256 (66.8)	127 (33.2)	874 (82.6)	184 (17.4)
50-59	409 (48.3)	438 (51.7)	1573 (74.1)	551 (25.9)
60-69	341 (35.7)	613 (64.3)	1347 (61.2)	854 (38.8)
70-79	126 (26.0)	359 (74.0)	659 (45.6)	785 (54.4)
80+	8 (25.8)	23 (74.2)	128 (43.5)	166 (56.5)
Sex				
Female	298 (45.4)	358 (54.6)	1780 (70.2)	757 (29.8)
Male	934 (42.6)	1258 (57.4)	3443 (64.9)	1859 (35.1)
Ethnicity *				
White	696 (43.0)	922 (57.0)	3476 (67.0)	1715 (33.0)
Mixed	23 (48.9)	24 (51.1)	86 (61.9)	53 (38.1)
Asian	183 (39.4)	282 (60.6)	737 (63.5)	424 (36.5)
Black	198 (48.1)	214 (51.9)	374 (65.6)	196 (34.4)
Other	89 (44.9)	109 (55.1)	362 (74.8)	122 (25.2)
Index of Multiple Deprivation (IMD) quintile				
1 (least deprived)	149 (45.7)	177 (54.3)	729 (67.3)	355 (32.7)
2	169 (42.6)	228 (57.4)	799 (67.5)	385 (32.5)
3	276 (48.8)	289 (51.2)	883 (65.2)	471 (34.8)
4	265 (41.3)	376 (58.7)	1156 (67.4)	558 (32.6)
5 (most deprived)	301 (43.9)	384 (56.1)	1298 (67.9)	613 (32.1)
Body mass index				
<25	265 (41.1)	379 (58.9)	1320 (65.5)	694 (34.5)
25-<30	369 (39.1)	575 (60.9)	1662 (65.5)	877 (34.5)
30-<40	462 (47.9)	503 (52.1)	1570 (70.5)	658 (29.5)
40+	110 (50.9)	106 (49.1)	425 (70.8)	175 (29.2)
Assistance required with daily activities				
No	1127 (43.3)	1476 (56.7)	4684 (68.3)	2179 (31.7)
Yes	97 (42.5)	131 (57.5)	496 (55.6)	396 (44.4)
Any very severe comorbidities *				
No	1099 (43.1)	1451 (56.9)	4874 (68.0)	2298 (32.0)
Yes	126 (44.8)	155 (55.2)	310 (52.7)	278 (47.3)

Please note that owing to the ongoing 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. * Please see Definitions on page 41. Includes 180 patients requiring chronic renal replacement therapy for end stage renal disease prior to critical care; outcomes for these patients are similar.

Characteristics of patients critically ill with confirmed COVID-19 receiving critical care for 28 days or more are summarised in * Please see Definitions on page 41.

Table 17 and Table 18.

Critical care unit outcomes among patients who have been discharged or died	Patients receiving critical care for 28 days or more (N=1908)
Outcome at end of critical care, n (%)	
Alive	1614 (84.6)
Dead	294 (15.4)
Duration of critical care	
Duration of critical care † (days), median (IQR)	
Survivors	40 (33, 51)
Non-survivors	34 (30, 43)
Organ support (Critical Care Minimum Dataset)*	
Receipt of organ support, at any point, n (%)	
Advanced respiratory support	1885 (98.9)
Basic respiratory support	1610 (84.5)
Advanced cardiovascular support	897 (47.1)
Basic cardiovascular support	1891 (99.2)
Renal support	912 (47.8)
Liver support	54 (2.8)
Neurological support	358 (18.8)
Duration of organ support (calendar days), median (IQR)	
Advanced respiratory support	33 (28, 42)
Total (advanced + basic) respiratory support	38 (31.5, 48)
Advanced cardiovascular support	4 (2, 9)
Total (advanced + basic) cardiovascular support	37 (31, 47)
Renal support	17 (9, 27)

* Please see Definitions on page 41.

Table 17   Patient characteristics: demographics for patients receiving critical care for a total of 28 days or more

Demographics	Patients receiving critical care for 28 days or more (N=1959)
Age at admission (years) [N=1955]	
Mean (SD)	56.7 (10.8)
Median (IQR)	58 (50, 64)
Sex, n (%) [N=1956]	
Female	509 (26.0)
Male	1447 (74.0)
Currently or recently pregnant, n (% of females) [N=133]	
Currently pregnant	4 (3.0)
Recently pregnant (within 6 weeks)	7 (5.3)
Not known to be pregnant	122 (91.7)
Ethnicity *, n (%) [N=1902]	
White	1108 (58.3)
Mixed	44 (2.3)
Asian	363 (19.1)
Black	214 (11.3)
Other	173 (9.1)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=1861]	
1 (least deprived)	236 (12.7)
2	279 (15.0)
3	398 (21.4)
4	470 (25.3)
5 (most deprived)	478 (25.7)
Body mass index *, n (%) [N=1905]	
<18.5	11 (0.6)
18.5-<25	476 (25.0)
25-<30	632 (33.2)
30-<40	658 (34.5)
40+	128 (6.7)

* Please see Definitions on page 41.

Table 18   Patient characteristics: medical history and indicators of acute severity for patients receiving critical care for a total of 28 days or more

Medical history	Patients receiving critical care for 28 days or more (N=1959)
Dependency prior to admission to acute hospital *, n (%) [N=1937]	
Able to live without assistance in daily activities	1815 (93.7)
Some assistance with daily activities	120 (6.2)
Total assistance with all daily activities	2 (0.1)
Very severe comorbidities *, n (%) [N=1941]	
Cardiovascular	4 (0.2)
Respiratory	14 (0.7)
Renal	24 (1.2)
Liver	2 (0.1)
Metastatic disease	6 (0.3)
Haematological malignancy	29 (1.5)
Immunocompromise	50 (2.6)
Prior hospital length of stay [N=1959]	
Mean (SD)	2.1 (4.4)
Median (IQR)	1 (0, 3)
CPR within previous 24h, n (%) [N=1956]	
In the community	3 (0.0)
In hospital	6 (0.1)
Indicator of acute severity	
Mechanically ventilated within first 24h *, n (%) [N=1942]	1454 (74.9)
APACHE II Score [N=1952]	
Mean (SD)	14.8 (4.8)
Median (IQR)	14 (12, 17.5)
PaO_2/FiO_2 ratio † (kPa), median (IQR) [N=1904]	14.9 (11.0, 20.2)
PaO_2/FiO_2 ratio †, n (%) [N=1904]	
≤ 13.3 kPa (≤ 100 mmHg)	769 (40.4)
> 13.3 and ≤ 26.7 kPa (> 100 and ≤ 200 mmHg)	951 (49.9)
> 26.7 kPa (> 200 mmHg)	184 (9.7)

* Please see Definitions on page 41. 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.

Critical care outcomes for patients critically ill with confirmed COVID-19 receiving critical care for 28 days or more are summarised in Table 19.

Table 19   **Outcome, duration of critical care and organ support for patients receiving critical care for a total of 28 days or more**

Critical care unit outcomes among patients who have been discharged or died	Patients receiving critical care for 28 days or more (N=1908)
Outcome at end of critical care, n (%)	
Alive	1614 (84.6)
Dead	294 (15.4)
Duration of critical care	
Duration of critical care † (days), median (IQR)	
Survivors	40 (33, 51)
Non-survivors	34 (30, 43)
Organ support (Critical Care Minimum Dataset)*	
Receipt of organ support, at any point, n (%)	
Advanced respiratory support	1885 (98.9)
Basic respiratory support	1610 (84.5)
Advanced cardiovascular support	897 (47.1)
Basic cardiovascular support	1891 (99.2)
Renal support	912 (47.8)
Liver support	54 (2.8)
Neurological support	358 (18.8)
Duration of organ support (calendar days), median (IQR)	
Advanced respiratory support	33 (28, 42)
Total (advanced + basic) respiratory support	38 (31.5, 48)
Advanced cardiovascular support	4 (2, 9)
Total (advanced + basic) cardiovascular support	37 (31, 47)
Renal support	17 (9, 27)

Please note that owing to the ongoing nature of the epidemic, the sample of patients with confirmed 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. * Please see Definitions on page 41. † Duration of critical care is from original admission to critical care until final unit outcome and includes any time spent outside critical care areas (e.g. prior to any readmissions).

Multivariable analyses

Patient population:
- A multivariable Cox proportional hazards regression model was developed based solely on available data from patients critically ill with confirmed COVID-19 with a start of critical care between 1 March and 21 April 2020, locked on 4 June 2020.
- All patients were followed up for a minimum of 7 days, and outcomes were censored at 30 days following the start of critical care. Patients discharged alive from hospital within 30 days, and those ending critical care within 30 days with missing hospital outcome were assumed to survive to 30 days.
- Patients either with a duration of critical care of less than 24 hours or with no data recorded for any core physiology (temperature, systolic blood pressure, heart rate or respiratory rate) were excluded.

Prognostic factors:
- Prognostic factors were selected, a priori, based on established relationships with outcome for critically ill patients and on emerging information from the COVID-19 pandemic.
- Continuous prognostic factors were assessed for non-linearity using restricted cubic splines with up to five knots.
- Missing data were imputed using fully conditional specification (with models fitted in ten multiply imputed datasets and results combined).

Results:
- Of 6989 patients, 58 had a duration of critical care of less than 24 hours and 595 had no data recorded for any core physiology; a cohort of 6336 patients were included in the model.
- The results of the multivariable modelling are presented in Figures 20-22.

Explanation:
- The figures present the hazard ratio (solid lines or points) for values of each prognostic factor compared with a reference value (as indicated).
- A hazard ratio is a measure of how much more or less likely the event (death) is to occur.

For example, a patient aged 70 has a hazard ratio of approximately 2 compared with a patient aged 60; this means that they are twice as likely to die within 30 days of the start of critical care. In contrast, a patient aged 40 has a hazard ratio of approximately 0.5 compared with a patient aged 60; this means that they are half as likely to die within 30 days of the start of critical care. A hazard ratio of 1 means that the risk of death is the same.

- The hazard ratios indicate the association between each prognostic factor and the outcome adjusted for the effect of all the other variables in the model.

For example, the hazard ratio for dependency is adjusted for patients with dependency being older on average than those without dependency.

- The estimated hazard ratios are shown with 95% confidence intervals (as dashed lines or vertical spikes) indicating a range of possible values for the hazard ratio that will include the true value 19 times out of 20.

A manuscript reporting the full details of the modelling has been submitted for publication.
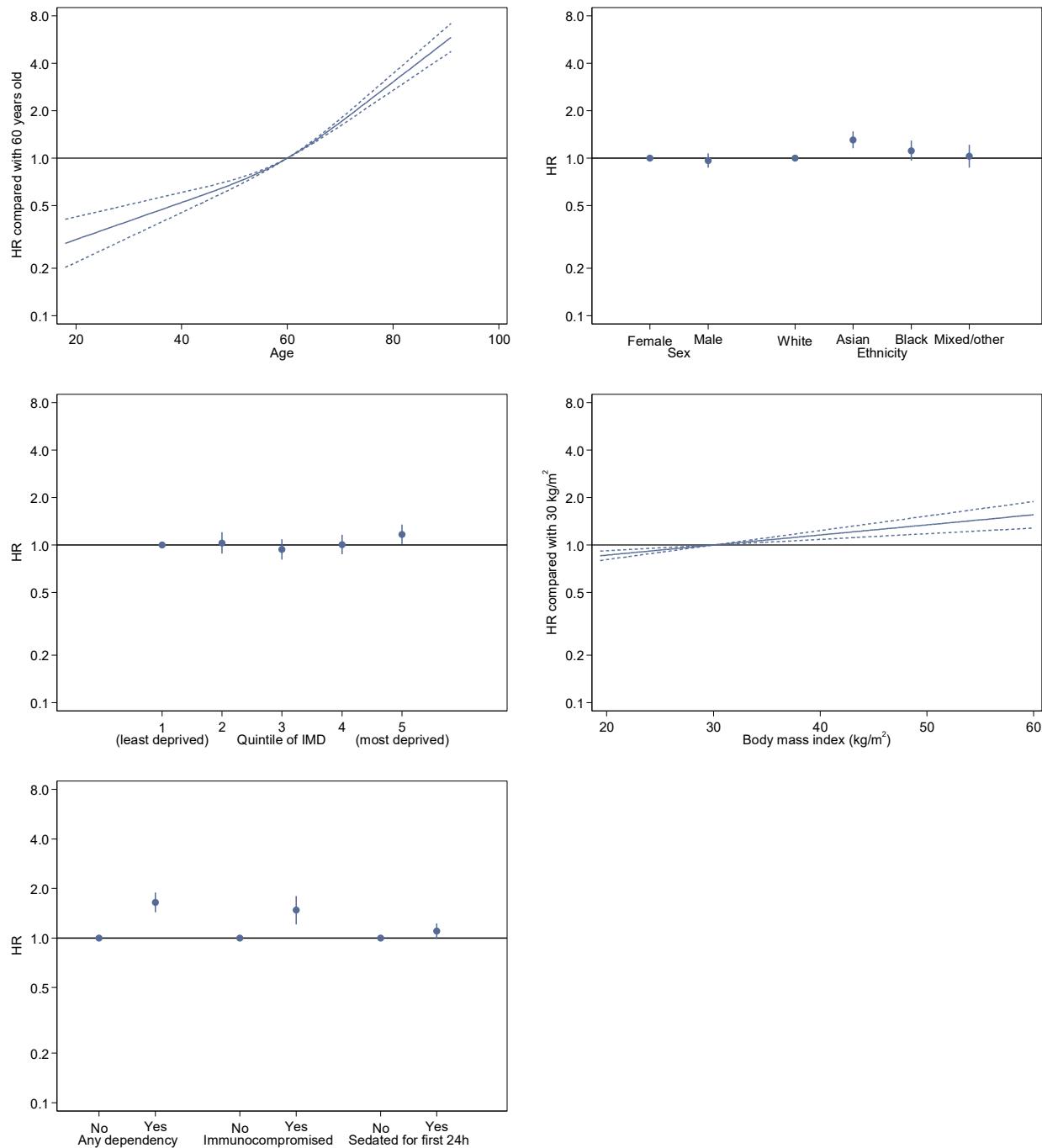
Figure 20   Hazard ratios and 95% confidence intervals from Cox proportional hazards regression model for death within 30 days following start of critical care: demographics and medical history

Please note that hazard ratios (HR) are reported relative to the median value for age (60 years) and the threshold for defining obesity for body mass index (30 kg/m^2). Immunocompromised includes the conditions as defined on page 41 and also metastatic disease and haematological malignancy.
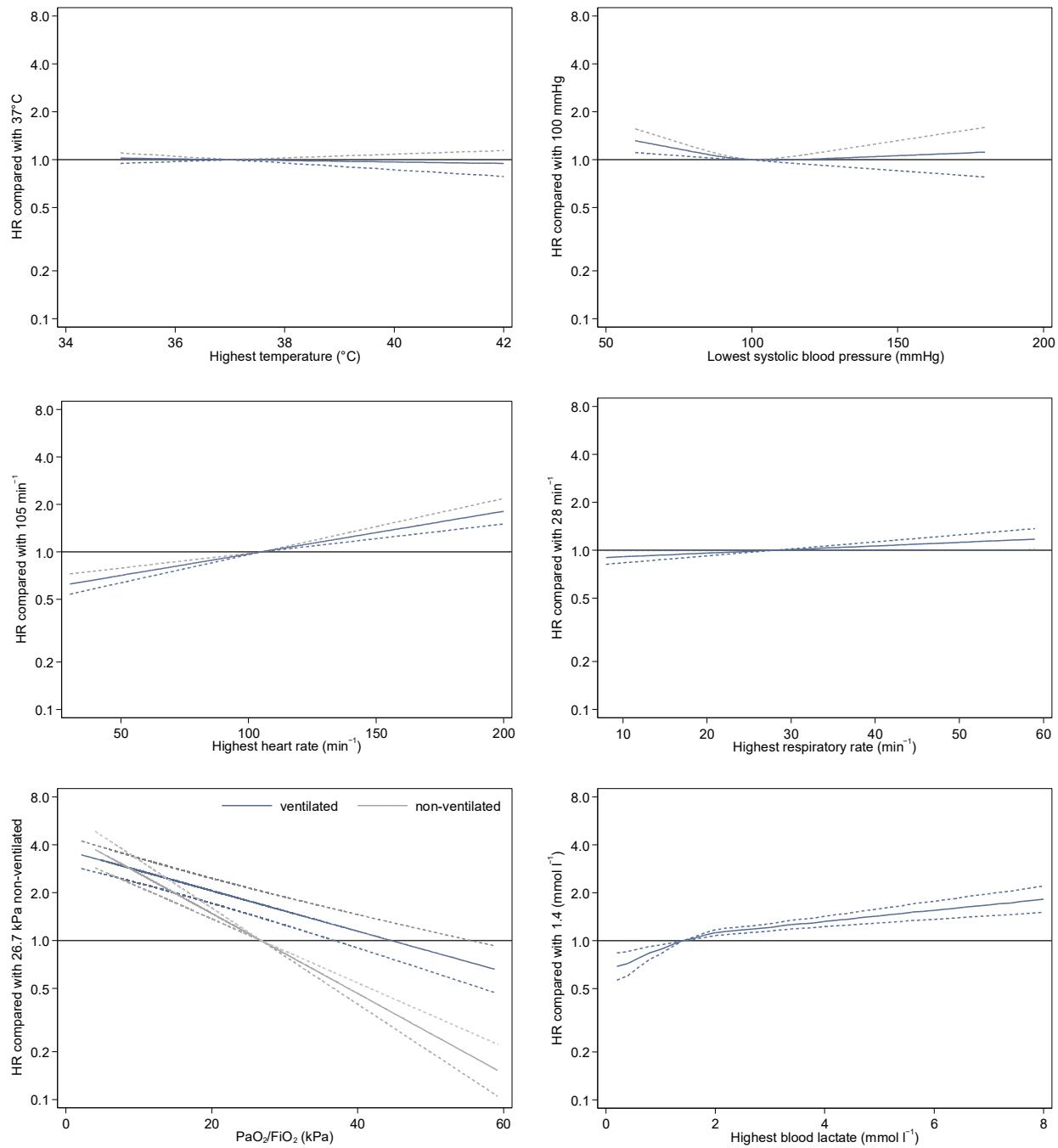
Figure 21 Hazard ratios and 95% confidence intervals from Cox proportional hazards regression model for death within 30 days following start of critical care: physiology (1)

Please note that hazard ratios (HR) are reported relative to the median value for each physiological parameter (as indicated on the y-axis) except for PaO_2/FiO_2 which is reported relative to the threshold for defining ARDS (26.7 kPa).
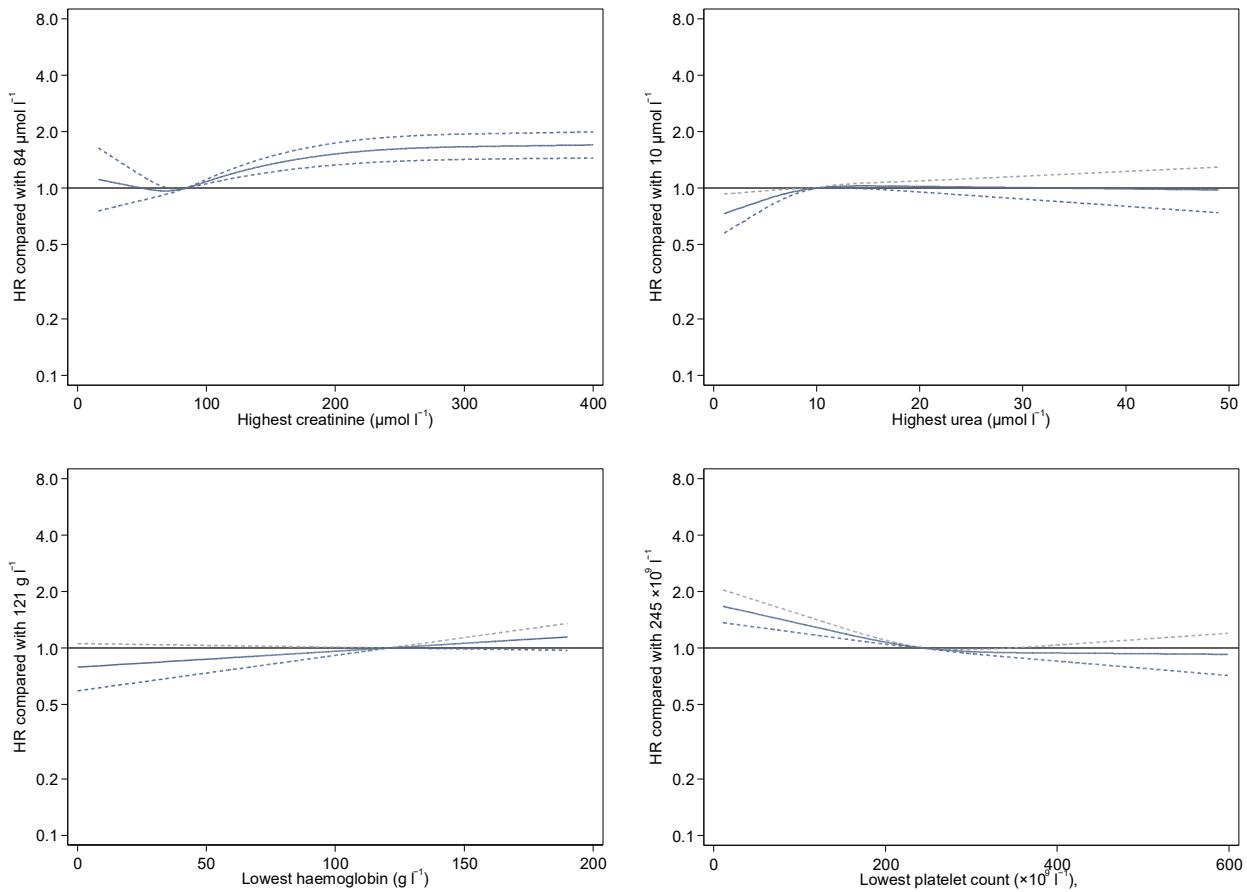
Figure 22   Hazard ratios and 95% confidence intervals from Cox proportional hazards regression model for death within 30 days following start of critical care: physiology (2)

Please note that hazard ratios (HR) are reported relative to the median value for each physiological parameter (as indicated on the y-axis).

Data completeness

Completeness of key variables is summarised in Table 20.

Table 20   Data completeness of key variables

Variable	N missing %
24h variables (N=10834)	
NHS number (used to combine transfers and readmissions)	196 (1.8)
Age	1 (0.0)
Sex	7 (0.1)
Currently or recently pregnant	2 (0.3) †
Ethnicity *	416 (3.8)
Index of Multiple Deprivation	846 (7.8)
BMI	552 (5.1)
Prior dependency *	120 (1.1)
Very severe comorbidities *	112 (1.0)
Prior hospital length of stay	3 (0.0)
CPR within previous 24h	16 (0.1)
Mechanical ventilation during the first 24h *	168 (1.6)
APACHE II Score	79 (0.7)
PaO2/FiO2 ratio	654 (6.0)
Outcome variables (N=10704)	
Length of stay in critical care	65 (0.6)
Advanced respiratory support *	9 (0.1)
Basic respiratory support *	10 (0.1)
Advanced cardiovascular support *	9 (0.1)
Basic cardiovascular support *	9 (0.1)
Renal support *	10 (0.1)
Liver support *	10 (0.1)
Neurological support *	10 (0.1)

* Please see Definitions on page 41; † % of female patients aged 16-49 years

Definitions

Patients are classified as either:

- Notification only received: 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 only received: 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
- 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)
- Hospital outcome data received: Data have been updated with outcomes at ultimate discharge from hospital

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

Acknowledgement