

ICNARC report on COVID-19 in critical care: England, Wales and Northern Ireland 17 September 2021

This report presents analyses of data on patients critically ill with confirmed COVID-19, reported to ICNARC up to 23:59 on 16 September 2021, 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) and increasing numbers of surge/other areas providing critical care.

Data are reported separately for patients critically ill with confirmed COVID-19 either at or after the admission to critical care:

- admitted from 1 May 2021 to date; and
- admitted from 1 September 2020 to 30 April 2021.

For additional reporting on patients admitted up to 31 August 2020, please see the report dated 5 July 2021 available from <https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports>.

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/areas participating in the Case Mix Programme are asked to:

- log a case with ICNARC by submitting a record, with minimal 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.

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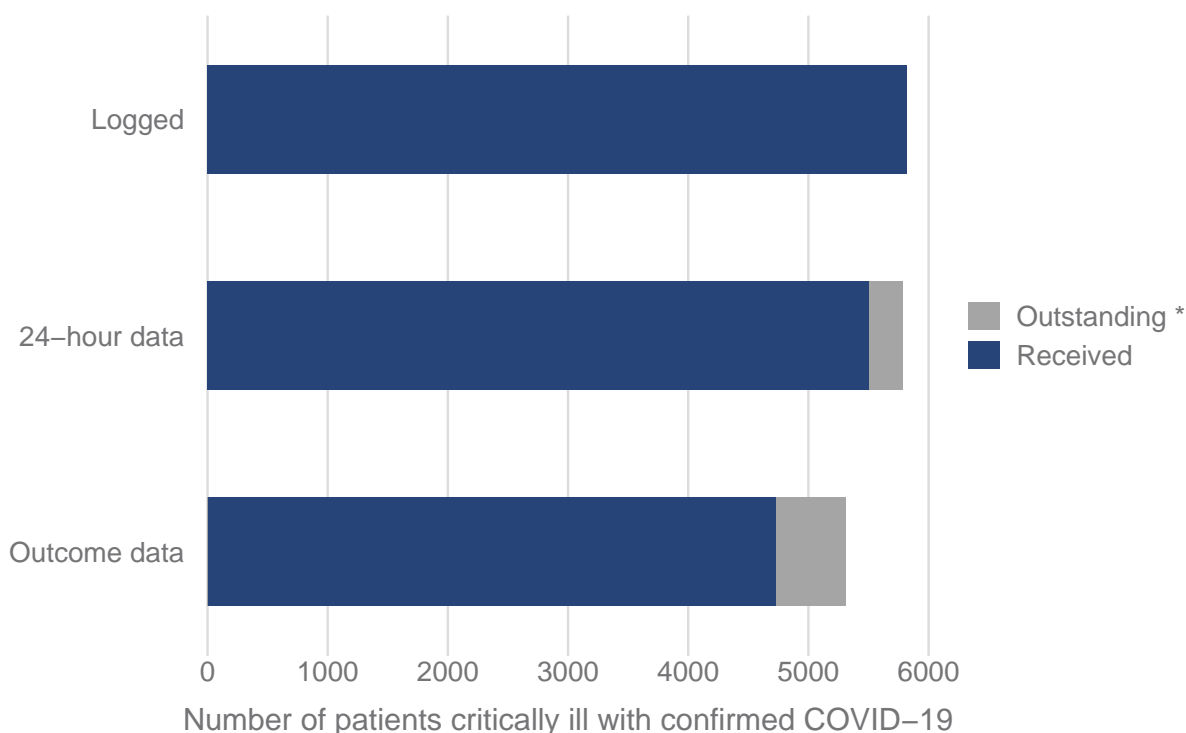
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Admissions to critical care – COVID-19

ICNARC have logged data for 6609 admissions of 5817 patients critically ill with confirmed COVID-19, either at or after admission to critical care, admitted from 1 May 2021 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 5505 patients (Figure 1). Of the 5817 total patients, 4726 have outcomes reported and 1091 patients were last reported as still receiving critical care. These patients are compared with a cohort of 25,847 patients with confirmed COVID-19 admitted from 1 September 2020 to 30 April 2021.



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

Numbers of critically ill patients with confirmed COVID-19 admitted from 1 May 2021 to date 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 admission to critical care.

The geographical distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date by NHS region is shown in Figure 2 and compared with those admitted from 1 September 2020 to 30 April 2021. Of the patients included in this week's report, 729 patients were admitted to critical care within the past 14 days (3 September 2021 to 16 September 2021). The geographical spread of these patients is shown in Figure 3.

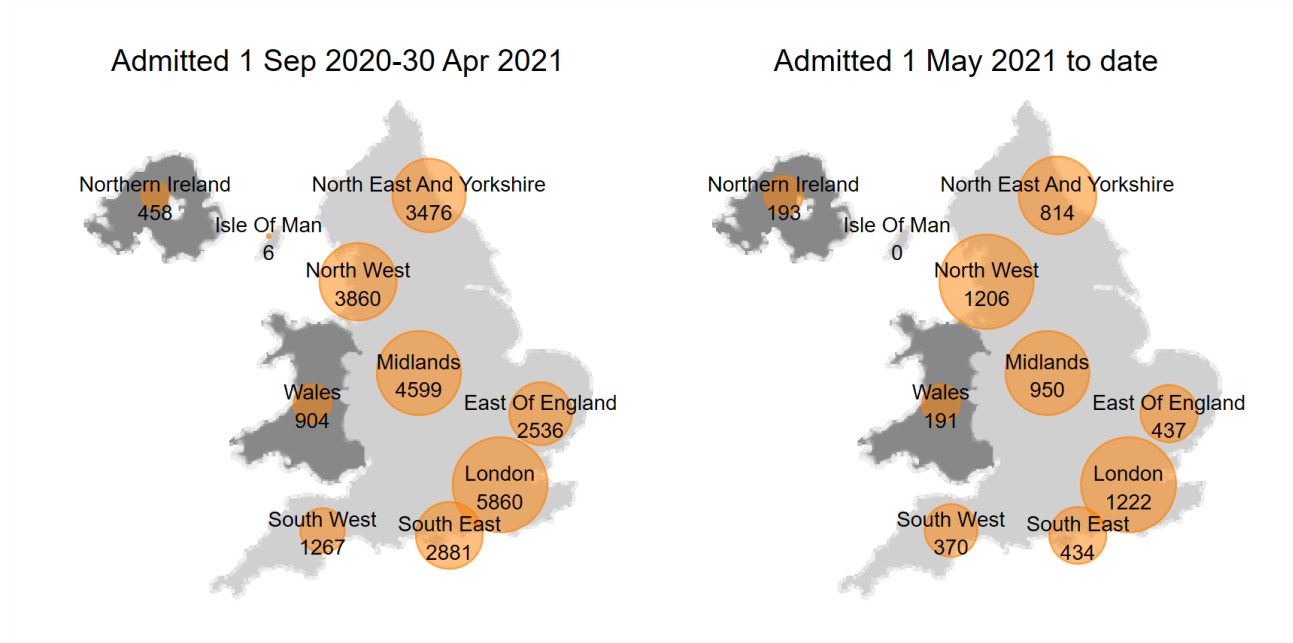


Figure 2. Geographical distribution

Geographical distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date compared with those admitted from 1 September 2020 to 30 April 2021 by NHS region.

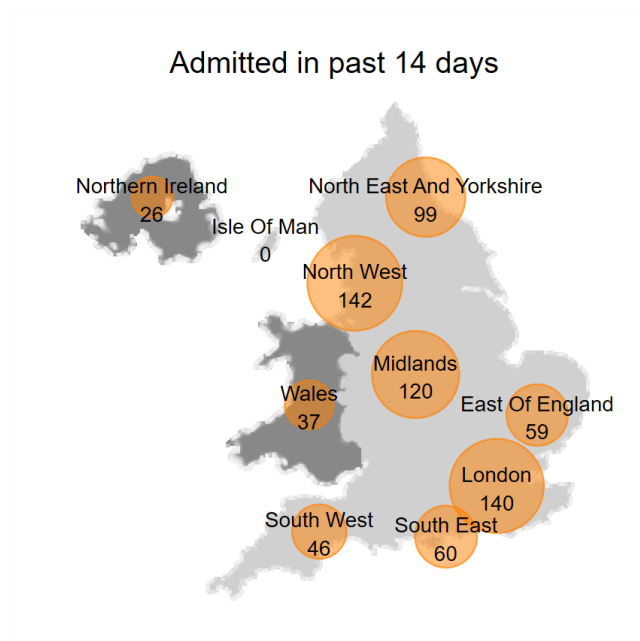
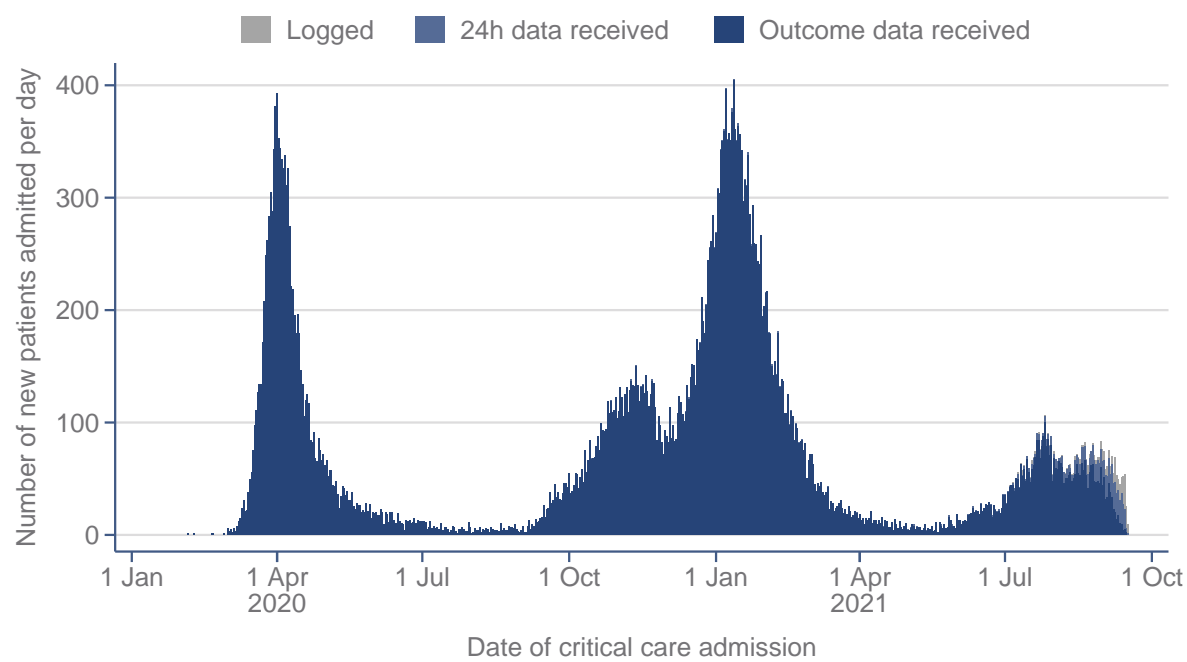


Figure 3. Geographical distribution – past 14 days

Geographical distribution of patients critically ill with confirmed COVID-19 admitted during the past 14 days by NHS region.

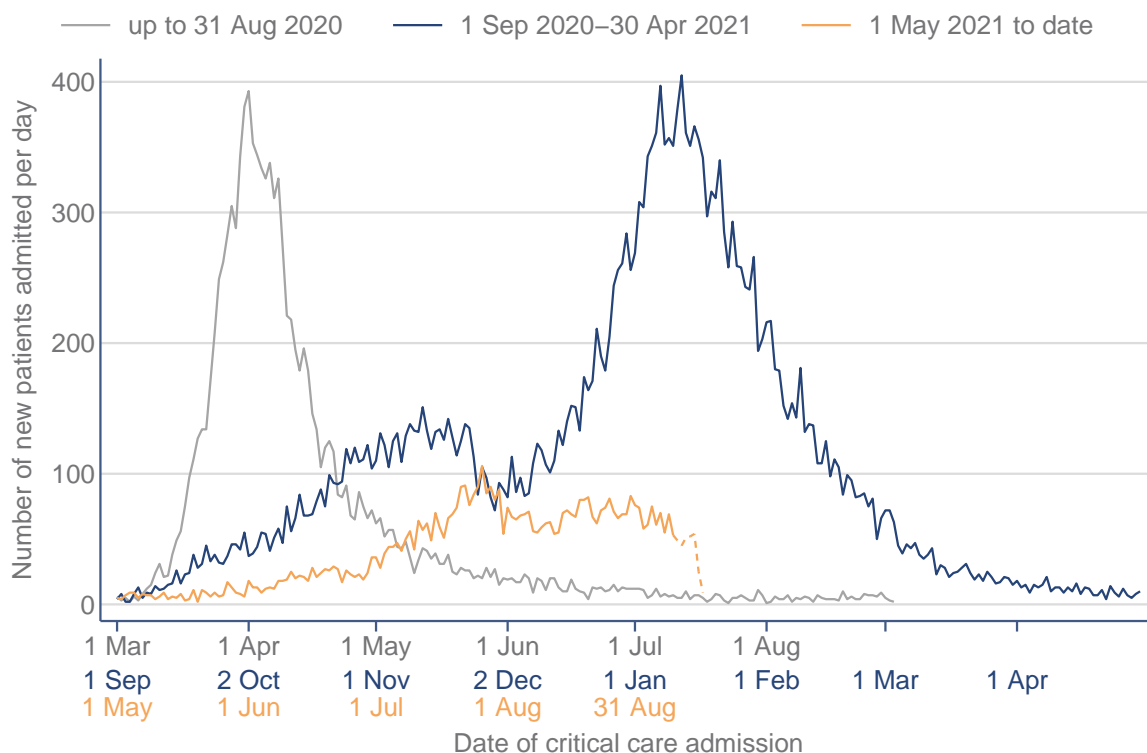
The numbers of new patients, cumulative numbers of patients and numbers of patients in critical care by date are shown in Figures 4-13. Please note that these figures are affected by a variable lag time for submission of data.



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Figure 4. Number of new patients by date of admission to critical care

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

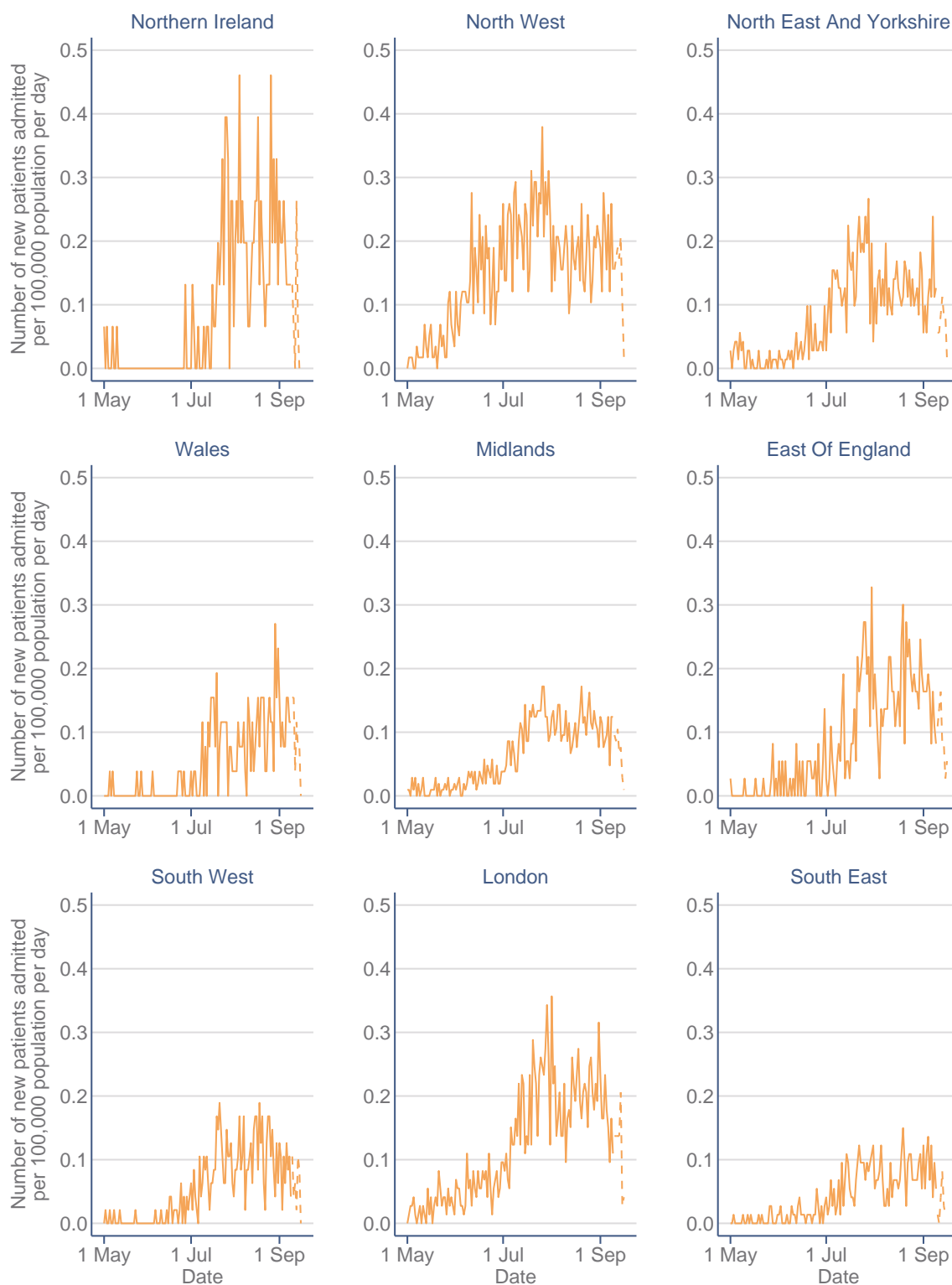


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Figure 5. Number of new patients admitted by time period *

Comparison of the number of new patients critically ill with confirmed COVID-19 by date of admission to critical care from 1 May 2021 to date compared with 1 September 2020 to 30 April 2021 and 1 March 2020 to 31 August 2020.

* Dashed line indicates lag in data submission.

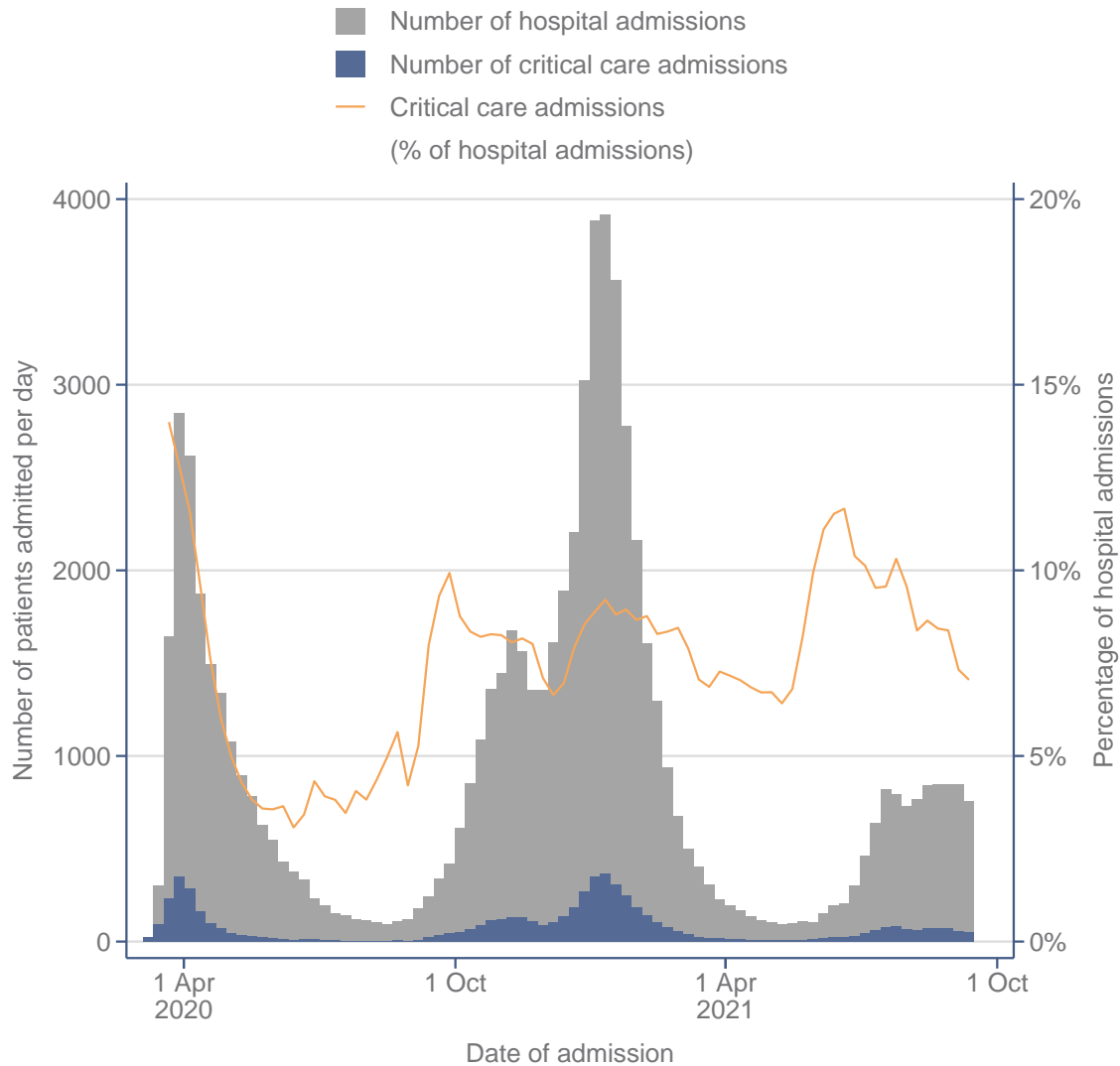


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Figure 6. Number of new patients admitted from 1 May 2021 to date by region *

Number of new patients critically ill with confirmed COVID-19 by date of admission to critical care from 1 May 2021 to date by region.

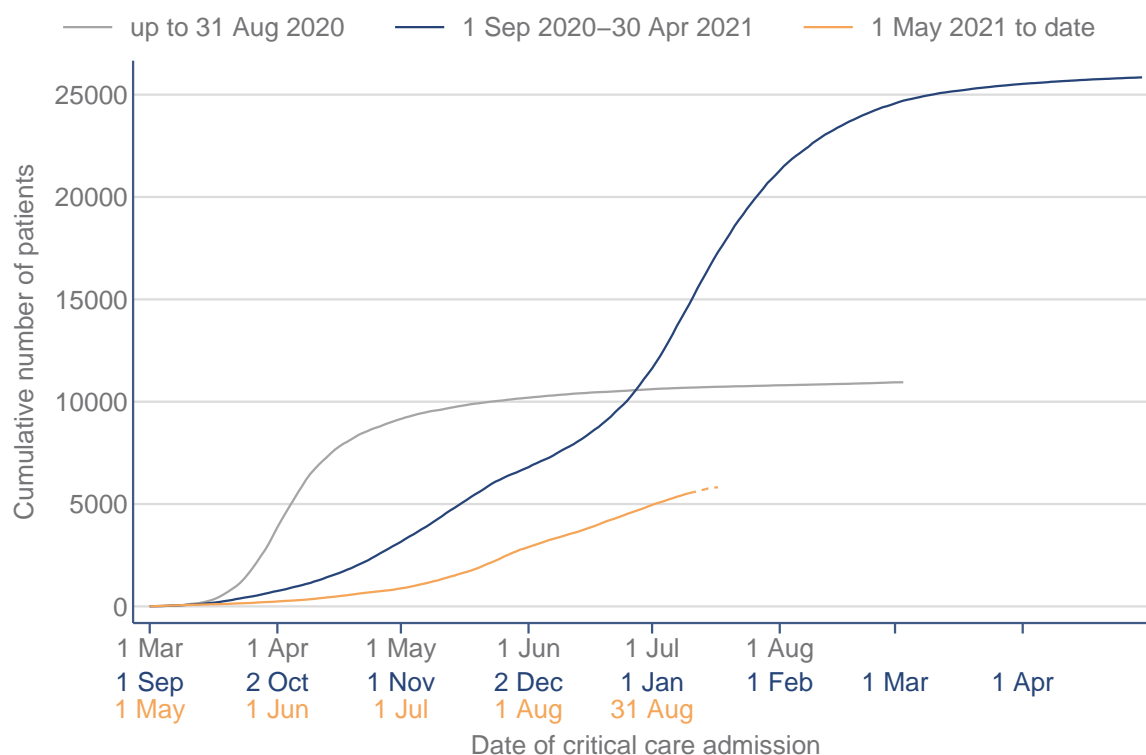
* Dashed line indicates lag in data submission.



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Figure 7. Number of new patients admitted to critical care compared with hospital admissions

Comparison of the number of new patients critically ill with confirmed COVID-19 by date of admission to critical care versus the total number of hospital admissions (source: <https://coronavirus.data.gov.uk/details/healthcare>).

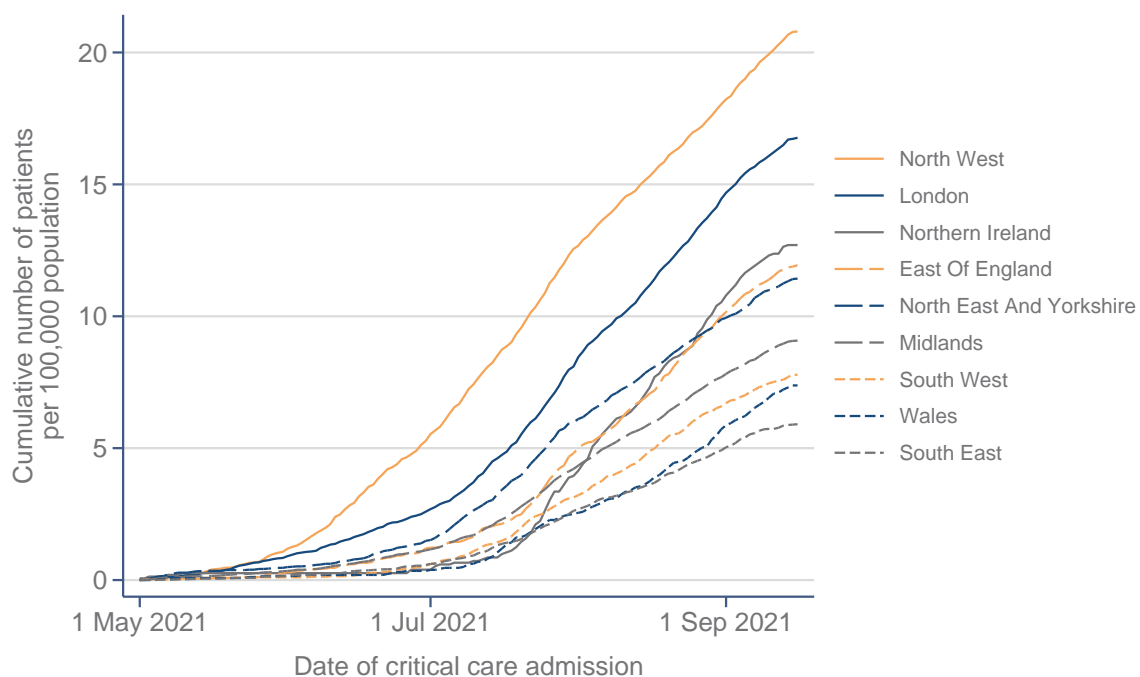


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Figure 8. Cumulative number of patients by time period *

Comparison of the cumulative number of patients critically ill with confirmed COVID-19 by date of admission to critical care from 1 May 2021 to date compared with 1 September 2020 to 30 April 2021 and 1 March 2020 to 31 August 2020.

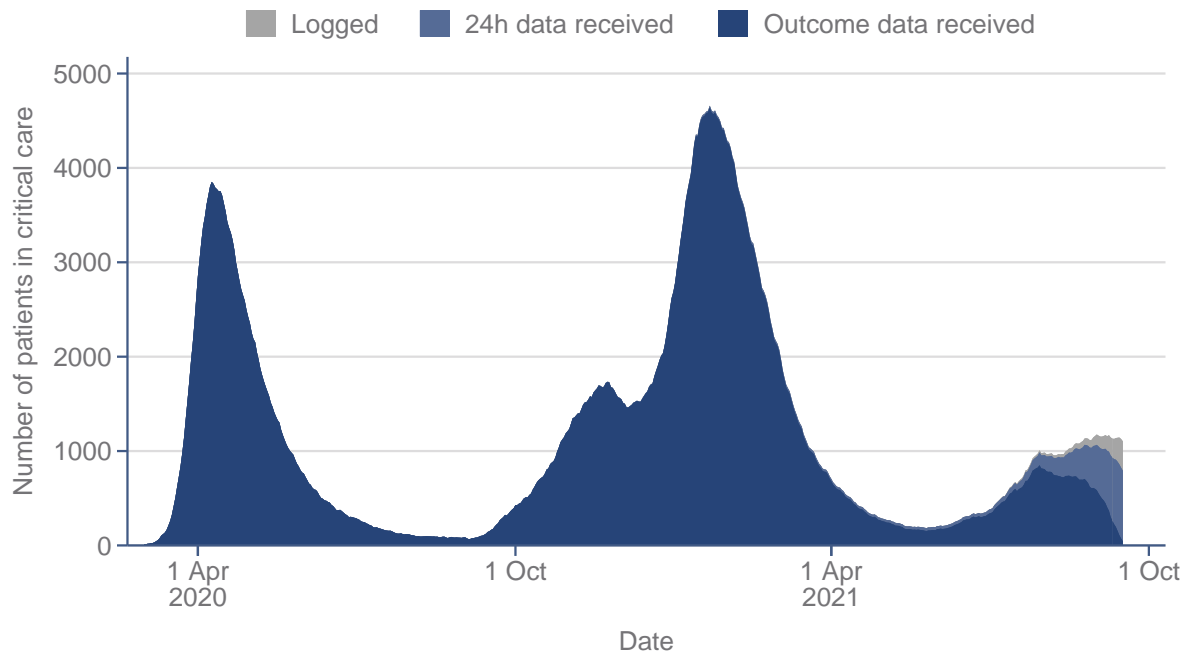
* Dashed line indicates lag in data submission.



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Figure 9. Cumulative number of patients per 100,000 adult population by region

Cumulative number of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date per 100,000 adult population by region.

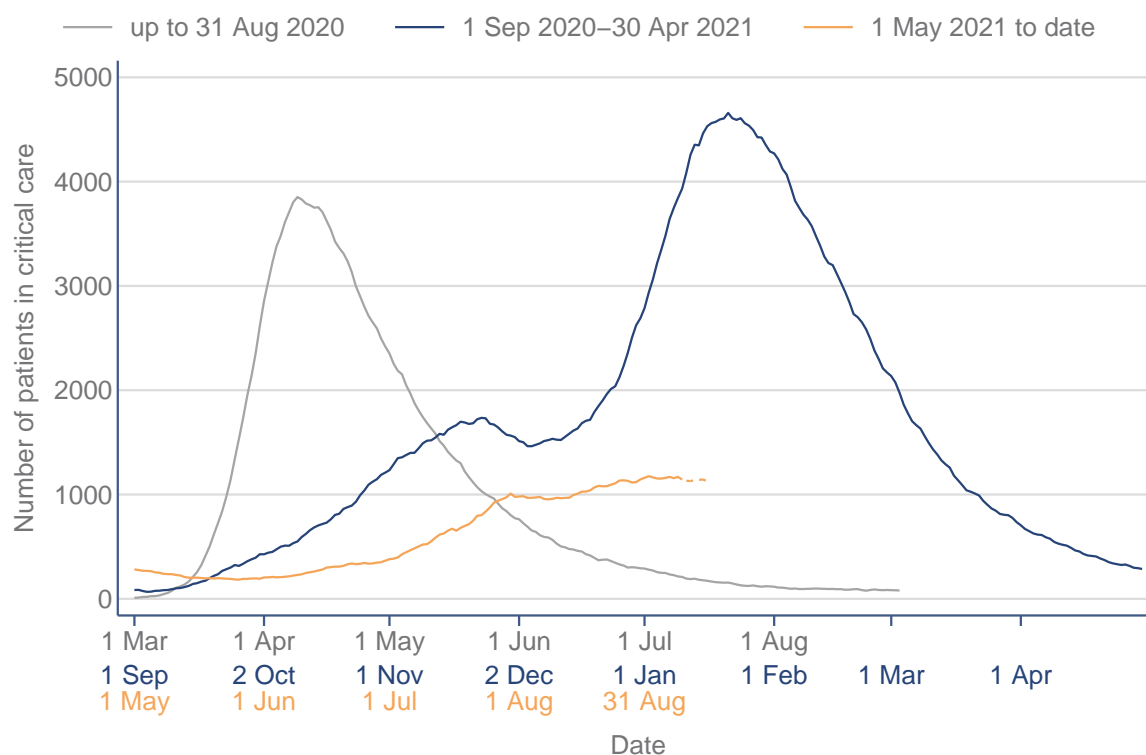


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Figure 10. Number of patients in critical care *

Number of patients with confirmed COVID-19 in critical care * by date over the entire epidemic.

* Please note patients whose outcome data have not been received are assumed to remain in critical care as of 16 September 2021.



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Figure 11. Number of patients in critical care * by time period

Number of patients with confirmed COVID-19 in critical care * by date from 1 May 2021 to date compared with 1 September 2020 to 30 April 2021 and 1 March 2020 to 31 August 2020.

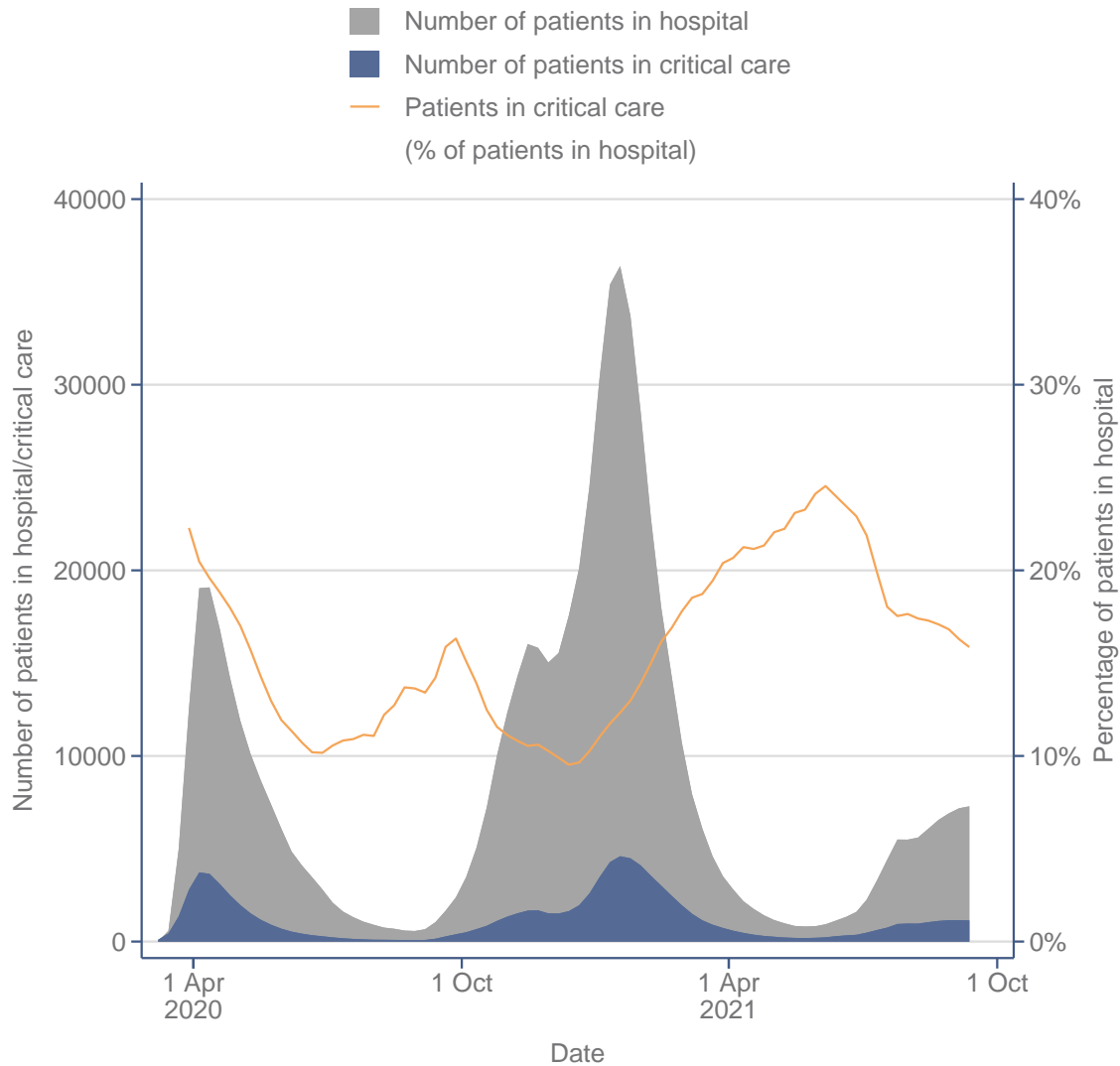
* Please note patients whose outcome data have not been received are assumed to remain in critical care as of 16 September 2021. Dashed line indicates lag in data submission.



Figure 12. Number of patients in critical care * from 1 May 2021 to date by region

Number of patients with confirmed COVID-19 in critical care * by date from 1 May 2021 to date by region.

* Please note patients whose outcome data have not been received are assumed to remain in critical care as of 16 September 2021. Dashed line indicates lag in data submission.



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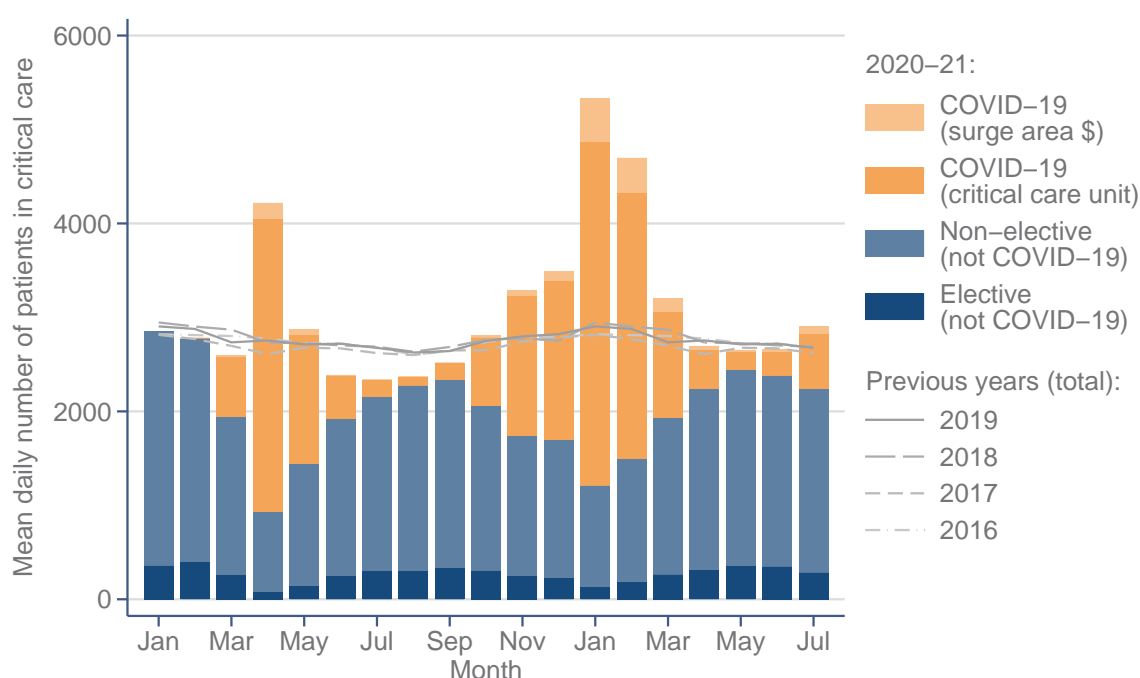
Figure 13. Number of patients in critical care compared with number in hospital

Comparison of the number of patients with confirmed COVID-19 in critical care by date * versus the total number in hospital (source: <https://coronavirus.data.gov.uk/details/healthcare>).

* Please note patients whose outcome data have not been received are assumed to remain in critical care as of 16 September 2021.

Admissions to critical care – COVID-19 and non-COVID-19

Figure 14 shows the average daily number of patients in critical care for each month over the past five years. For 2020-21, this is broken down into the numbers of: elective admissions (not COVID-19) – those admitted directly following elective or scheduled surgery or for a planned medical procedure; non-elective admissions (not COVID-19); confirmed COVID-19 admitted to a critical care unit; and confirmed COVID-19 managed in a surge area outside of an established critical care unit.



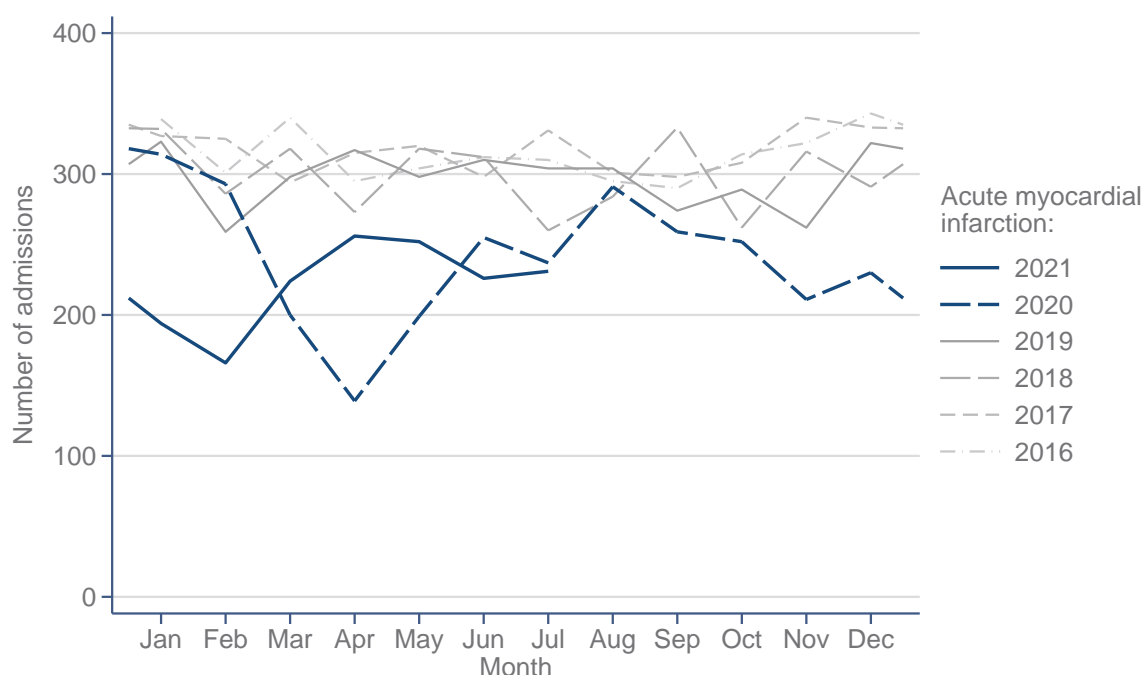
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Figure 14. Average daily number of patients in critical care by month, 2016-2021 *

* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.

\$ Not all surge patients are identifiable from critical care unit data and not all surge areas are covered.

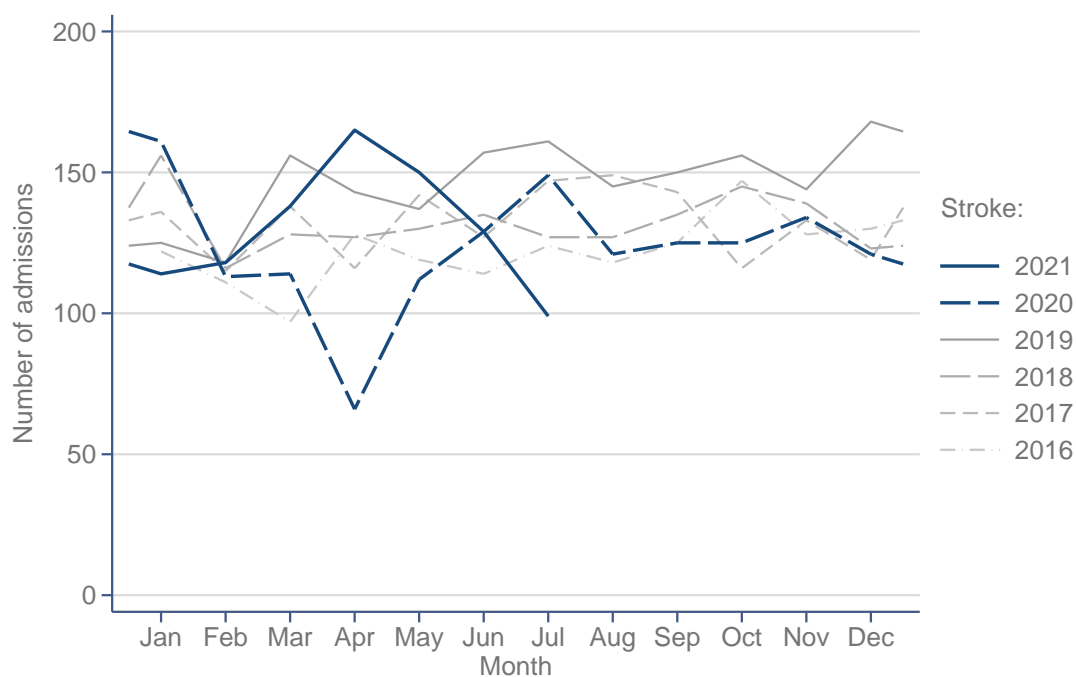
The numbers of admissions with acute myocardial infarction, stroke, trauma and self-harm (with drugs or other substances) recorded as primary or secondary reason for admission to critical care (with or without recording of COVID-19 as the other reason for admission) are shown in Figures 15 to 18.



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Figure 15. Number of admissions with acute myocardial infarction by month, 2016-2021 *

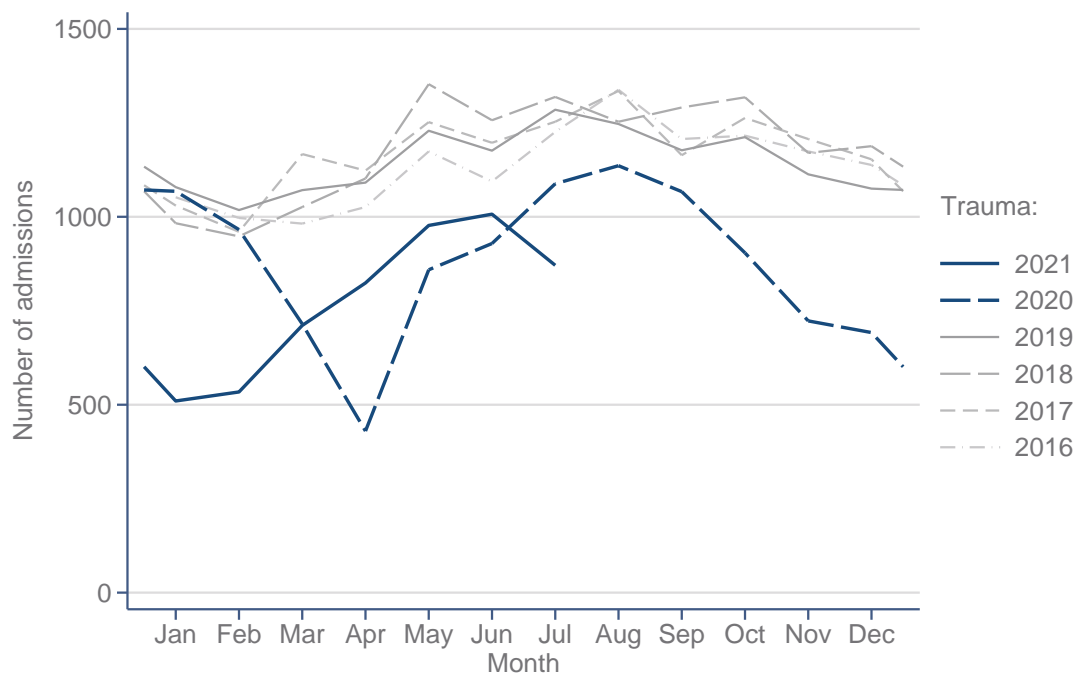
* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.



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Figure 16. Number of admissions with stroke by month, 2016-2021 *

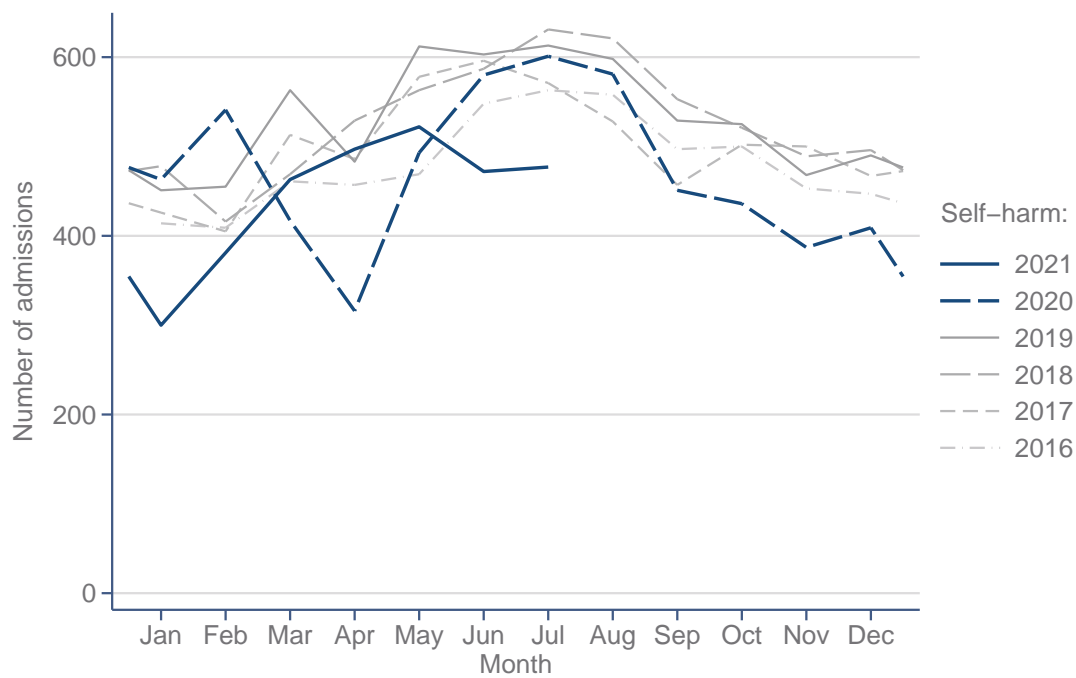
* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.



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Figure 17. Number of admissions with trauma by month, 2016-2021 *

* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.



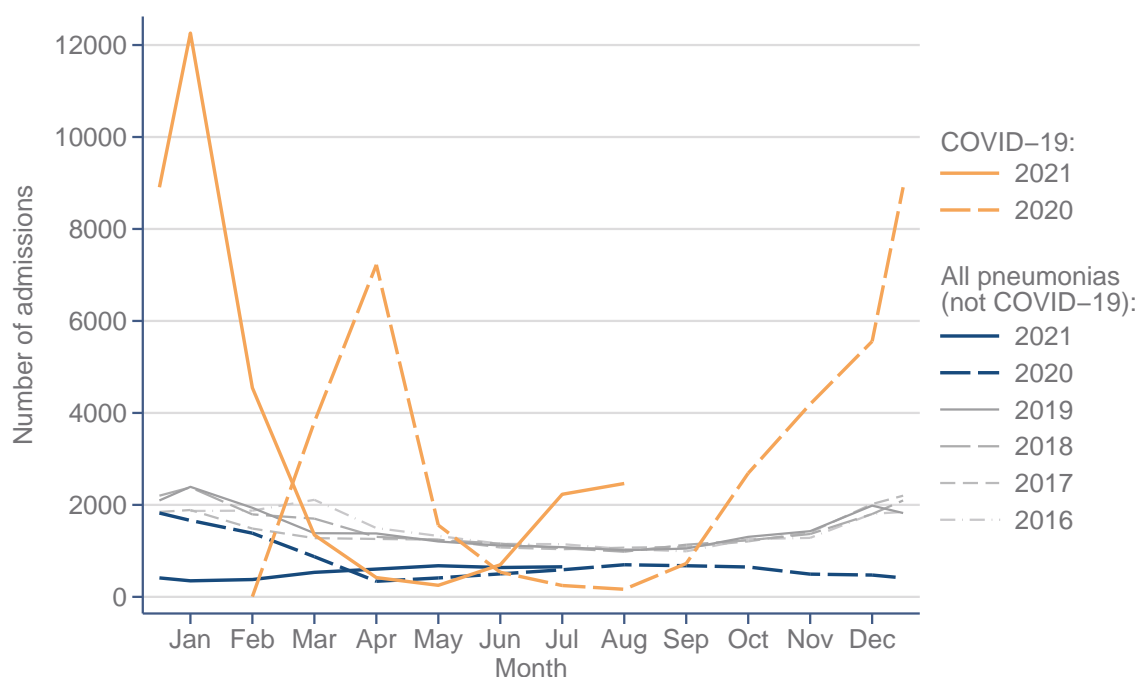
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Figure 18. Number of admissions with self-harm (drugs or other substances) by month, 2016-2021 *

* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.

Admissions to critical care – pneumonia (not COVID-19)

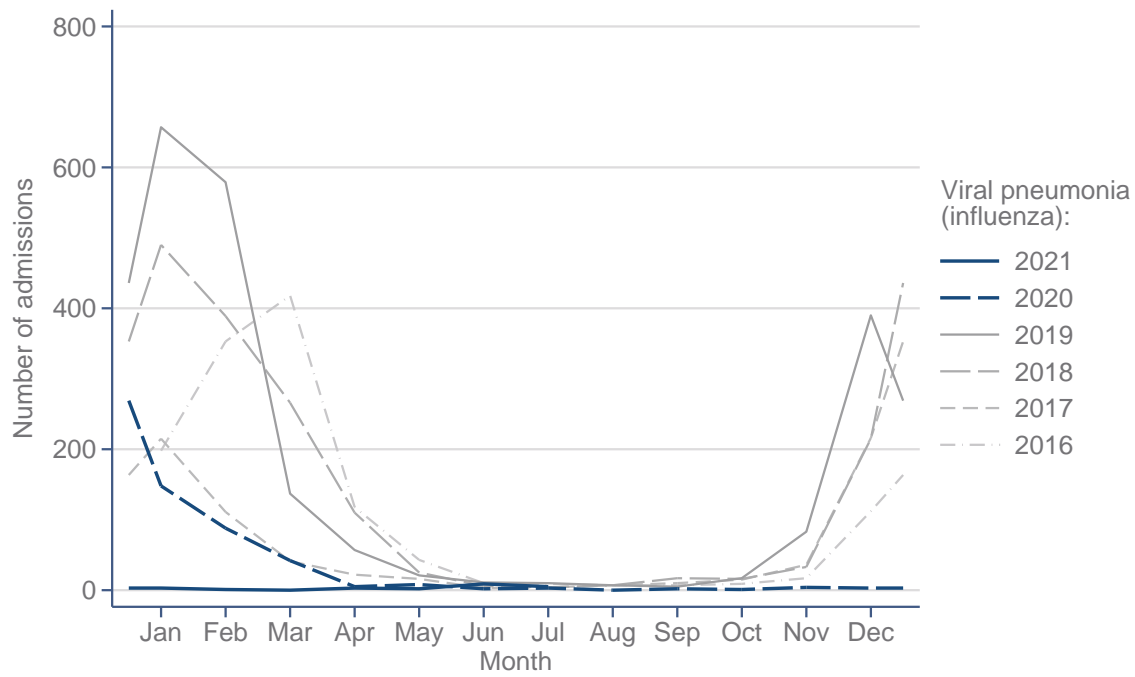
Figure 19 shows the total numbers of admissions to critical care over the past five years by month of admission reported as due to pneumonia (not COVID-19), compared with the numbers with confirmed COVID-19. Figure 20 shows the number of these pneumonia admissions that were specifically coded as due to influenza. Note that not all admissions due to influenza will be coded as viral pneumonia (influenza) as if the organism has not yet been identified, then these will likely be coded under pneumonia (no organism isolated).



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Figure 19. Number of admissions with pneumonia (not COVID-19) by month, 2016-2021 *, compared with confirmed COVID-19 during 2020

* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.



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Figure 20. Number of admissions with viral pneumonia (influenza) by month, 2016-2021 *

* Please note that data for patients without COVID-19 are submitted by participating critical care units either monthly or quarterly. Values have been adjusted for coverage.

Patient characteristics

Characteristics of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date are summarised in Tables 1-3 and compared with those admitted from 1 September 2020 to 30 April 2021.

Table 1. Patient characteristics: demographics

Demographics	Patients with confirmed COVID-19	
	Admitted 1 May 2021 to date (N=5817)	Admitted 1 Sep 2020-30 Apr 2021 (N=25,847)
Age at admission (years) [N=5813]		
Mean (SD)	51.7 (15.9)	59.2 (13.3)
Median (IQR)	52 (40, 64)	60 (51, 69)
Sex, n (%) [N=5814]		
Female	2339 (40.2)	8846 (34.2)
Male	3475 (59.8)	16988 (65.8)
Ethnicity, n (%) [N=5380]		
White	3675 (68.3)	17648 (71.8)
Mixed	112 (2.1)	365 (1.5)
Asian	740 (13.8)	3969 (16.1)
Black	526 (9.8)	1319 (5.4)
Other	327 (6.1)	1293 (5.3)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=5689]		
1 (least deprived)	534 (9.4)	3137 (12.3)
2	733 (12.9)	3909 (15.3)
3	951 (16.7)	4791 (18.7)
4	1440 (25.3)	6198 (24.2)
5 (most deprived)	2031 (35.7)	7544 (29.5)
Urban/rural classification *, n (%) [N=5563]		
Major conurbation	2790 (50.2)	11352 (44.9)
Minor conurbation	259 (4.7)	948 (3.8)
City and town	1999 (35.9)	10157 (40.2)
Rural	508 (9.1)	2805 (11.1)

* Please see Definitions on page 65.

Table 2. Patient characteristics: medical history

Medical history	Patients with confirmed COVID-19	
	Admitted 1 May 2021 to date (N=5817)	Admitted 1 Sep 2020-30 Apr 2021 (N=25,847)
Dependency prior to admission to acute hospital, n (%) [N=5386]		
Able to live without assistance in daily activities	4901 (91.0)	22431 (87.8)
Some assistance with daily activities	466 (8.7)	3041 (11.9)
Total assistance with all daily activities	19 (0.4)	72 (0.3)
Very severe comorbidities *, n (%) [N=5438]		
Cardiovascular	21 (0.4)	170 (0.7)
Respiratory	72 (1.3)	246 (1.0)
Renal	95 (1.7)	419 (1.6)
Liver	27 (0.5)	169 (0.7)
Metastatic disease	28 (0.5)	172 (0.7)
Haematological malignancy	129 (2.4)	436 (1.7)
Immunocompromised	251 (4.6)	915 (3.6)
Body mass index *, n (%) [N=5136]		
<18.5	56 (1.1)	181 (0.7)
18.5-<25	935 (18.2)	4702 (19.5)
25-<30	1573 (30.6)	7486 (31.0)
30-<40	1887 (36.7)	8930 (37.0)
≥40	685 (13.3)	2841 (11.8)
CPR within previous 24h, n (%) [N=5522]		
In the community	36 (0.7)	160 (0.6)
In hospital	33 (0.6)	268 (1.0)
Prior hospital length of stay [N=5790]		
Mean (SD)	2.3 (10.8)	3.2 (6.8)
Median (IQR)	1 (0, 3)	1 (0, 4)
Currently or recently pregnant, n (% of females aged 16-49) [N=1091]		
Currently pregnant	192 (17.6)	169 (7.4)
Recently pregnant (within 6 weeks)	143 (13.1)	150 (6.6)
Not known to be pregnant	756 (69.3)	1970 (86.1)

* Please see Definitions on page 65.

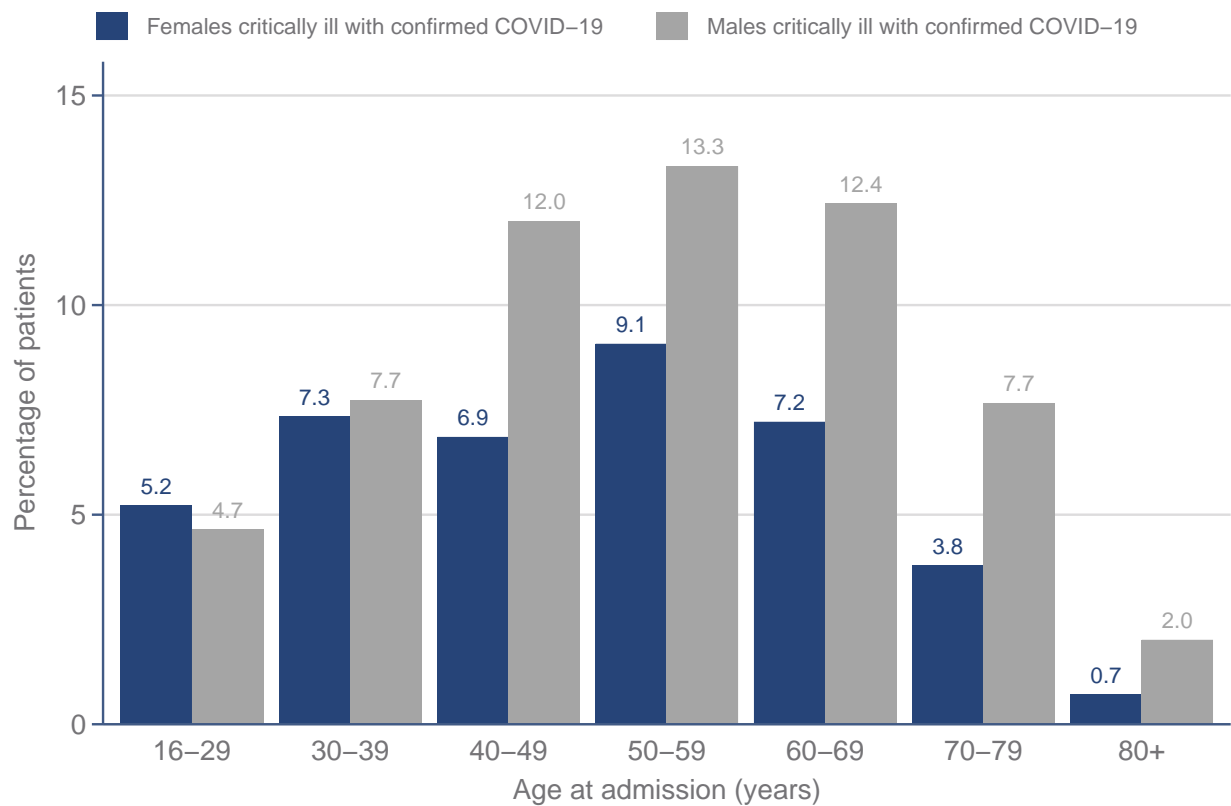
Table 3. Patient characteristics: indicators of acute severity

Indicators of acute severity	Patients with confirmed COVID-19 and 24h data received	
	Admitted 1 May 2021 to date (N=5505)	Admitted 1 Sep 2020-30 Apr 2021 (N=25,847)
Invasively ventilated within first 24h *, n (%) [N=5177]	1107 (21.4)	7863 (30.6)
APACHE II Score [N=5308]		
Mean (SD)	13.2 (5.3)	14.4 (5.2)
Median (IQR)	13 (10, 16)	14 (11, 17)
PaO ₂ /FiO ₂ ratio † (kPa), median (IQR) [N=4874]	13.6 (10.0, 19.0)	13.0 (9.6, 18.2)
PaO ₂ /FiO ₂ ratio †, n (%) [N=4874]		
< 13.3 kPa (< 100 mmHg)	2335 (47.9)	12323 (51.8)
13.3-26.6 kPa (100-200 mmHg)	2022 (41.5)	9134 (38.4)
≥ 26.7 kPa (≥ 200 mmHg)	517 (10.6)	2335 (9.8)
FiO ₂ †, median (IQR) [N=4883]	0.60 (0.43, 0.75)	0.60 (0.45, 0.80)

* Please see Definitions on page 65. 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 PaO₂ during the first 24 hours of critical care.

The distribution of age and sex for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date is presented in Figure 21.



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Figure 21. Age and sex distribution

Age and sex distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date.

The distribution of ethnicity for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date, compared with a local population matched on 2011 census ward for residence of patients critically ill with COVID-19, is presented in Figure 22.

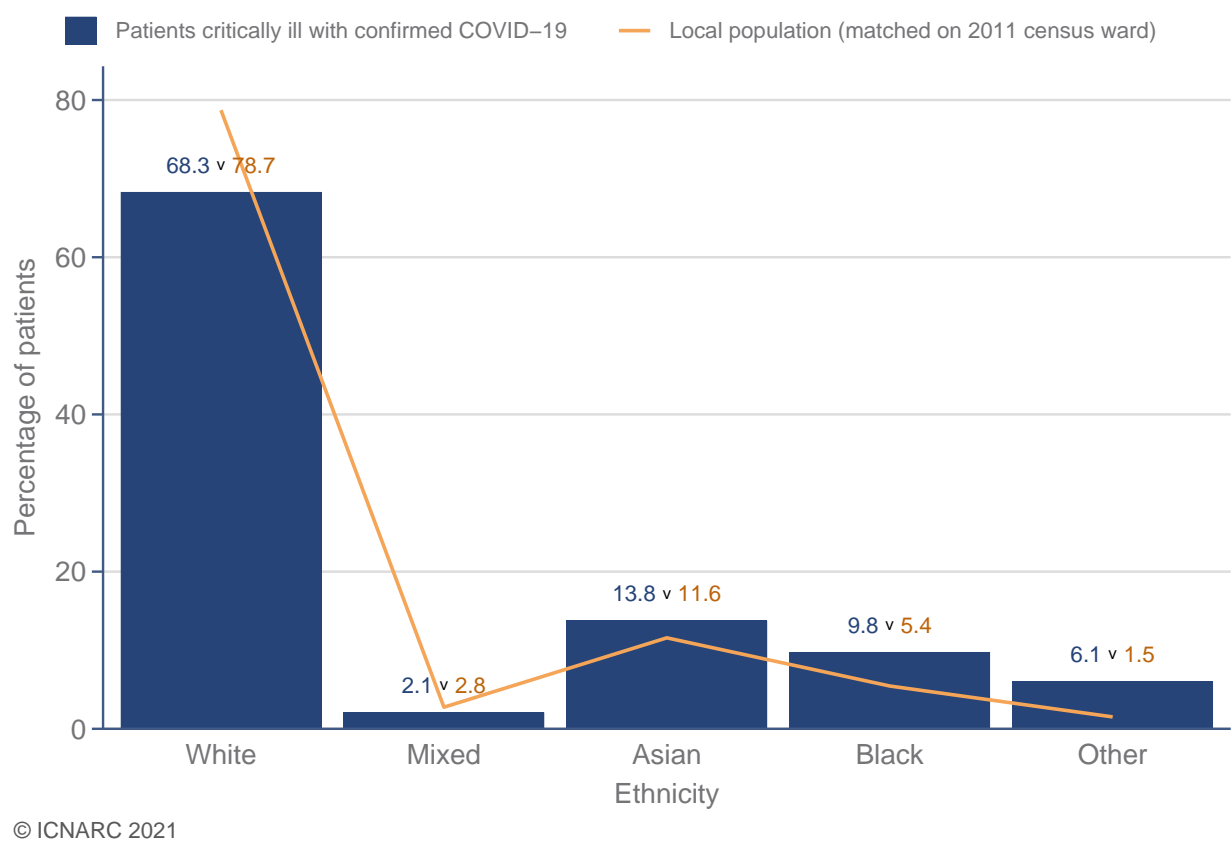


Figure 22. Ethnicity distribution compared with the local population

Ethnicity distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date compared with the local population (linked to 2011 census ward).

The distribution of Index of Multiple Deprivation (IMD) for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date, compared with the general population, is presented in Figure 23.

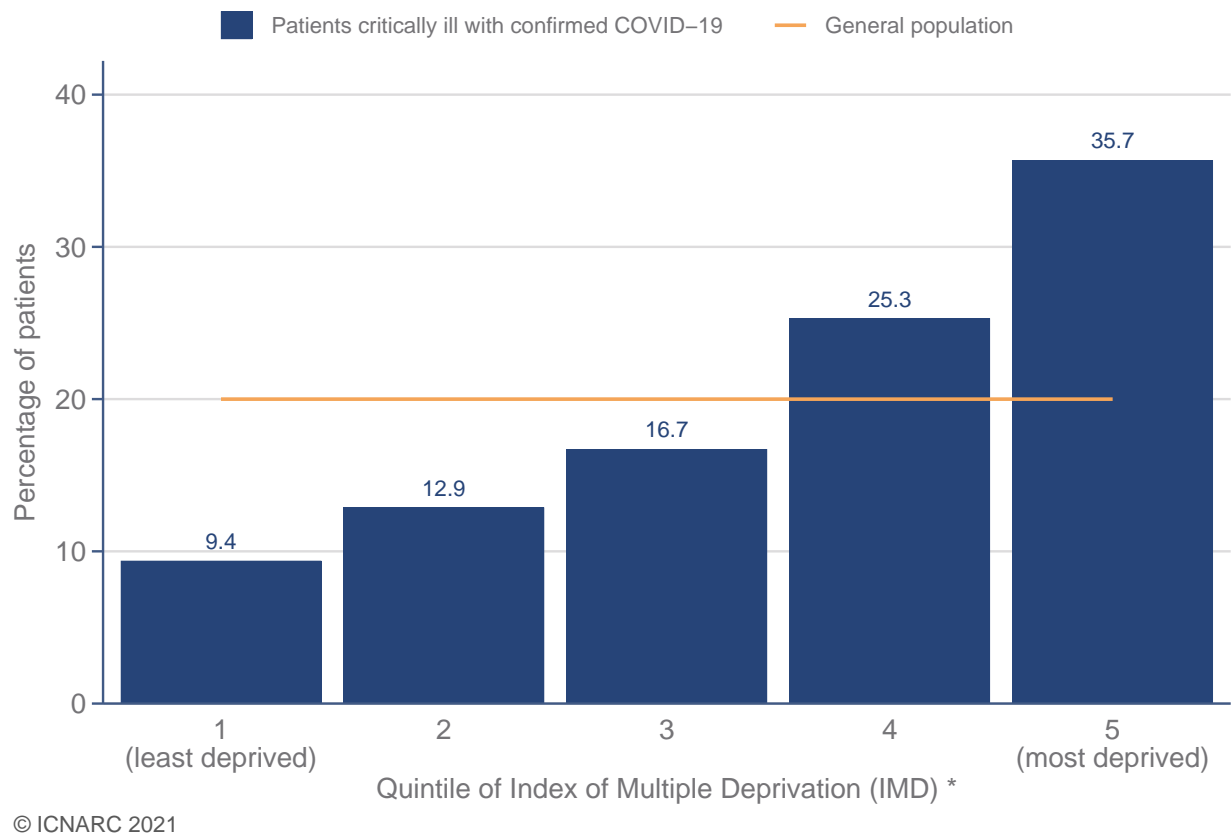
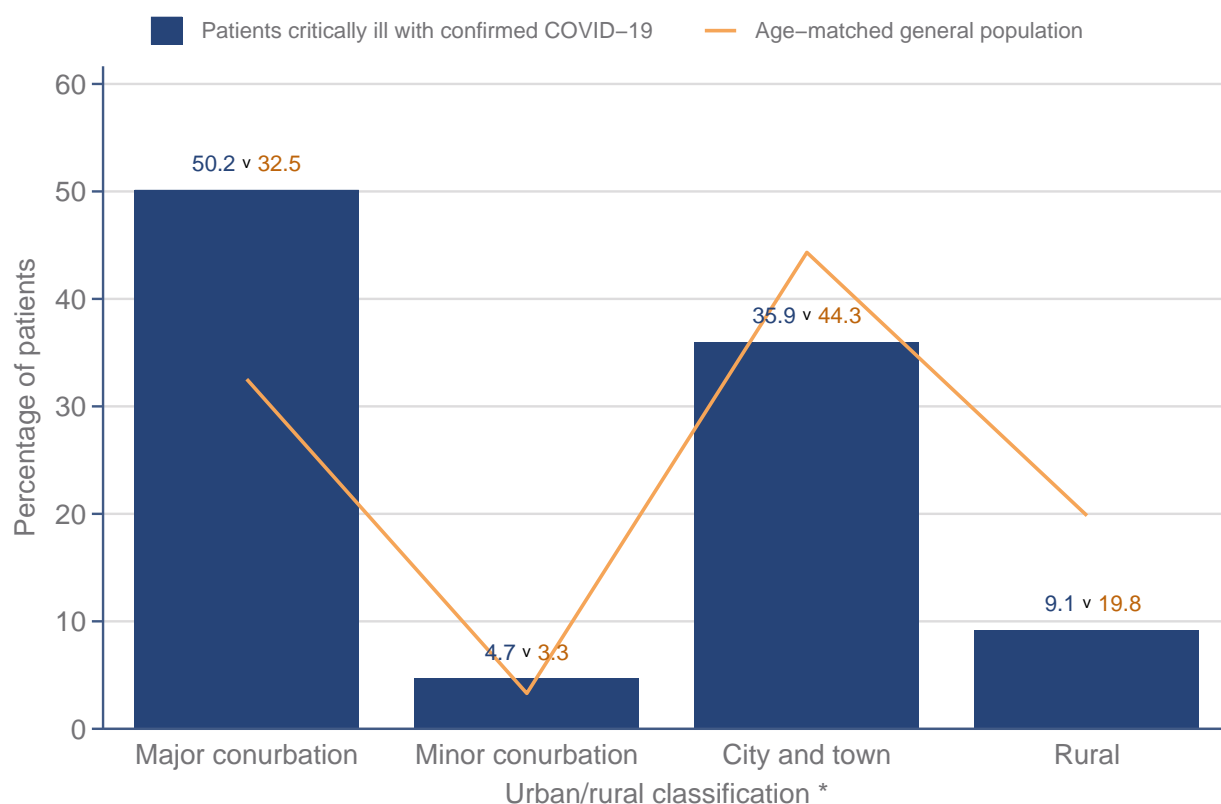


Figure 23. Index of Multiple Deprivation * distribution compared with the general population

Index of Multiple Deprivation (IMD) * distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date compared with the general population.

* Please see Definitions on page 65.

The distribution of the percentage of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date by the urban/rural classification of their usual residence, compared with the age-matched general population (Office for National Statistics 2020), is presented in Figure 24.



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Figure 24. Urban/rural * distribution compared with the age-matched general population

Urban/rural * distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date compared with the age-matched general population.

* Please see Definitions on page 65.

The distribution of body mass index (BMI) for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date, compared with an age- and sex-matched population (from the Health Survey for England 2018), is presented in Figure 25.

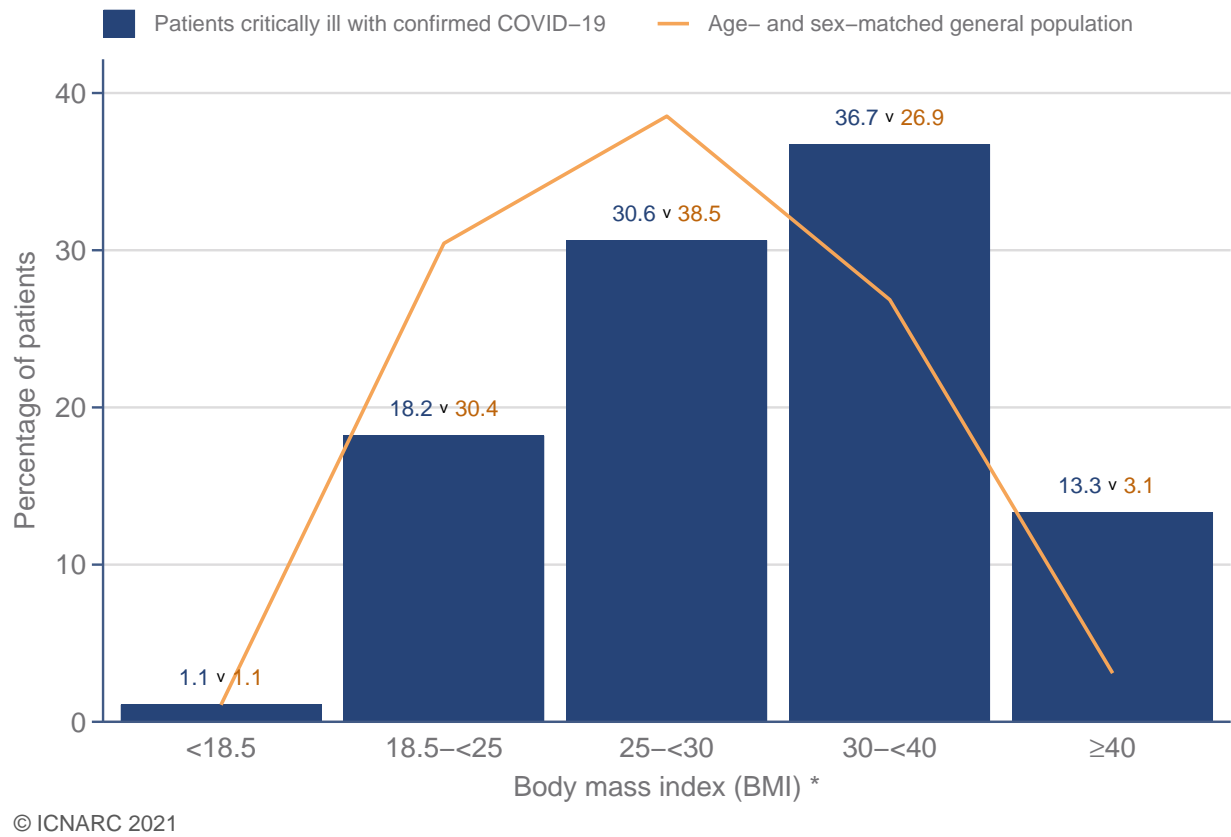


Figure 25. Body mass index * distribution compared with the age- and sex-matched general population

Body mass index (BMI) * distribution of patients critically ill with confirmed COVID-19 admitted from 1 May 2021 compared with the age- and sex-matched general population (Health Survey for England 2018).

* Please see Definitions on page 65.

Patient characteristics – invasively ventilated first 24 hours

Characteristics of patients critically ill with confirmed COVID-19 and receiving invasive ventilation during the first 24 hours in critical care admitted from 1 May 2021 to date are summarised in Tables 4-6 and compared with those admitted from 1 September 2020 to 30 April 2021.

Table 4. Patient characteristics: demographics (invasively ventilated first 24 hours)

Demographics	Patients with confirmed COVID-19 invasively ventilated first 24 hours *	
	Admitted 1 May 2021 to date (N=1107)	Admitted 1 Sep 2020-30 Apr 2021 (N=7863)
Age at admission (years) [N=1107]		
Mean (SD)	51.5 (15.8)	58.6 (12.9)
Median (IQR)	53 (40, 64)	60 (51, 68)
Sex, n (%) [N=1107]		
Female	484 (43.7)	2731 (34.8)
Male	623 (56.3)	5127 (65.2)
Ethnicity, n (%) [N=1042]		
White	700 (67.2)	4973 (67.1)
Mixed	28 (2.7)	128 (1.7)
Asian	149 (14.3)	1355 (18.3)
Black	109 (10.5)	493 (6.7)
Other	56 (5.4)	460 (6.2)
Index of Multiple Deprivation (IMD) quintile *, n (%) [N=1086]		
1 (least deprived)	96 (8.8)	898 (11.5)
2	110 (10.1)	1116 (14.3)
3	179 (16.5)	1431 (18.4)
4	286 (26.3)	1964 (25.3)
5 (most deprived)	415 (38.2)	2369 (30.5)
Urban/rural classification *, n (%) [N=986]		
Major conurbation	491 (49.8)	3981 (52.7)
Minor conurbation	32 (3.2)	195 (2.6)
City and town	378 (38.3)	2665 (35.3)
Rural	84 (8.5)	706 (9.4)

* Please see Definitions on page 65.

Table 5. Patient characteristics: medical history (invasively ventilated first 24 hours)

Patients with confirmed COVID-19 invasively ventilated first 24 hours *		
Medical history	Admitted 1 May 2021 to date (N=1107)	Admitted 1 Sep 2020-30 Apr 2021 (N=7863)
Dependency prior to admission to acute hospital, n (%) [N=1092]		
Able to live without assistance in daily activities	978 (89.6)	6878 (88.3)
Some assistance with daily activities	109 (10.0)	893 (11.5)
Total assistance with all daily activities	5 (0.5)	21 (0.3)
Very severe comorbidities *, n (%) [N=1089]		
Cardiovascular	5 (0.5)	61 (0.8)
Respiratory	12 (1.1)	58 (0.7)
Renal	16 (1.5)	103 (1.3)
Liver	8 (0.7)	78 (1.0)
Metastatic disease	4 (0.4)	29 (0.4)
Haematological malignancy	19 (1.7)	114 (1.5)
Immunocompromised	51 (4.7)	268 (3.4)
Body mass index *, n (%) [N=1074]		
<18.5	14 (1.3)	66 (0.9)
18.5-<25	202 (18.8)	1548 (20.6)
25-<30	318 (29.6)	2324 (30.9)
30-<40	359 (33.4)	2686 (35.8)
≥40	181 (16.9)	885 (11.8)
CPR within previous 24h, n (%) [N=1101]		
In the community	26 (2.4)	126 (1.6)
In hospital	20 (1.8)	204 (2.6)
Prior hospital length of stay [N=1107]		
Mean (SD)	2.4 (7.4)	3.7 (6.6)
Median (IQR)	1 (0, 3)	2 (0, 5)
Currently or recently pregnant, n (% of females aged 16-49) [N=228]		
Currently pregnant	28 (12.3)	35 (4.7)
Recently pregnant (within 6 weeks)	35 (15.4)	64 (8.6)
Not known to be pregnant	165 (72.4)	649 (86.8)

* Please see Definitions on page 65.

Table 6. Patient characteristics: indicators of acute severity (invasively ventilated first 24 hours)

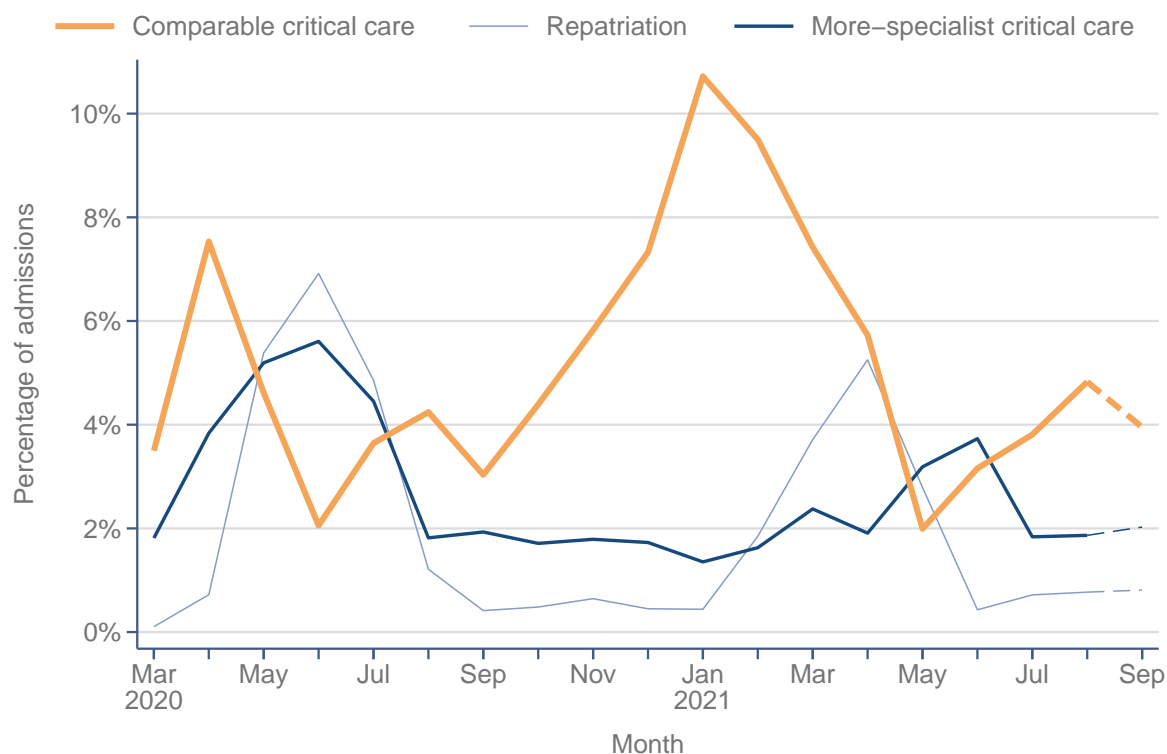
Indicators of acute severity	Patients with confirmed COVID-19 invasively ventilated first 24 hours *	
	Admitted 1 May 2021 to date (N=1107)	Admitted 1 Sep 2020-30 Apr 2021 (N=7863)
APACHE II Score [N=1107]		
Mean (SD)	15.4 (5.8)	16.2 (5.5)
Median (IQR)	15 (11, 19)	15 (12, 19)
PaO ₂ /FiO ₂ ratio † (kPa), median (IQR) [N=1097]	12.8 (8.4, 20.0)	12.6 (8.6, 19.1)
PaO ₂ /FiO ₂ ratio †, n (%) [N=1097]		
< 13.3 kPa (< 100 mmHg)	572 (52.1)	4140 (53.3)
13.3-26.6 kPa (100-200 mmHg)	383 (34.9)	2754 (35.5)
≥ 26.7 kPa (≥ 200 mmHg)	142 (12.9)	871 (11.2)
FiO ₂ †, median (IQR) [N=1097]	0.60 (0.40, 0.90)	0.65 (0.45, 0.90)

* Please see Definitions on page 65. 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 PaO₂ during the first 24 hours of critical care.

Inter-hospital critical care transfers

From 1 May 2021 to date, there have been 448 inter-hospital critical care transfers of 393 patients with confirmed COVID-19, of which 265 transfers of 249 patients were classified as being for comparable critical care. The percentage of transfers by month is shown in Figure 26.



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Figure 26. Inter-hospital critical care transfers

Percentage of critical care admissions with confirmed COVID-19 that were transfers between critical care units in different hospitals by month of admission and reason for transfer *.

* Please see Definitions on page 65. Dashed line indicates incomplete month.

Outcomes, duration of critical care and organ support

Critical care outcomes have been received for 4726 (of 5817) patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date. Of these, 1264 have died and 3462 have been discharged from critical care (Figures 27). The remaining 1091 were last reported to still be receiving critical care.

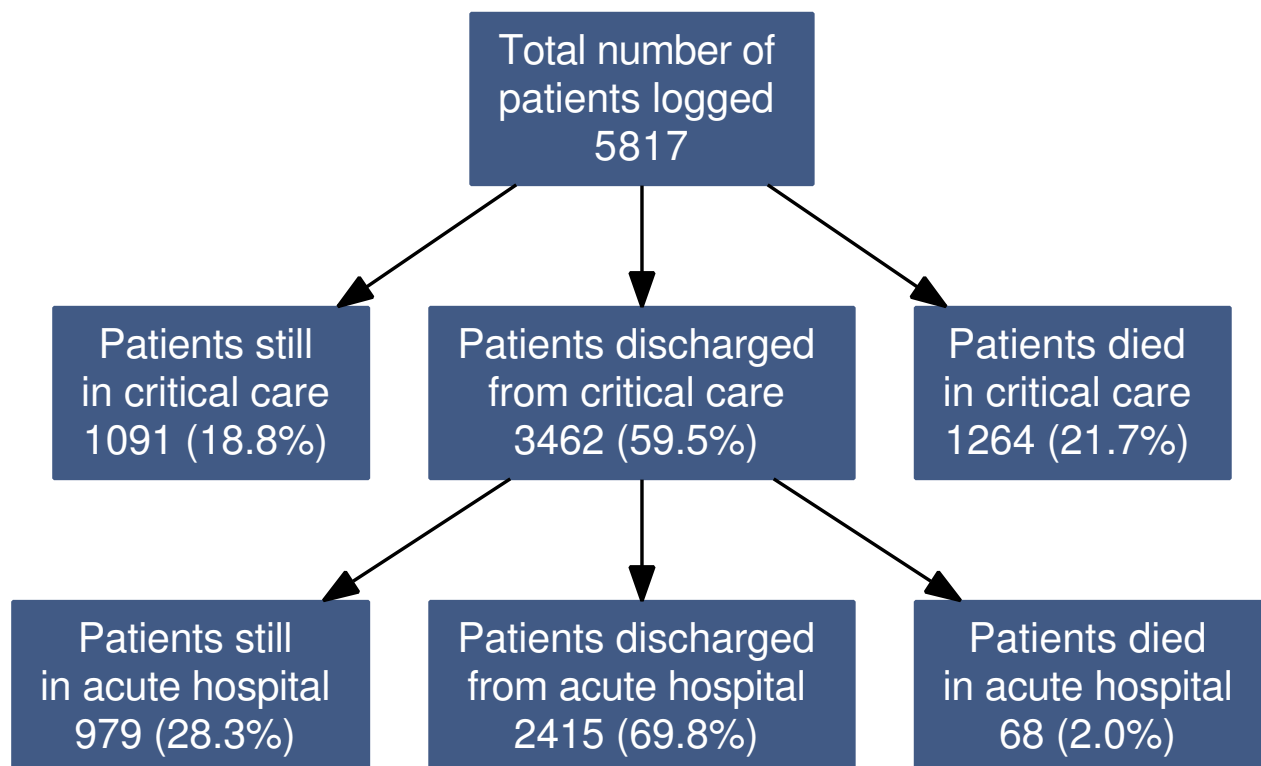


Figure 27. Critical care and acute hospital outcomes

Critical care and acute hospital outcomes for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date.

Critical care outcome, duration of critical care and organ support for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date for whom outcomes have been received are summarised in Table 7 and compared with those admitted from 1 September 2020 to 30 April 2021.

Table 7. Critical care outcome, duration of critical care and organ support

Critical care outcome	Patients with confirmed COVID-19 and outcome received	
	Admitted 1 May 2021 to date (N=5817)	Admitted 1 Sep 2020-30 Apr 2021 (N=25,847)
Outcome at end of critical care, n (%)		
Discharged	3462 (59.5)	15913 (61.6)
Died	1264 (21.7)	9883 (38.2)
Last reported still in critical care	1091 (18.8)	51 (0.2)
Duration of critical care	(N=4705)	(N=25,761)
Duration of critical care (days) †, median (IQR)		
Survivors	5 (3, 10)	7 (4, 16)
Non-survivors	11 (5, 18)	12 (6, 19)
Organ support (Critical Care Minimum Dataset) *	(N=4687)	(N=25,769)
Receipt of organ support, at any point, n (%)		
Advanced respiratory support	1838 (39.4)	14254 (55.4)
Basic respiratory support only	2642 (56.6)	10885 (42.3)
No respiratory support	186 (4.0)	570 (2.2)
Advanced cardiovascular support	677 (14.5)	5990 (23.3)
Basic cardiovascular support only	3657 (78.4)	18495 (71.9)
No cardiovascular support	331 (7.1)	1224 (4.8)
Renal support	504 (10.8)	4287 (16.7)
Liver support	30 (0.6)	221 (0.9)
Neurological support	180 (3.9)	1789 (7.0)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	10 (5, 17)	12 (6, 24)
Total (advanced + basic) respiratory support	7 (4, 13)	9 (5, 19)
Advanced cardiovascular support	2 (1, 4)	3 (1, 5)
Total (advanced + basic) cardiovascular support	7 (4, 13)	9 (5, 19)
Renal support	5 (2, 11)	6 (3, 13)

Please note that the results for patients admitted from 1 May 2021 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 65.

† 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).

Outcomes, duration of critical care and organ support – invasively ventilated first 24 hours

Critical care outcome, duration of critical care and organ support for patients critically ill with confirmed COVID-19 for whom outcomes have been received and who received invasive ventilation during the first 24 hours in critical care admitted from 1 May 2021 to date are summarised in Table 8 and compared with those admitted from 1 September 2020 to 30 April 2021.

Table 8. Critical care outcome, duration of critical care and organ support (invasively ventilated first 24 hours)

Patients with confirmed COVID-19 invasively ventilated first 24 hours *		
Critical care outcome	Admitted 1 May 2021 to date (N=1107)	Admitted 1 Sep 2020-30 Apr 2021 (N=7863)
Outcome at end of critical care, n (%)		
Discharged	513 (46.3)	3962 (50.4)
Died	361 (32.6)	3877 (49.3)
Last reported still in critical care	233 (21.0)	24 (0.3)
Duration of critical care	(N=872)	(N=7834)
Duration of critical care (days) †, median (IQR)		
Survivors	11 (6, 18)	17 (8, 36)
Non-survivors	9 (4, 17)	12 (6, 19)
Organ support (Critical Care Minimum Dataset) *	(N=870)	(N=7829)
Receipt of organ support, at any point, n (%)		
Advanced cardiovascular support	298 (34.3)	3162 (40.4)
Basic cardiovascular support only	571 (65.6)	4660 (59.5)
No cardiovascular support	1 (0.1)	7 (0.1)
Renal support	190 (21.8)	2129 (27.2)
Liver support	16 (1.8)	136 (1.7)
Neurological support	93 (10.7)	1071 (13.7)
Duration of organ support (calendar days), median (IQR)		
Advanced respiratory support	9 (4, 16)	13 (6, 24)
Total (advanced + basic) respiratory support	11 (5, 18)	14 (8, 26)
Advanced cardiovascular support	2 (1, 5)	3 (2, 5)
Total (advanced + basic) cardiovascular support	11 (6, 18)	14 (8, 26)
Renal support	6 (3, 12)	7 (3, 14)

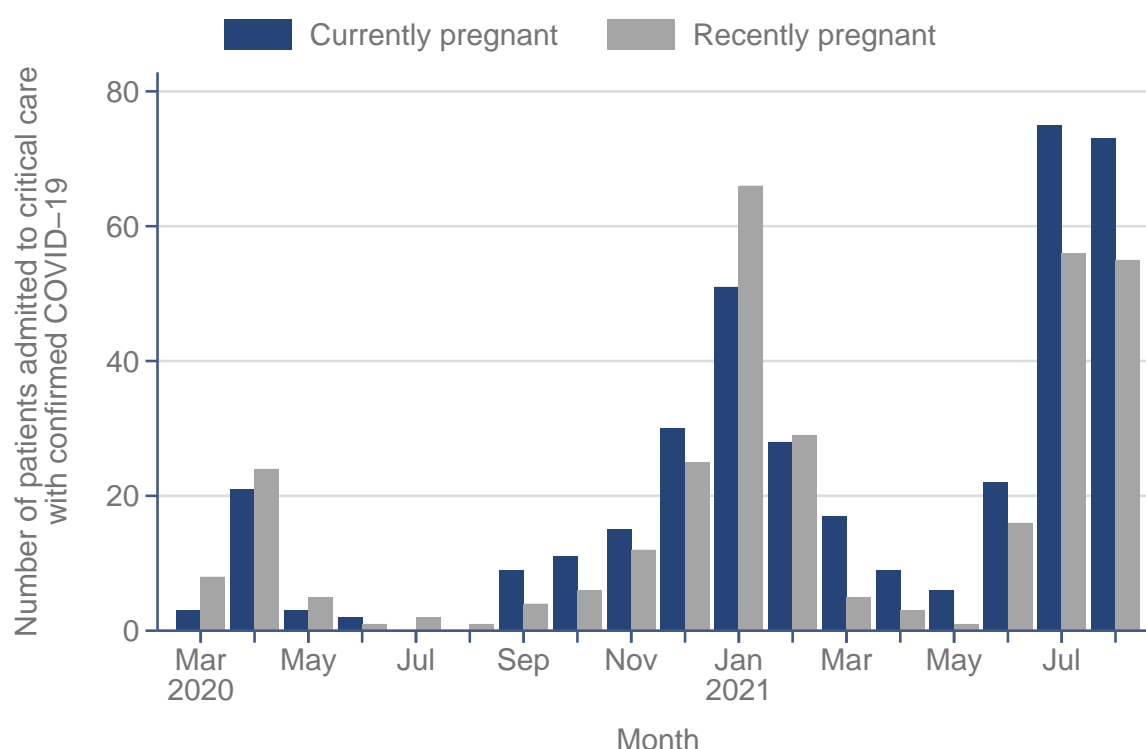
Please note that the results for patients admitted from 1 May 2021 are biased towards patients with shorter lengths of stay in critical care prior to discharge or death, i.e. those who died or recovered quickly.

* Please see Definitions on page 65.

† 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).

Pregnancy

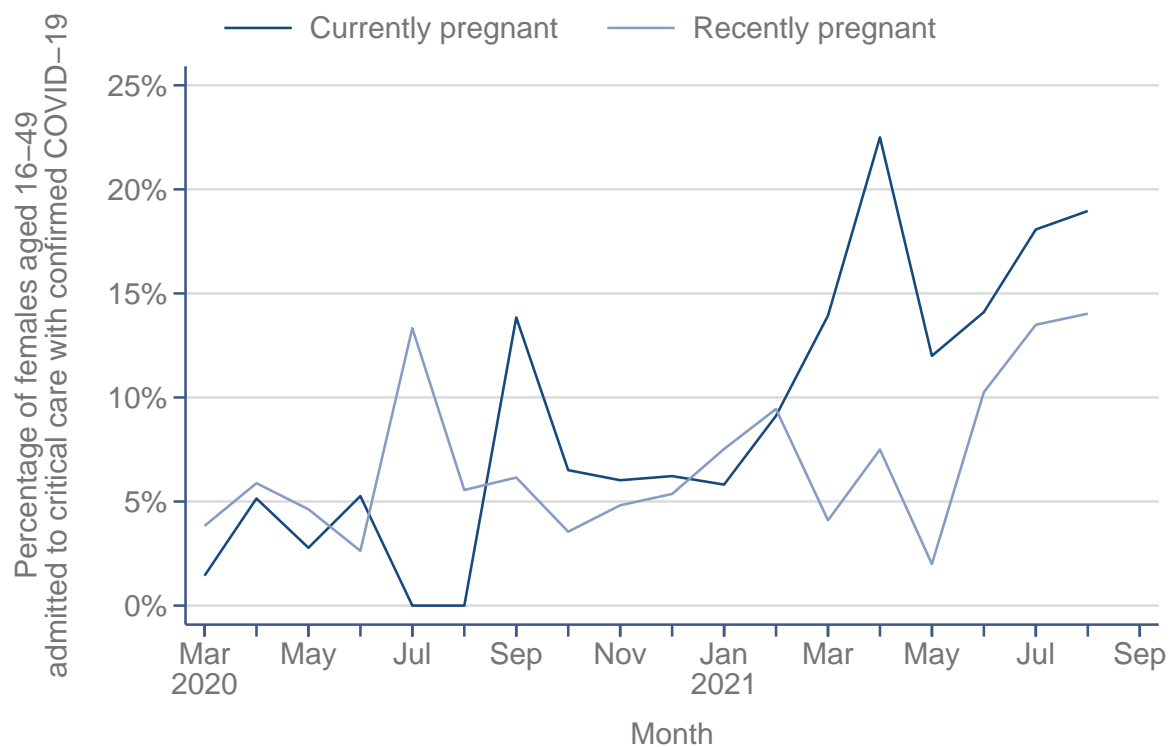
The numbers of critically ill women with confirmed COVID-19 reported to be currently and recently pregnant on admission to critical care are shown in Figure 28 and, as a percentage of women aged 16-49 years, in Figure 29. Characteristics and critical care outcome of women aged 16-49 years by pregnancy status are reported in Table 9 for women admitted from 1 May 2021 to date and compared with women admitted from 1 September 2020 to 30 April 2021 in Table 10.



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Figure 28. Numbers currently and recently pregnant

Monthly trend in the number of women reported to be currently or recently pregnant on admission to critical care.



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Figure 29. Percentages currently and recently pregnant

Monthly trend in the percentage of women aged 16-49 years reported to be currently or recently pregnant on admission to critical care.

Table 9. Characteristics of females aged 16-49 admitted from 1 May 2021 to date by pregnancy status

Characteristics	Women with confirmed COVID-19 aged 16-49 years		
	Currently pregnant (N=192)	Recently pregnant (N=143)	Not known to be pregnant (N=756)
Age at admission (years)			
Mean (SD)	32.0 (5.8)	31.5 (5.6)	37.0 (9.0)
Median (IQR)	32 (28, 36)	31 (27, 35)	39 (31, 45)
Ethnicity, n (%)			
White	103 (56.0)	88 (63.3)	472 (65.6)
Mixed	10 (5.4)	6 (4.3)	25 (3.5)
Asian	45 (24.5)	26 (18.7)	118 (16.4)
Black	19 (10.3)	12 (8.6)	70 (9.7)
Other	7 (3.8)	7 (5.0)	34 (4.7)
IMD quintile *, n (%)			
1 (least deprived)	22 (12.0)	13 (9.4)	51 (6.9)
2	19 (10.3)	14 (10.1)	61 (8.2)
3	28 (15.2)	21 (15.1)	114 (15.3)
4	53 (28.8)	38 (27.3)	197 (26.5)
5 (most deprived)	62 (33.7)	53 (38.1)	320 (43.1)
First pregnancy, n (%)	N/A	56 (42.1)	N/A
Invasively ventilated within first 24h *, n (%)	28 (15.1)	35 (26.7)	165 (23.8)
APACHE II Score			
Mean (SD)	11.9 (3.5)	10.7 (3.9)	11.9 (4.8)
Median (IQR)	12 (9, 14)	10 (8, 13)	11 (9, 14)
PaO ₂ /FiO ₂ ratio † (kPa), median (IQR)	15.7 (12.5, 21.8)	18.2 (11.1, 24.6)	14.2 (10.0, 20.6)
PaO ₂ /FiO ₂ ratio †, n (%)			
< 13.3 kPa (< 100 mmHg)	59 (33.1)	59 (33.1)	59 (33.1)
13.3-26.6 kPa (100-200 mmHg)	39 (31.0)	39 (31.0)	39 (31.0)
≥ 26.7 kPa (≥ 200 mmHg)	292 (45.1)	292 (45.1)	292 (45.1)
FiO ₂ †, median (IQR)	0.50 (0.40, 0.70)	0.50 (0.35, 0.70)	0.60 (0.40, 0.75)
Outcome at end of critical care, n (%)			
Discharged	161 (83.9)	120 (83.9)	561 (74.2)
Died	3 (1.6)	3 (2.1)	94 (12.4)
Last reported still in critical care	28 (14.6)	20 (14.0)	101 (13.4)

* Please see Definitions on page 65. Indicators of acute severity are based on data from the first 24 hours of critical care. N/A denotes not available.

† Derived from the arterial blood gas with the lowest PaO₂ during the first 24 hours of critical care.

Table 10. Characteristics of females aged 16-49 admitted from 1 September 2020 to 30 April 2021 by pregnancy status

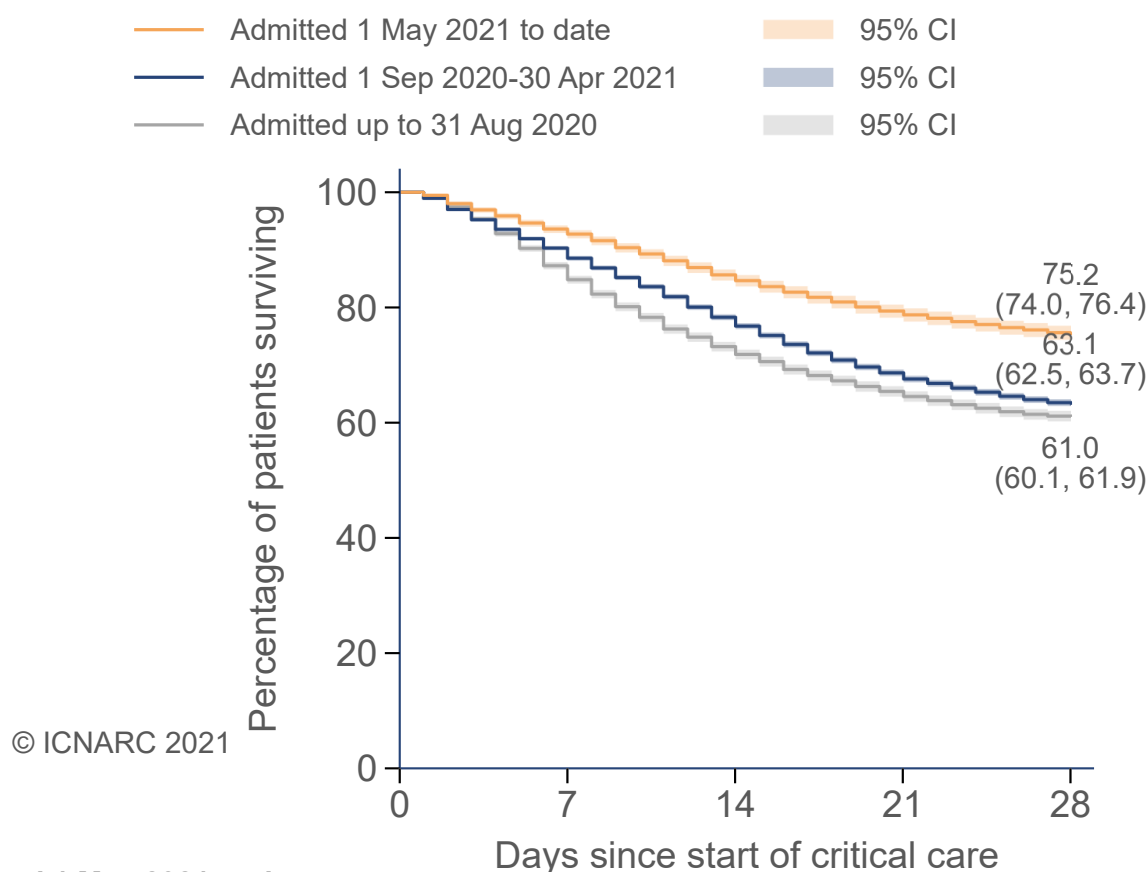
Characteristics	Women with confirmed COVID-19 aged 16-49 years		
	Currently pregnant (N=169)	Recently pregnant (N=150)	Not known to be pregnant (N=1970)
Age at admission (years)			
Mean (SD)	32.4 (5.6)	32.8 (5.6)	40.1 (7.7)
Median (IQR)	32 (29, 37)	33 (29, 37)	42 (35, 47)
Ethnicity, n (%)			
White	66 (40.2)	76 (52.4)	1260 (66.6)
Mixed	5 (3.0)	10 (6.9)	37 (2.0)
Asian	58 (35.4)	37 (25.5)	357 (18.9)
Black	20 (12.2)	14 (9.7)	130 (6.9)
Other	15 (9.1)	8 (5.5)	109 (5.8)
IMD quintile *, n (%)			
1 (least deprived)	12 (7.3)	14 (9.7)	170 (8.7)
2	13 (7.9)	19 (13.1)	212 (10.9)
3	29 (17.7)	28 (19.3)	335 (17.2)
4	54 (32.9)	29 (20.0)	521 (26.7)
5 (most deprived)	56 (34.1)	55 (37.9)	710 (36.4)
First pregnancy, n (%)	N/A	63 (42.0)	N/A
Invasively ventilated within first 24h *, n (%)	35 (20.7)	64 (42.7)	649 (33.1)
APACHE II Score			
Mean (SD)	11.4 (4.2)	11.1 (4.1)	12.2 (4.9)
Median (IQR)	11 (9, 14)	11 (8, 14)	12 (9, 15)
PaO ₂ /FiO ₂ ratio † (kPa), median (IQR)	17.0 (11.6, 26.0)	19.3 (12.6, 32.3)	13.7 (9.6, 20.0)
PaO ₂ /FiO ₂ ratio †, n (%)			
< 13.3 kPa (< 100 mmHg)	49 (32.0)	49 (32.0)	49 (32.0)
13.3-26.6 kPa (100-200 mmHg)	38 (26.8)	38 (26.8)	38 (26.8)
≥ 26.7 kPa (≥ 200 mmHg)	876 (48.1)	876 (48.1)	876 (48.1)
FiO ₂ †, median (IQR)	0.50 (0.35, 0.70)	0.40 (0.30, 0.65)	0.60 (0.40, 0.80)
Outcome at end of critical care, n (%)			
Discharged	163 (96.4)	148 (98.7)	1591 (80.8)
Died	6 (3.6)	2 (1.3)	377 (19.1)
Last reported still in critical care	0 (0.0)	0 (0.0)	2 (0.1)

* Please see Definitions on page 65. Indicators of acute severity are based on data from the first 24 hours of critical care. N/A denotes not available.

† Derived from the arterial blood gas with the lowest PaO₂ during the first 24 hours of critical care.

28-day in-hospital outcome - overall

A Kaplan-Meier plot of in-hospital survival to 28 days following admission to critical care for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date is shown in Figure 30 and compared with those admitted from 1 September 2020 to 30 April 2021 and up to 31 August 2020.



Admitted 1 May 2021 to date

At risk	5505	4834	4032	3405	2888
Died (in hospital)	0	398	801	1072	1217
Censored	0	273	672	1028	1400

Admitted 1 Sep 2020-30 Apr 2021

At risk	25847	22863	19806	17442	16266
Died (in hospital)	0	2974	5999	8353	9523
Censored	0	10	42	52	58

Admitted up to 31 Aug 2020

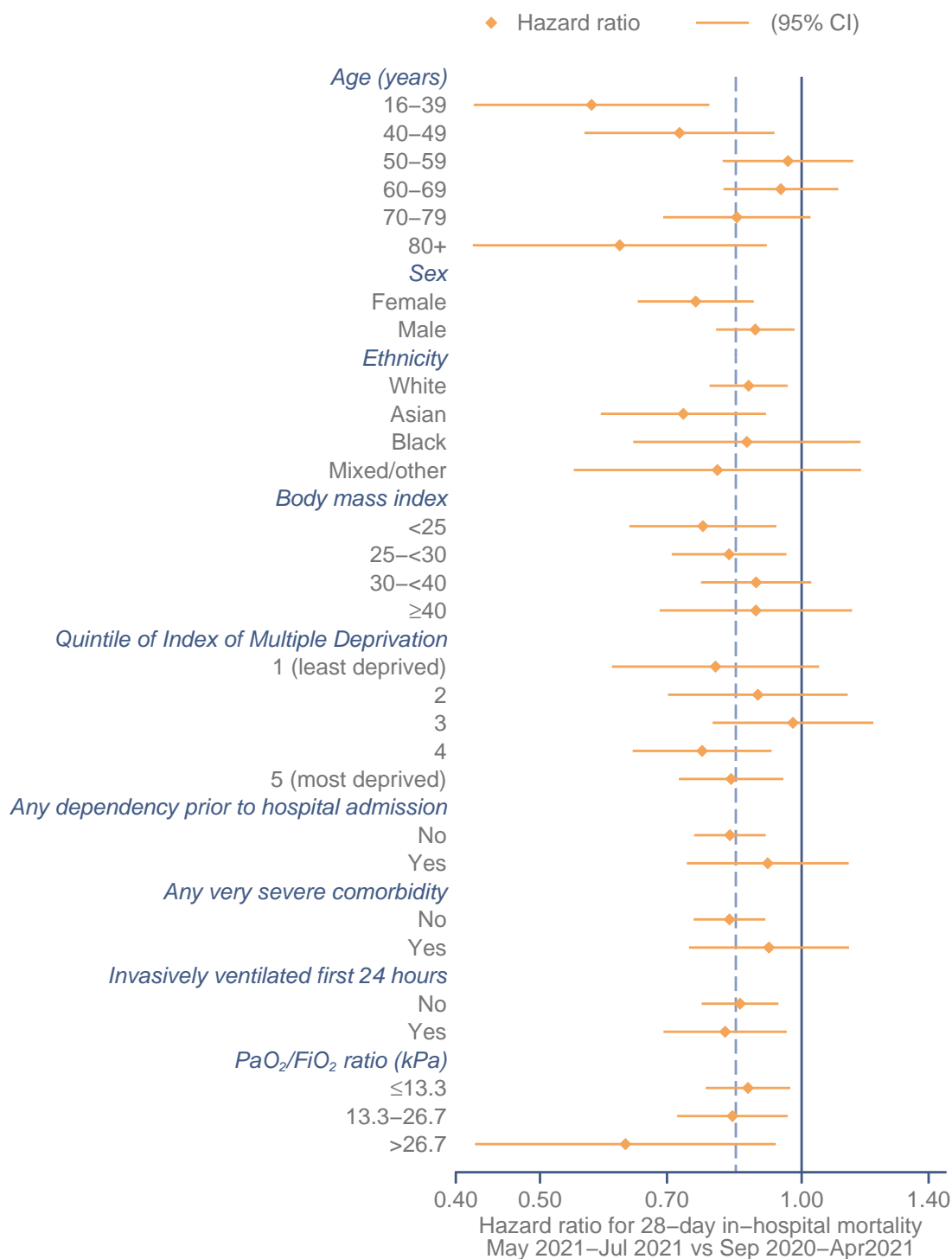
At risk	10951	9286	7873	7078	6681
Died (in hospital)	0	1665	3078	3873	4269
Censored	0	0	0	0	1

Figure 30. In-hospital survival to 28 days following admission to critical care

Kaplan-Meier survival analysis for patients critically ill with confirmed COVID-19. 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).

Comparison of adjusted 28-day in-hospital mortality between time periods

Figure 31 shows hazard ratios comparing 28-day in-hospital mortality for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to 30 July 2021 compared with those admitted from 1 September 2020 to 30 April 2021 across patient subgroups. Hazard ratios are calculated from Cox proportional hazards models adjusted for all the subgroup variables shown and for physiology measured during the first 24 hours of critical care. Dashed vertical line shows the overall adjusted hazard ratio between the time periods.



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Figure 31. Hazard ratios comparing patients admitted May 2021 to July 2021 vs September 2020 to April 2021 by patient subgroup *

Hazard ratios from Cox proportional hazards models adjusted for all subgroup variables plus the following physiological measurements from the first 24 hours of critical care: highest heart rate; highest respiratory rate; highest blood lactate concentration; highest serum creatinine; highest serum urea; lowest platelet count; and neutrophil count associated with the lowest white blood cell count.

90-day in-hospital outcome

A Kaplan-Meier plot of in-hospital survival to 90 days following admission to critical care for patients critically ill with confirmed COVID-19 admitted from 1 May 2021 to date is shown in Figure 32 and compared with those admitted from 1 September 2020 to 30 April 2021 and up to 31 August 2020.

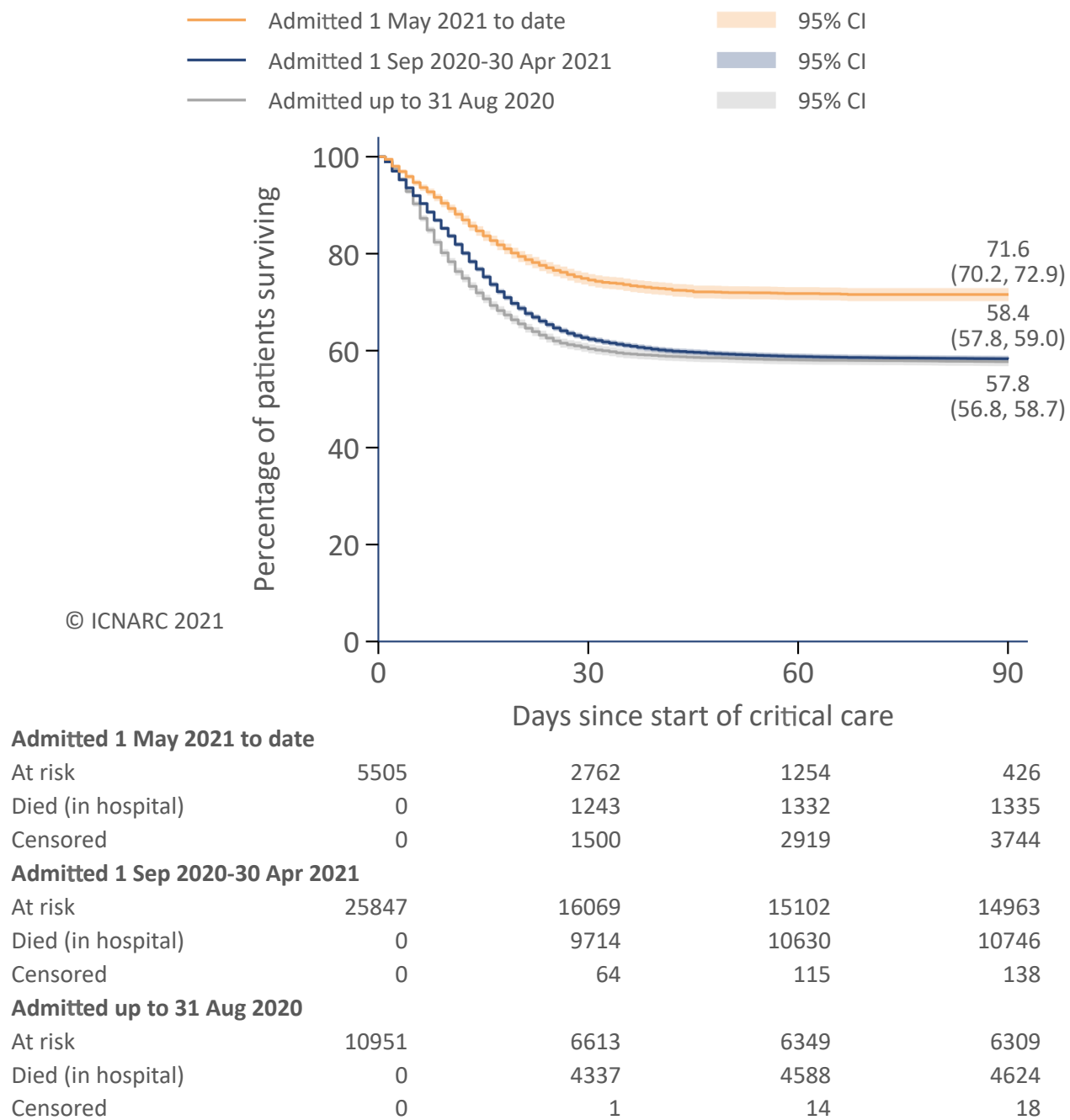
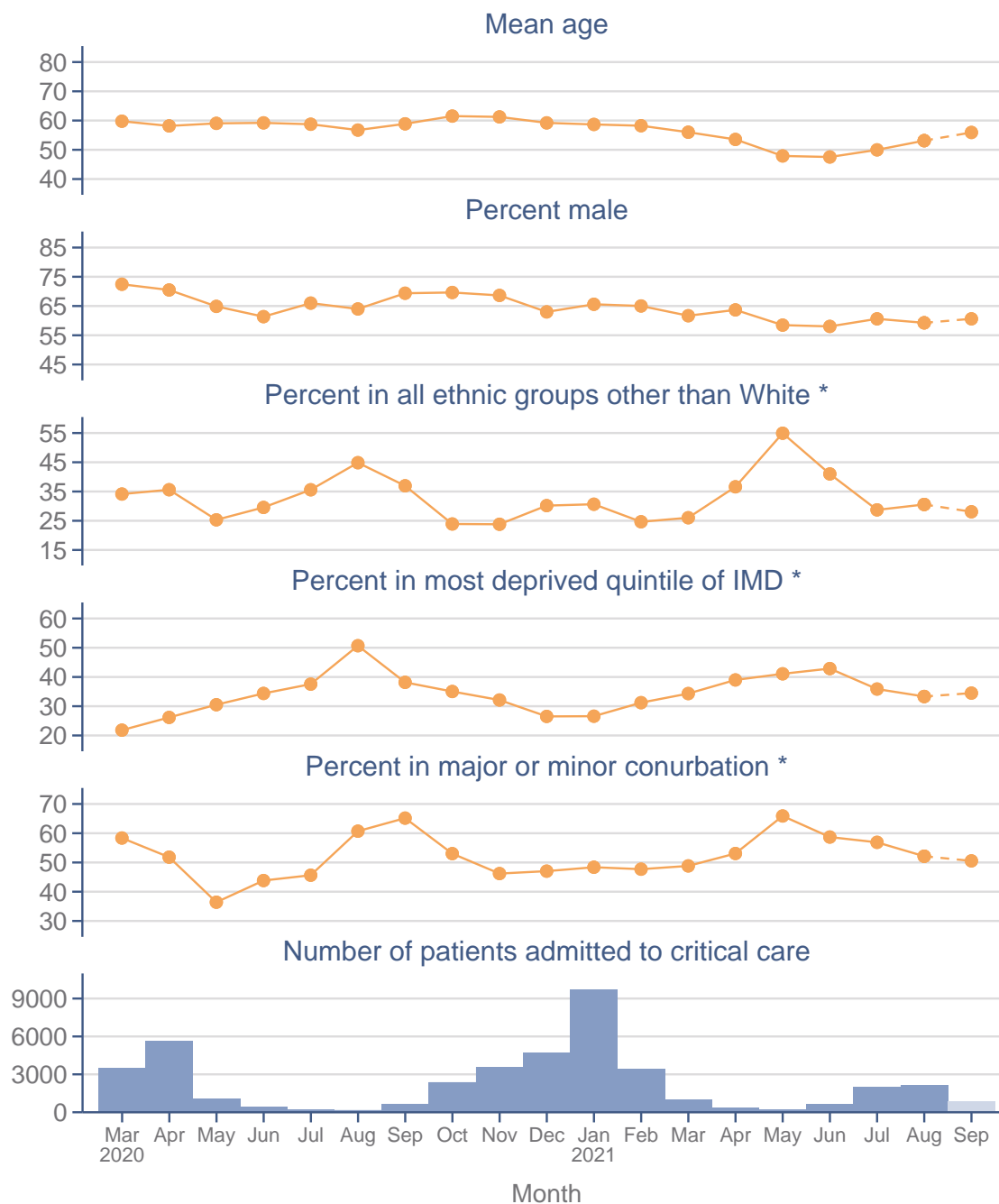


Figure 32. In-hospital survival to 90 days following admission to critical care
 Kaplan-Meier survival analysis for patients critically ill with confirmed COVID-19. Patients last reported to be still receiving critical care censored on the most recent date of data submission by the treating unit. Patients discharged from acute hospital within 90 days assumed to survive to 90 days. Please note that these survival curves are not adjusted for differences in patient characteristics (see Tables 1-3).

Monthly trends – COVID-19

Monthly trends in characteristics for patients critically ill with confirmed COVID-19 are shown for key summary statistics in Figures 33-35 and as full distributions in Figures 36-38.

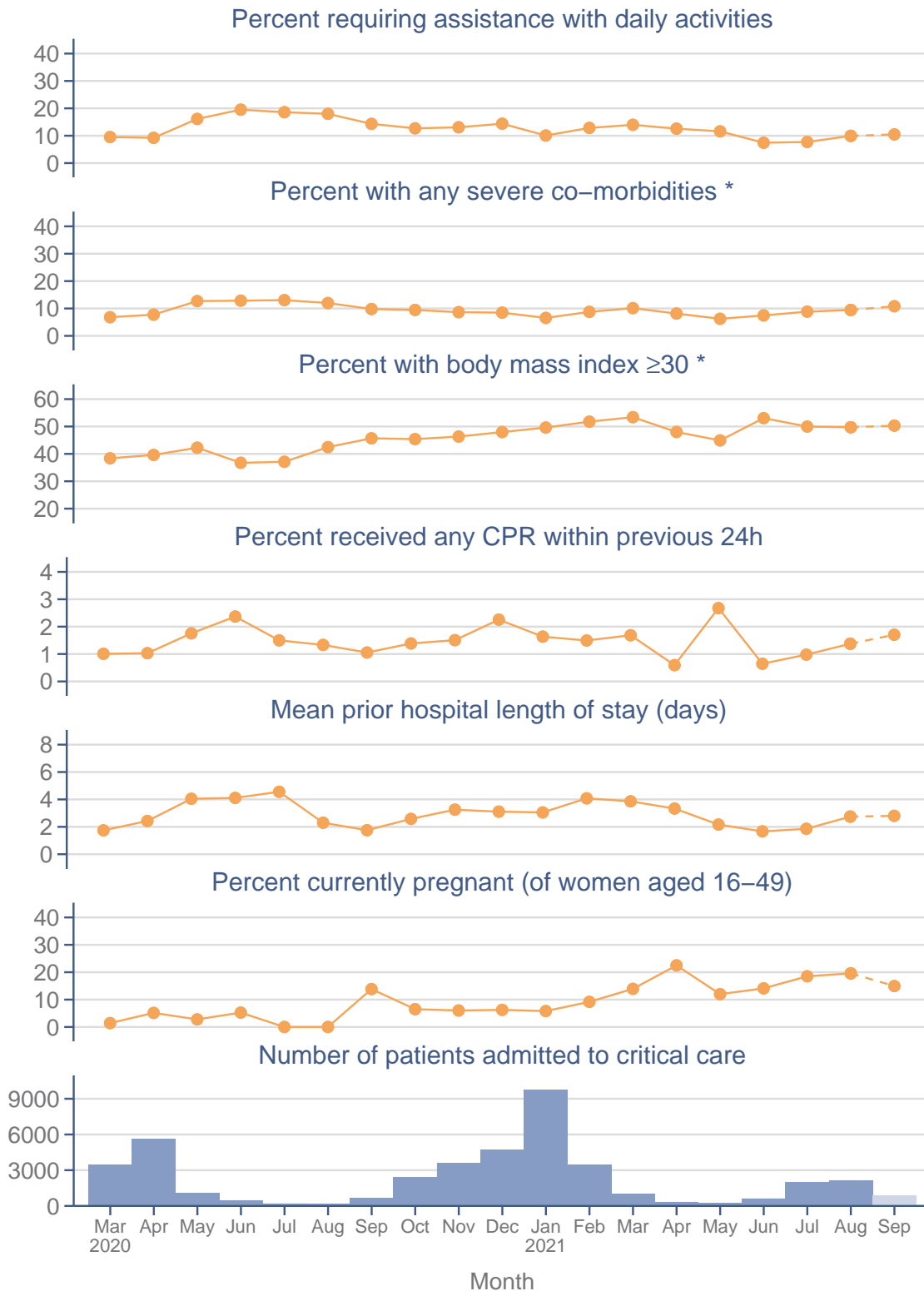


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Figure 33. Monthly trend in patient characteristics (demographics)

Monthly trend in patient characteristics (demographics) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Dashed line and shading indicates incomplete month.

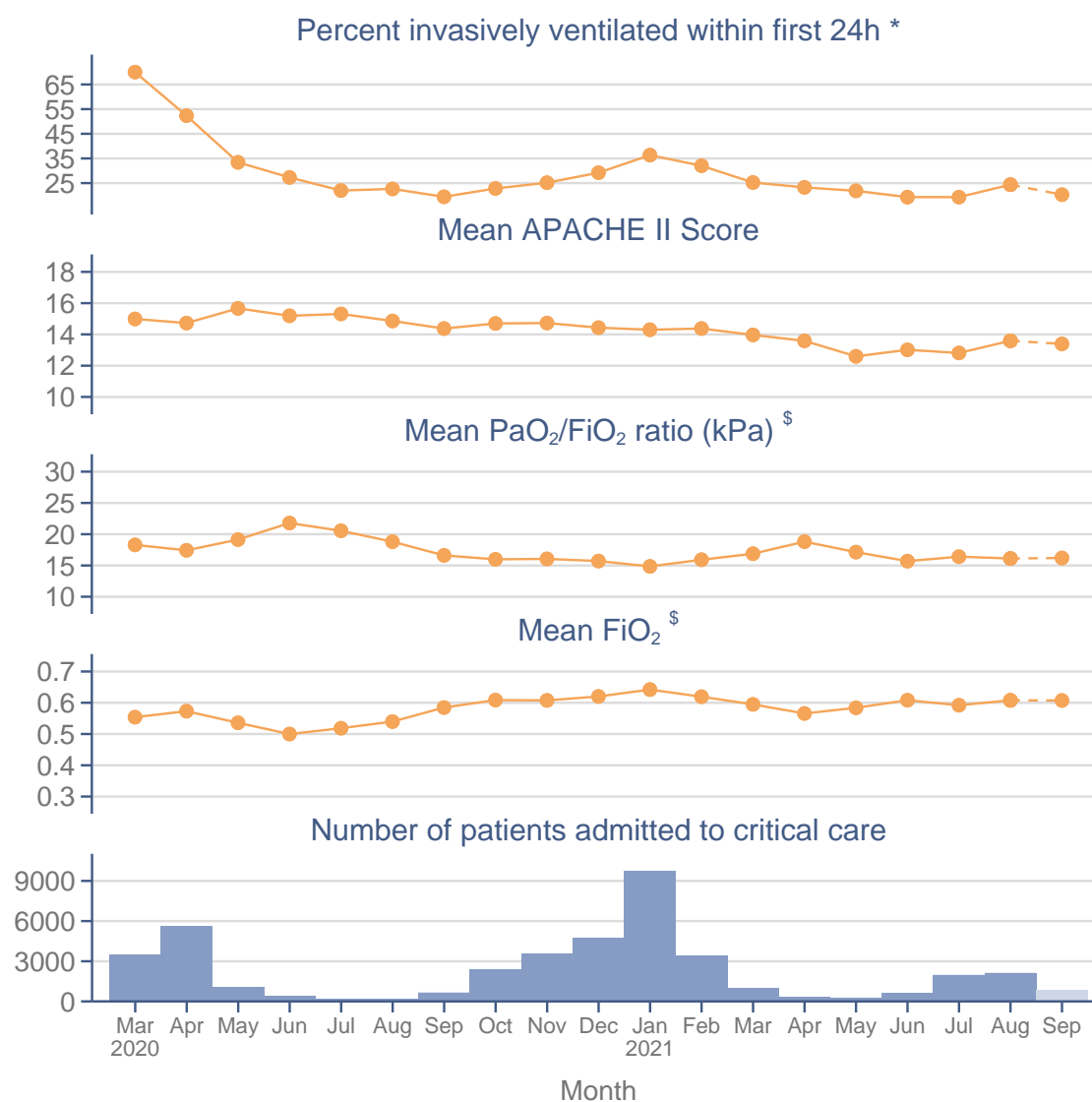


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Figure 34. Monthly trend in patient characteristics (medical history)

Monthly trend in patient characteristics (medical history) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Dashed line and shading indicates incomplete month.



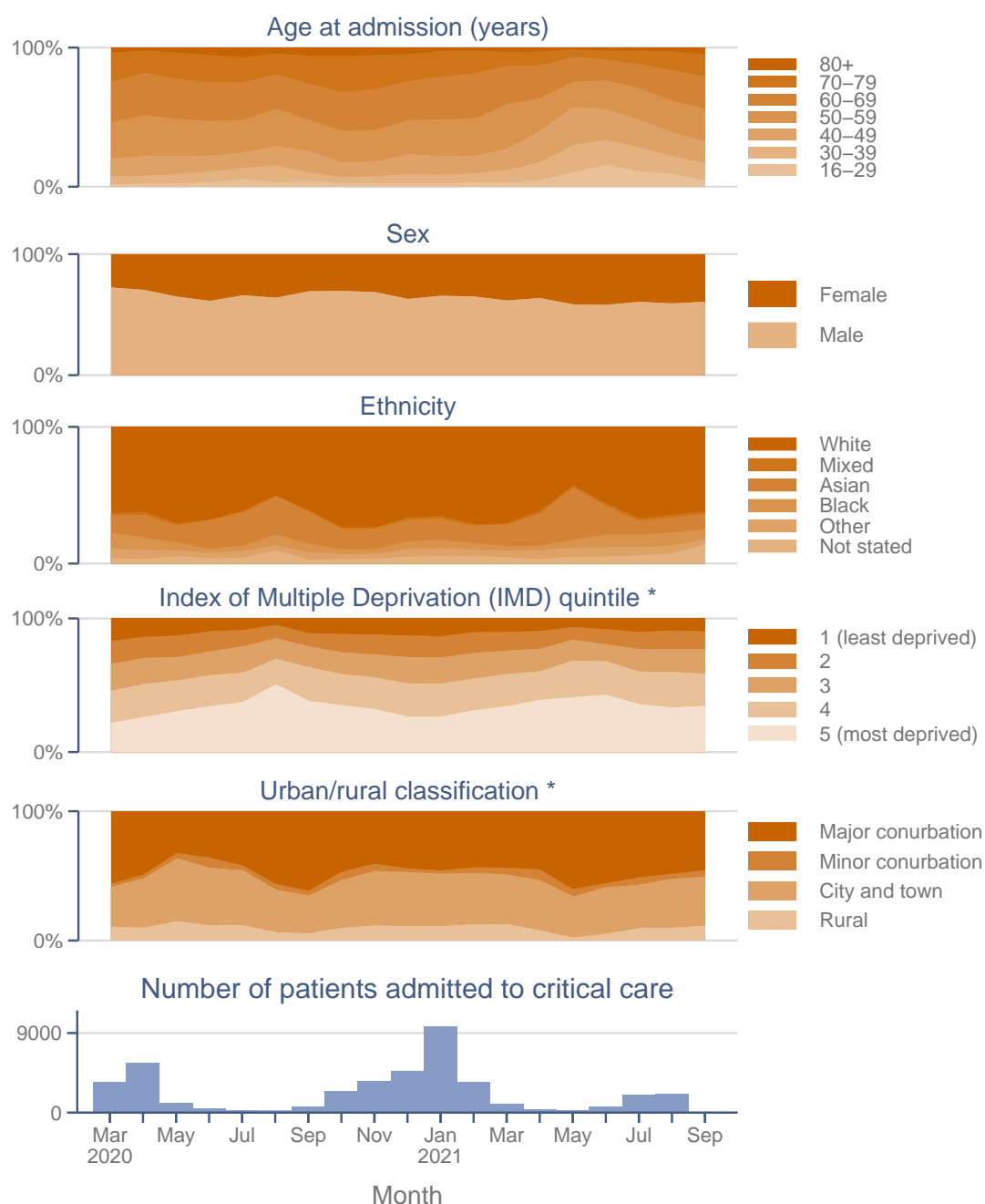
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Figure 35. Monthly trend in patient characteristics (indicators of acute severity)

Monthly trend in patient characteristics (indicators of acute severity) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Dashed line and shading indicates incomplete month.

\$ Derived from the arterial blood gas with the lowest PaO_2 during the first 24 hours of critical care.

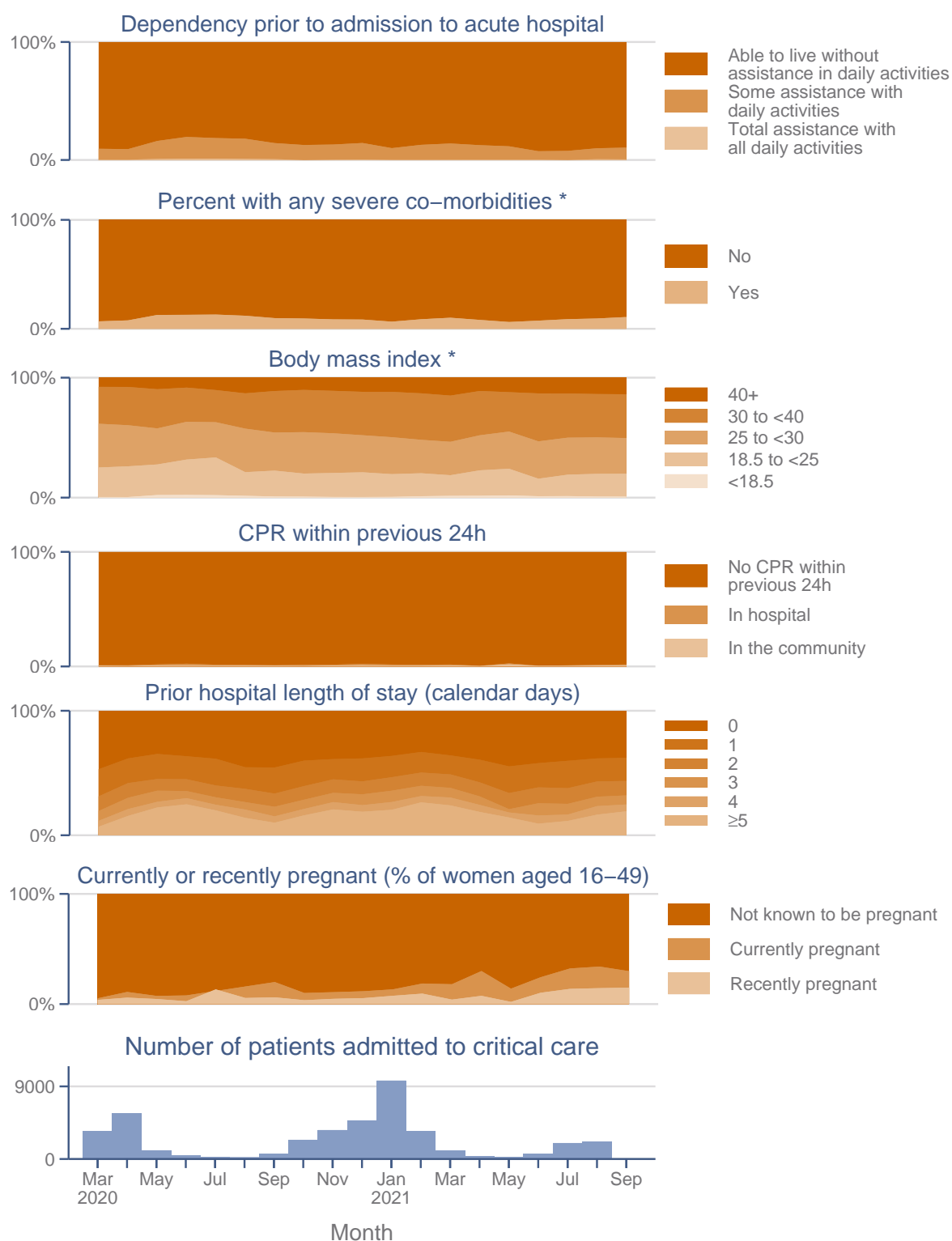


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Figure 36. Monthly trend in patient characteristics (demographics) – distributions

Monthly trend in the distribution of patient characteristics (demographics) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Shading indicates incomplete month.

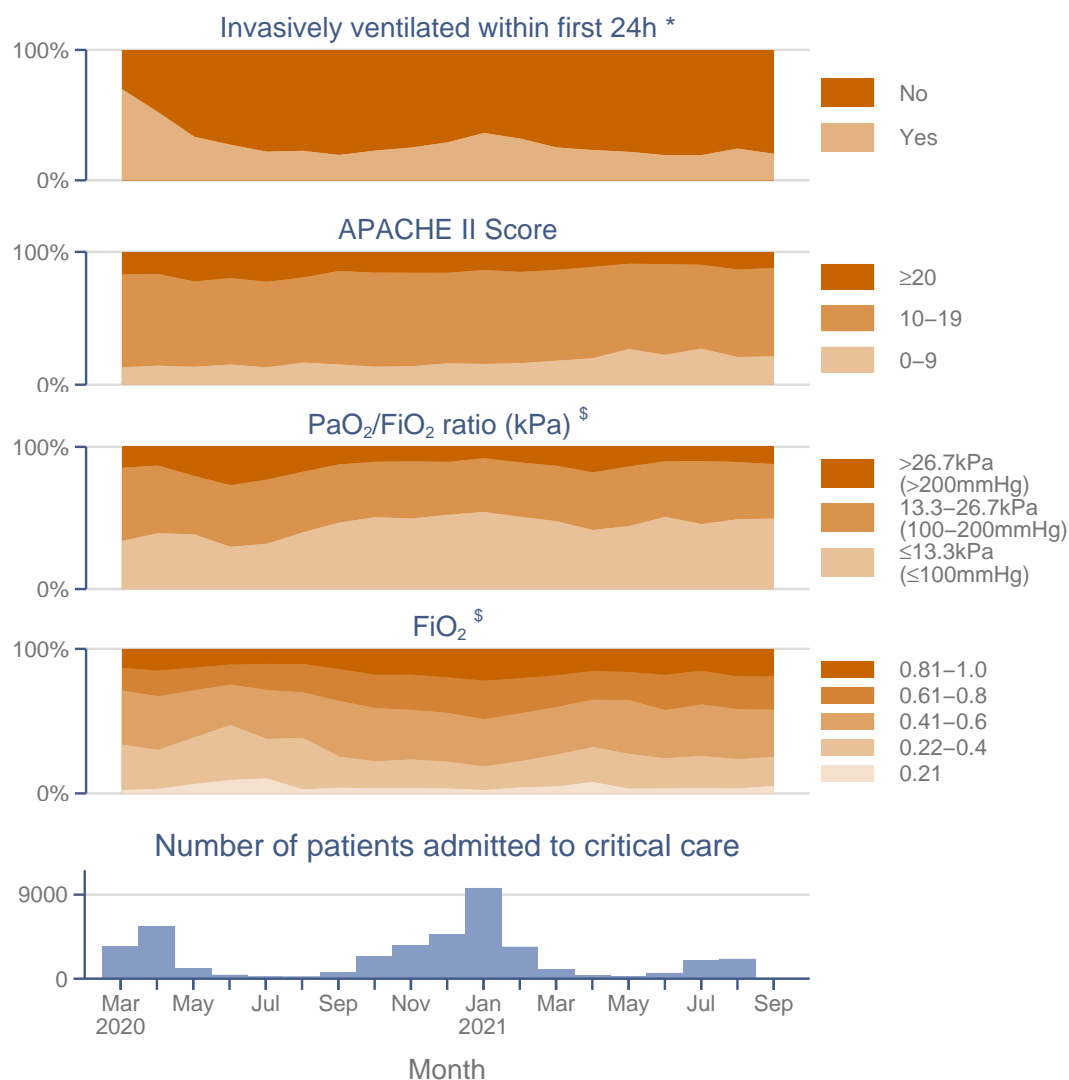


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Figure 37. Monthly trend in patient characteristics (medical history) – distributions

Monthly trend in the distribution of patient characteristics (medical history) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Shading indicates incomplete month.



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Figure 38. Monthly trend in patient characteristics (indicators of acute severity) – distributions

Monthly trend in the distribution of patient characteristics (indicators of acute severity) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Shading indicates incomplete month.

§ Derived from the arterial blood gas with the lowest PaO₂ during the first 24 hours of critical care.

Figure 39 shows the monthly number of new patients critically ill with confirmed COVID-19 from March 2020 until the last complete month and the corresponding 28-day in-hospital mortality, indicating the months in which information became available identifying steroids (Dexamethasone) and IL-6 inhibitors (Tocilizumab) as effective treatments for critically ill patients. Figures 40-42 show monthly variation in patient characteristics relating to ventilation and timing of critical care compared with the change in mortality.

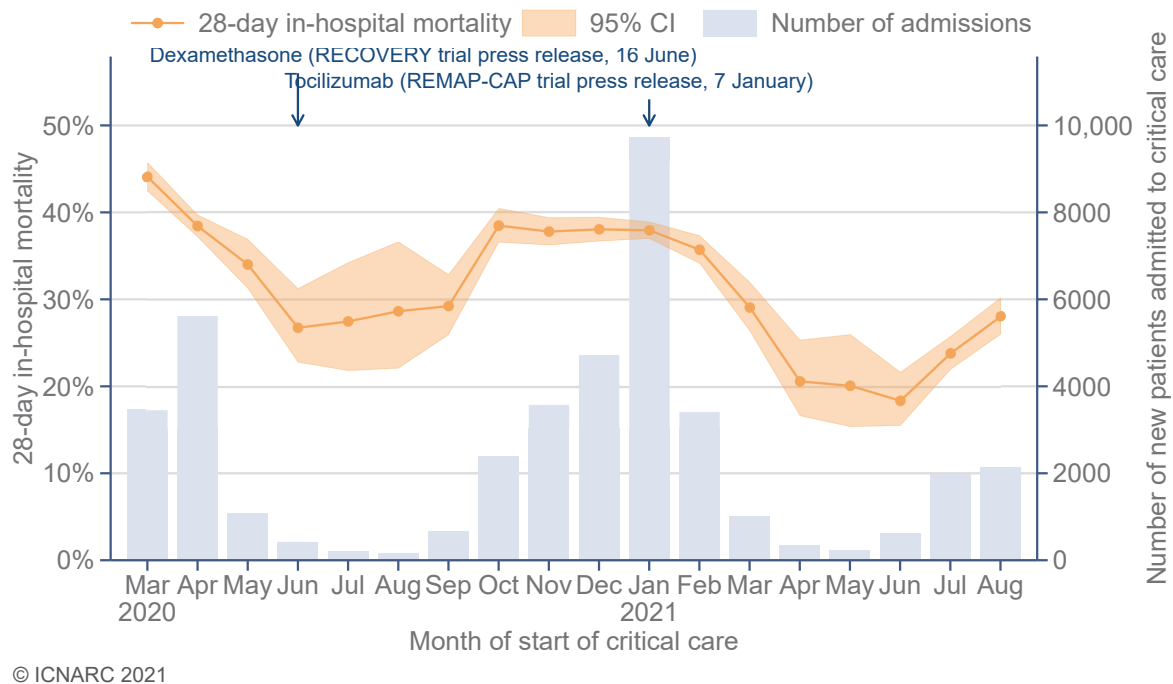
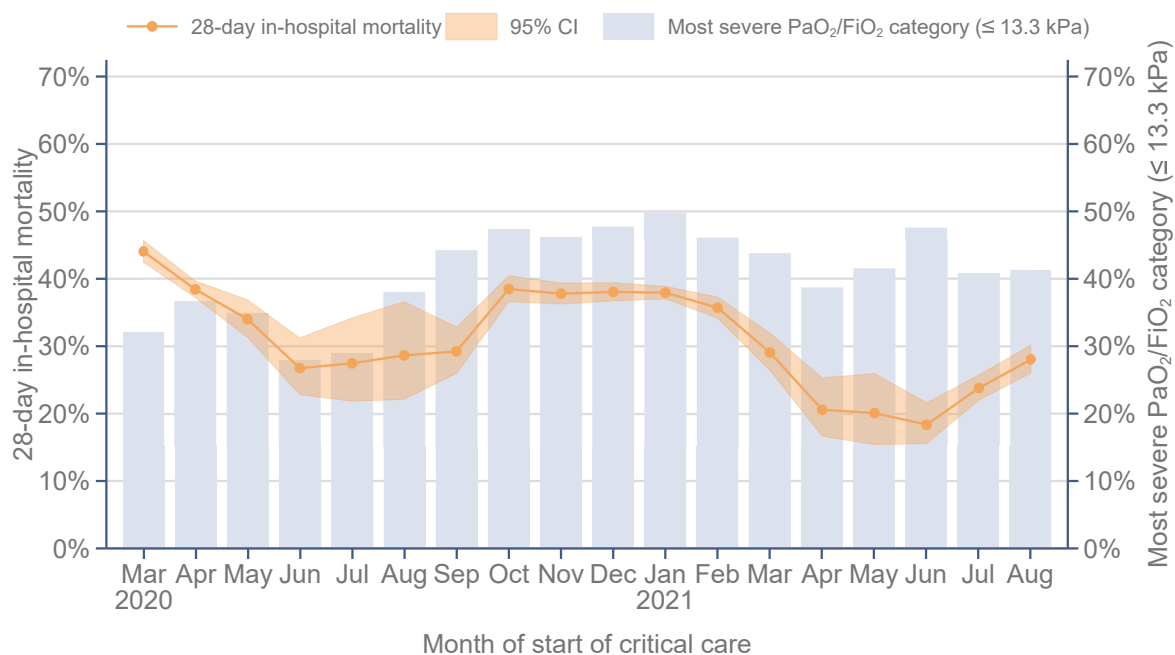


Figure 39. Number of admissions and 28-day in-hospital mortality by month

Number of new admissions and 28-day in-hospital mortality for patients critically ill with confirmed COVID-19 by month of admission to critical care.

Estimates of 28-day in-hospital mortality based on 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 estimates are not adjusted for changes in patient characteristics (see Tables 1-3).

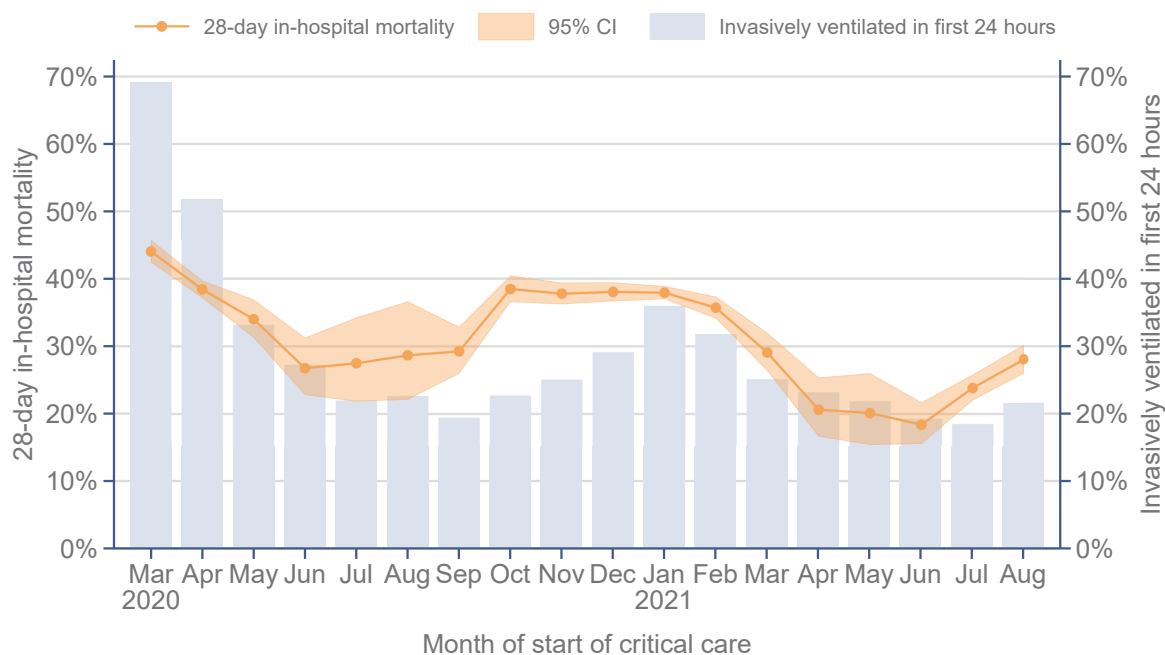


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Figure 40. PaO₂/FiO₂ and 28-day in-hospital mortality by month

Percentage of patients in most severe PaO₂/FiO₂ category (≤ 13.3 kPa) and 28-day in-hospital mortality for patients critically ill with confirmed COVID-19 by month of admission to critical care.

Estimates of 28-day in-hospital mortality based on 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 estimates are not adjusted for changes in patient characteristics (see Tables 1-3).

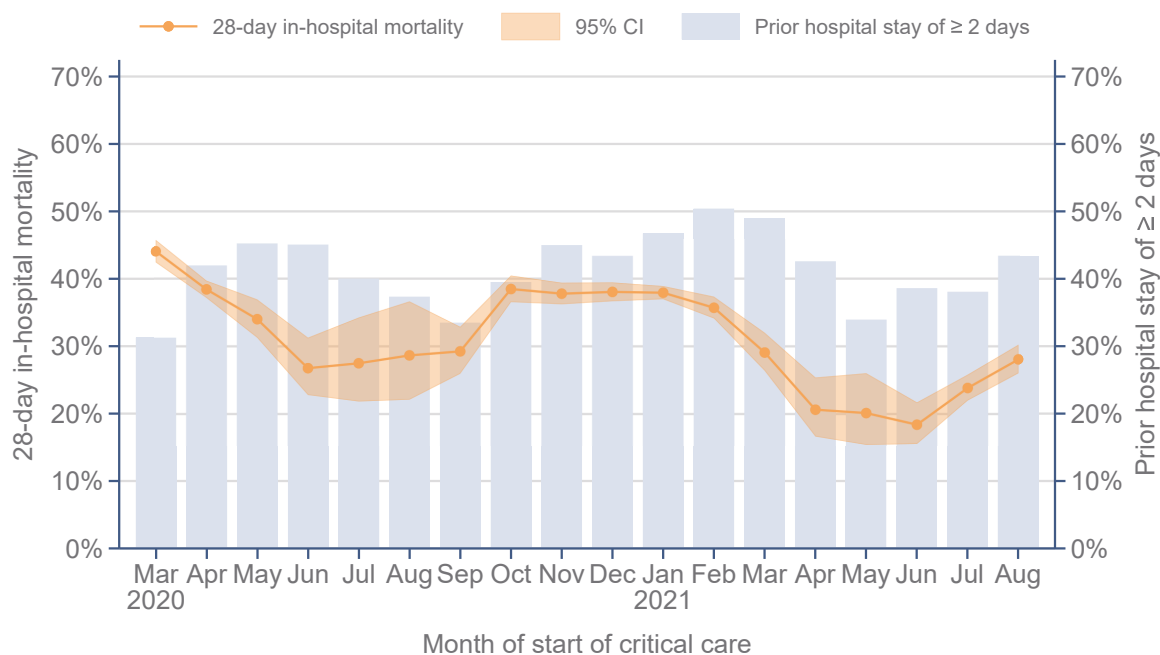


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Figure 41. Invasive ventilation first 24 hours and 28-day in-hospital mortality by month

Percentage of patients receiving invasive ventilation during the first 24 hours in critical care and 28-day in-hospital mortality for patients critically ill with confirmed COVID-19 by month of admission to critical care.

Estimates of 28-day in-hospital mortality based on 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 estimates are not adjusted for changes in patient characteristics (see Tables 1-3).



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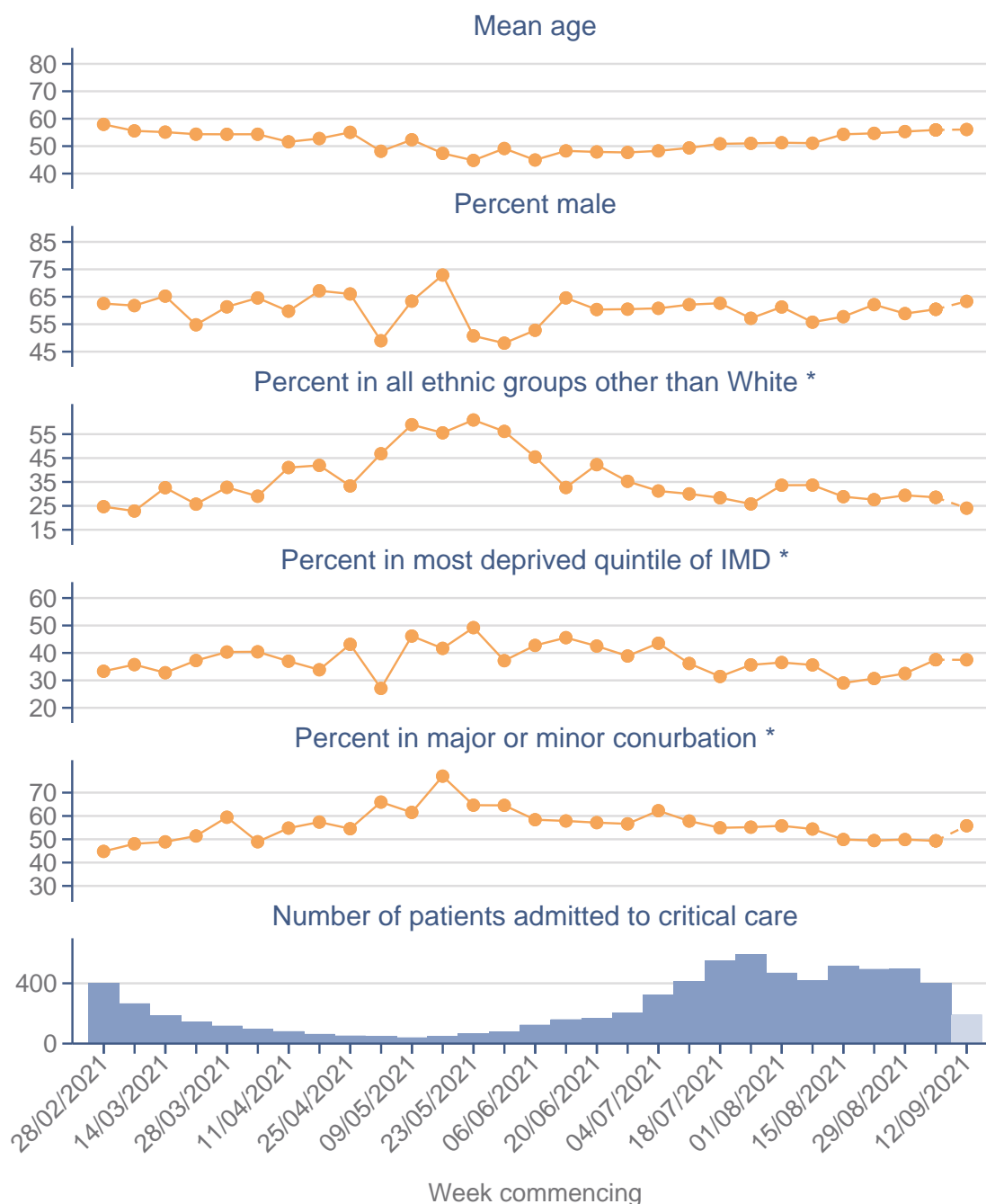
Figure 42. Prior hospital length of stay and 28-day in-hospital mortality by month

Percentage of patients with a hospital stay of 2 or more days before admission to critical care and 28-day in-hospital mortality for patients critically ill with confirmed COVID-19 by month of admission to critical care.

Estimates of 28-day in-hospital mortality based on 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 estimates are not adjusted for changes in patient characteristics (see Tables 1-3).

Weekly trends in recent admissions – COVID-19

Weekly trends in characteristics for patients critically ill with confirmed COVID-19 from 28 February 2021 onwards are shown for key summary statistics in Figures 43-45 and as full distributions in Figures 46-48.

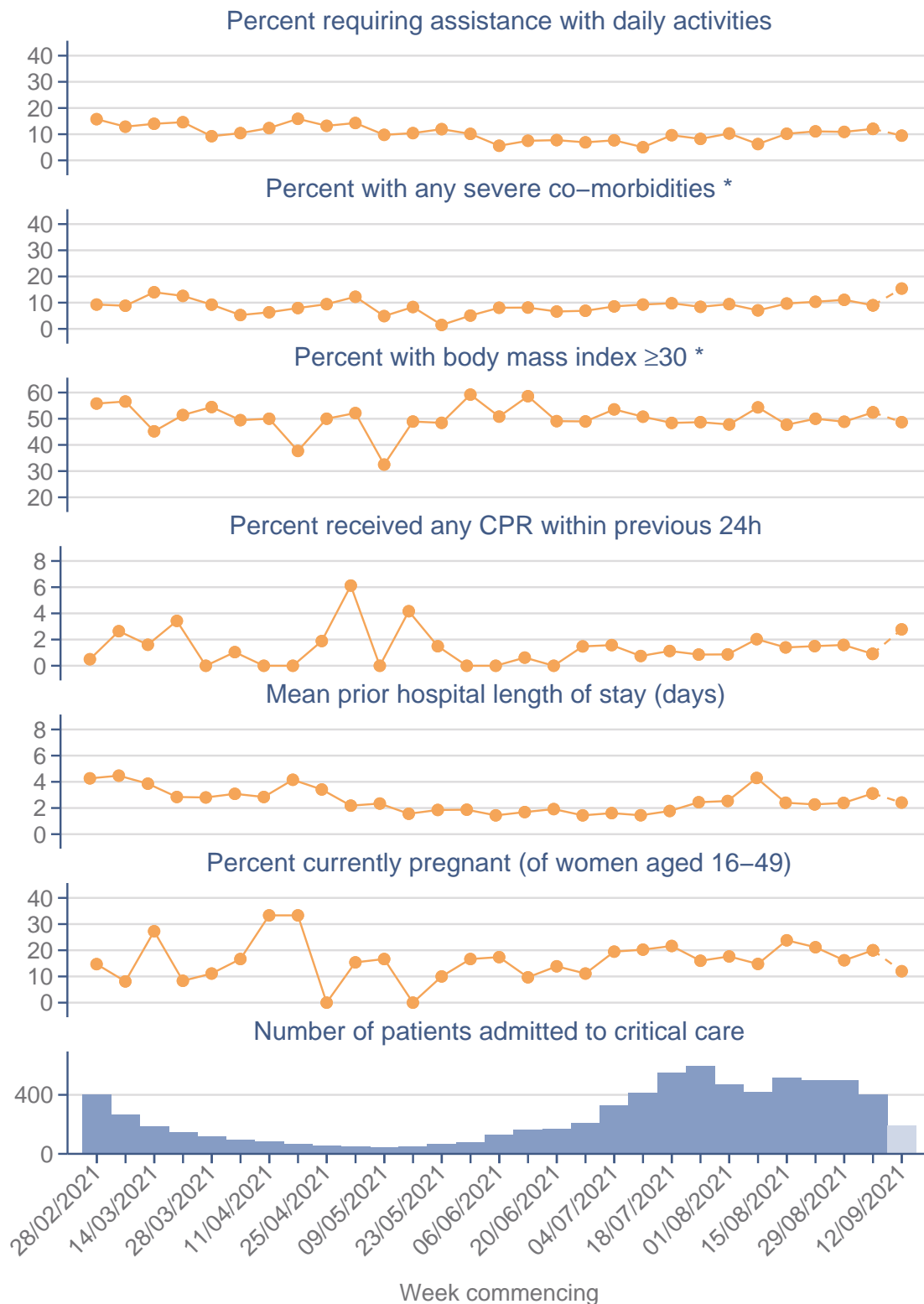


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Figure 43. Weekly trend in patient characteristics (demographics)

Weekly trend in patient characteristics (demographics) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Dashed line and shading indicates incomplete week.

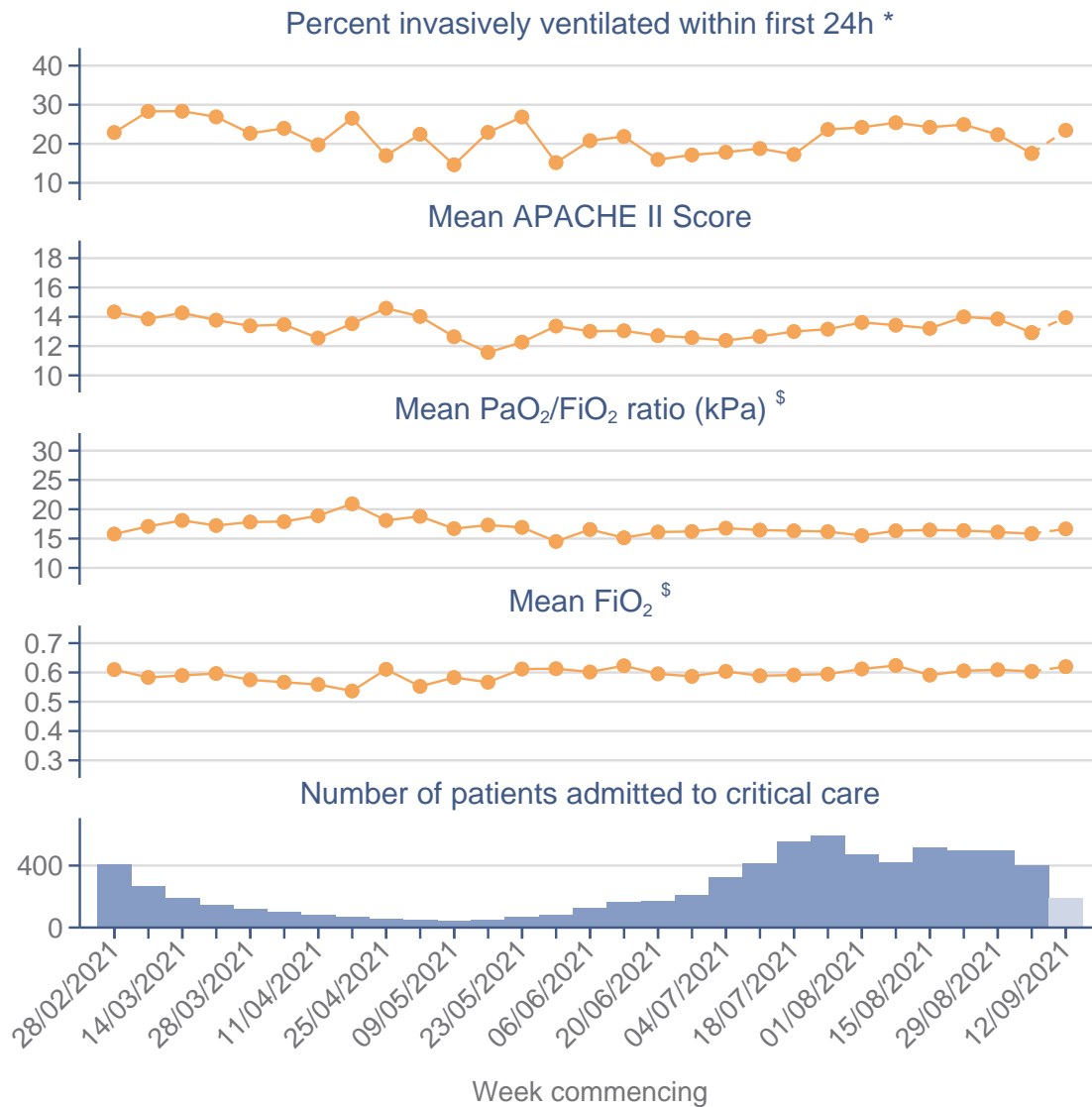


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Figure 44. Weekly trend in patient characteristics (medical history)

Weekly trend in patient characteristics (medical history) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Dashed line and shading indicates incomplete week.



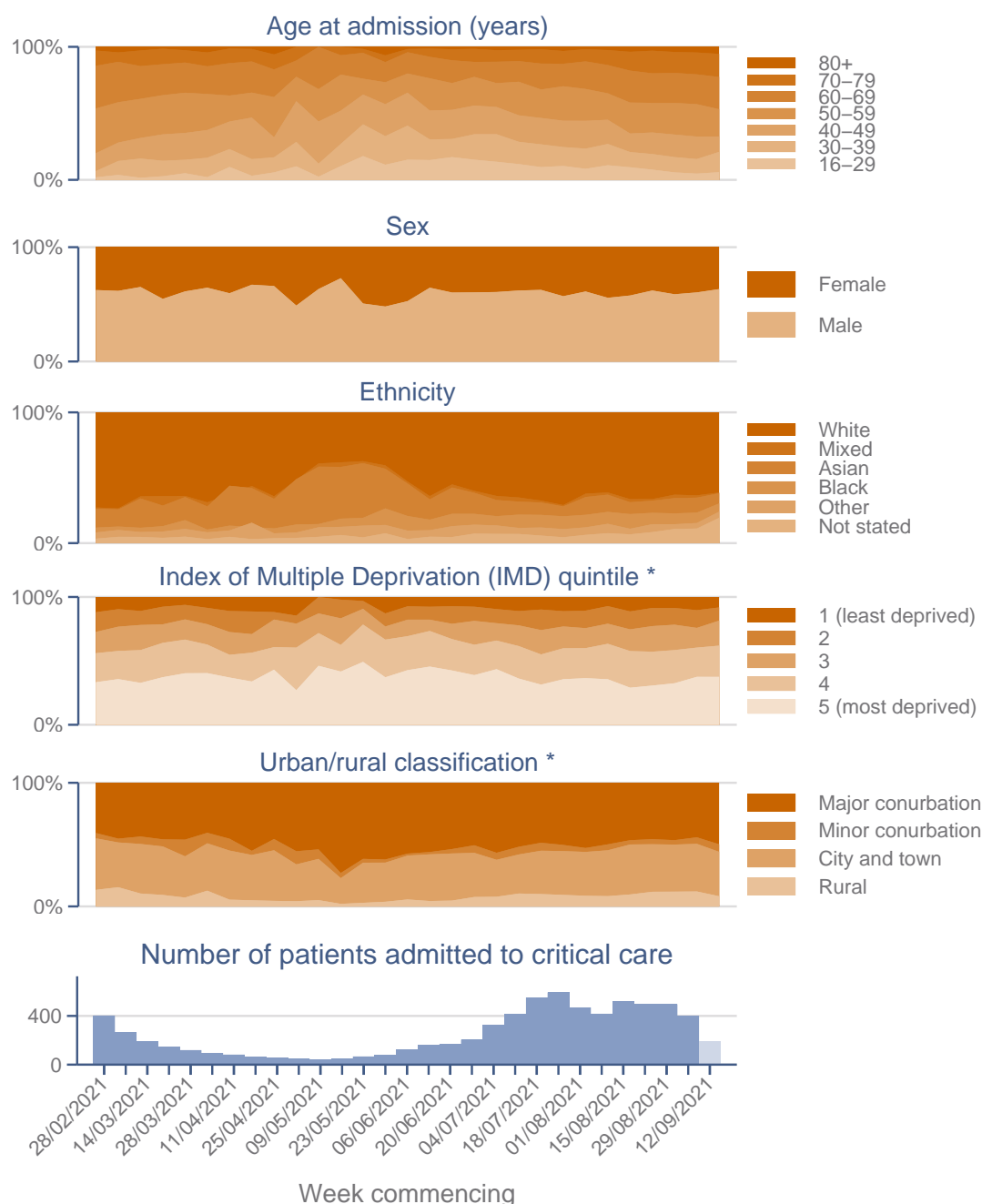
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Figure 45. Weekly trend in patient characteristics (indicators of acute severity)

Weekly trend in patient characteristics (indicators of acute severity) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Dashed line and shading indicates incomplete week.

\$ Derived from the arterial blood gas with the lowest PaO₂ during the first 24 hours of critical care.

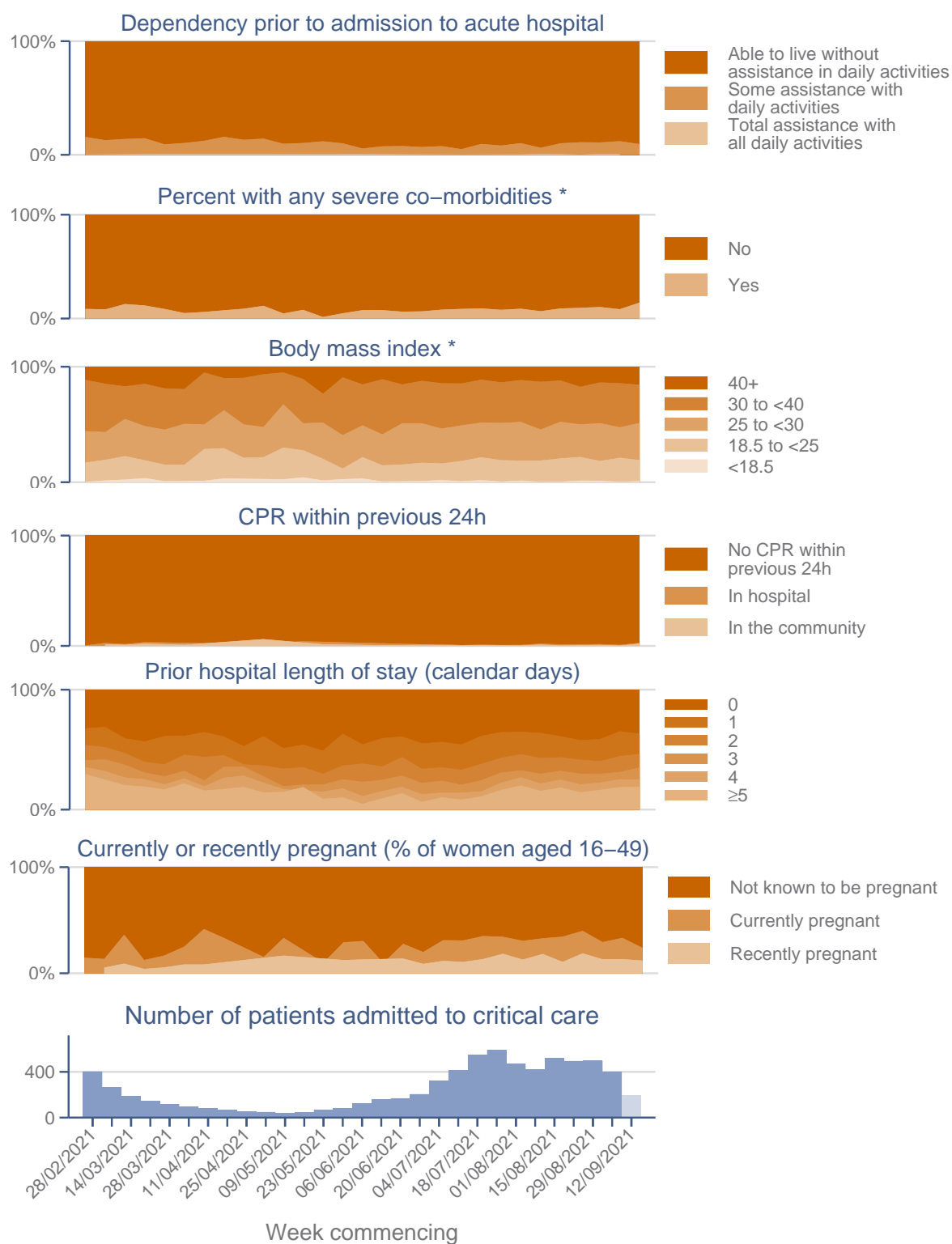


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Figure 46. Weekly trend in patient characteristics (demographics) – distributions

Weekly trend in the distribution of patient characteristics (demographics) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Shading indicates incomplete week.

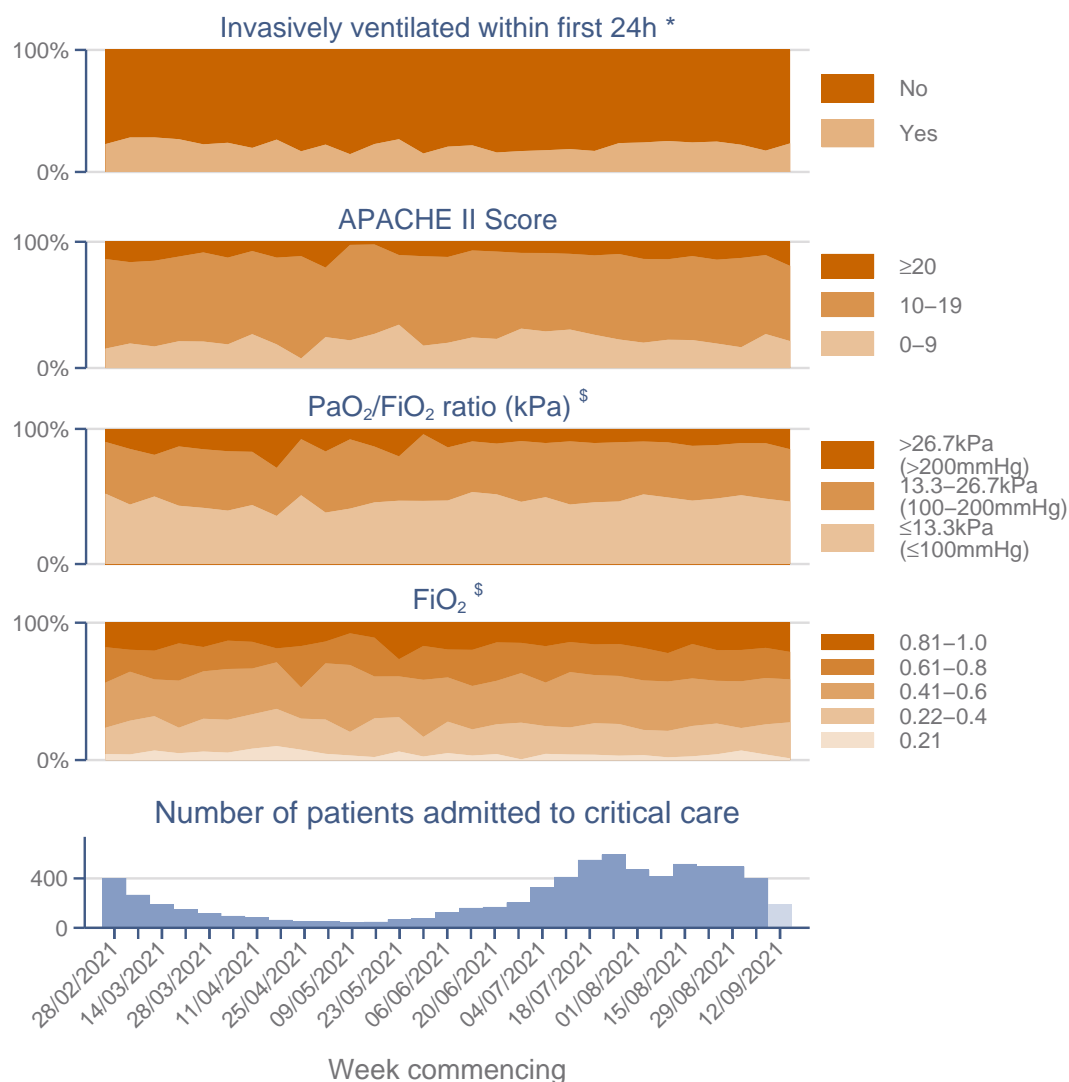


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Figure 47. Weekly trend in patient characteristics (medical history) – distributions

Weekly trend in the distribution of patient characteristics (medical history) for patients critically ill with confirmed COVID-19.

* Please see Definitions on page 65. Shading indicates incomplete week.



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Figure 48. Weekly trend in patient characteristics (indicators of acute severity) – distributions

Weekly trend in the distribution of patient characteristics (indicators of acute severity) for patients critically ill with confirmed COVID-19.

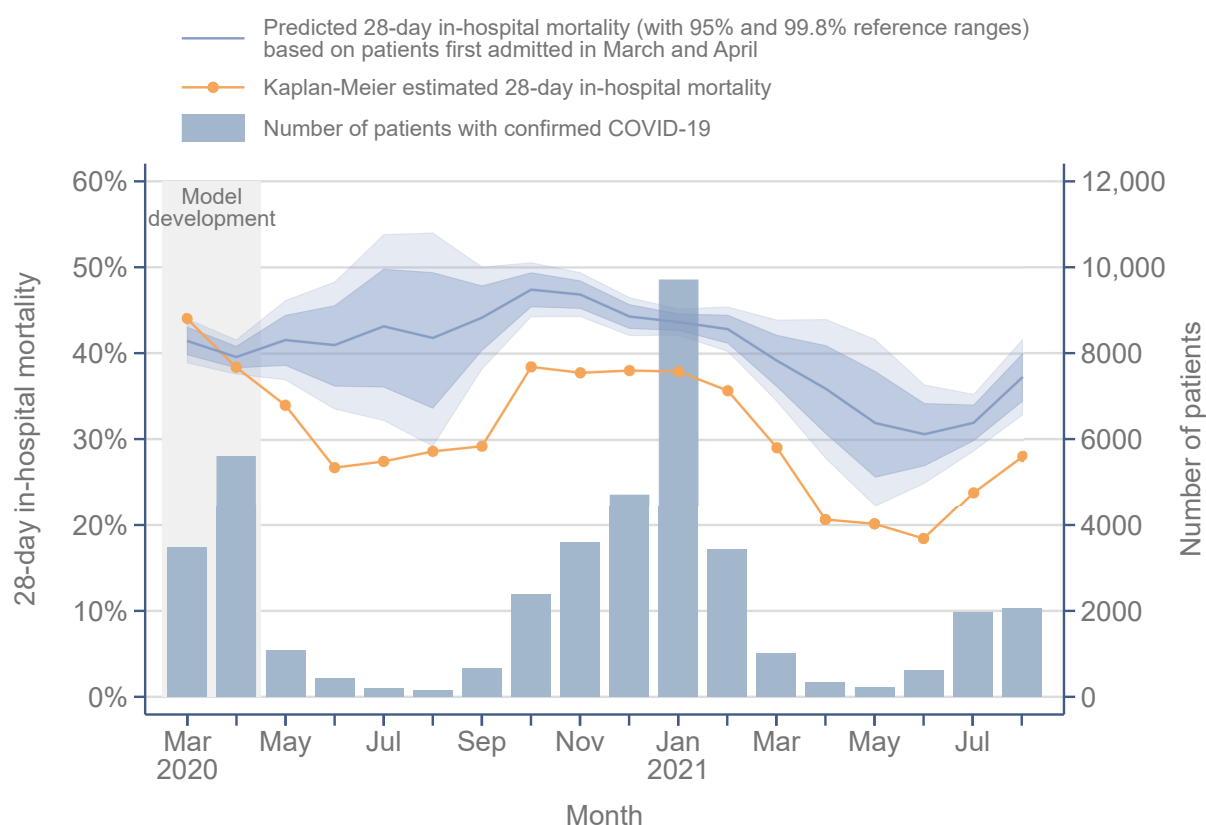
* Please see Definitions on page 65. Shading indicates incomplete week.

§ Derived from the arterial blood gas with the lowest PaO₂ during the first 24 hours of critical care.

Risk-adjusted 28-day in-hospital mortality

Changes in mortality over time may be driven in part by changes in the characteristics of patients admitted to critical care, i.e. their average predicted risk of death at the time of admission (due to illness severity, comorbidities or demographic risk factors). To adjust for changes in the predicted risk of death over time, we developed a risk prediction model for 28-day in-hospital mortality using all patients critically ill with COVID-19 first admitted from 1 March to 30 April 2020 (Ferrando-Vivas et al, 2021). We validated the model using both the same patients and patients admitted from 1 May to 31 August 2020.

Figure 49 shows observed 28-day in-hospital mortality by month compared with predicted 28-day in-hospital mortality based on the characteristics and outcomes of patients admitted during March and April 2020. Although predicted mortality has varied, most recently decreasing substantially as the patients admitted to critical care have become younger on average, the observed mortality has remained lower than predicted since May 2020.



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Figure 49. Risk-adjusted 28-day in-hospital mortality

Kaplan-Meier based estimates of observed 28-day in-hospital mortality for patients critically ill with confirmed COVID-19 compared with predicted mortality from a prediction model developed using data for patients admitted during March and April 2020. If the observed outcomes are as predicted by the model, then we would expect the observed mortality to lie within the 95% reference range 19 times out of 20 and within the 99.8% reference range 998 times out of 1000.

Definitions

Reason for transfer between critical care units is categorised as:

- Comparable critical care: transfer for similar care as provided in the transferring critical care unit
- Repatriation: returning a patient to their original unit, hospital or area
- More-specialist critical care: transfer for specialist critical care not available in the transferring critical care unit

Critical care transfer groups are groups of local critical care units developed to reduce the number of long distance transfers that take place and to ensure that transfers are contained within the critical care network or, by special agreement, between hospitals at the borders of adjacent networks.

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

Urban/rural classification is based on the patient's usual residential postcode (assigned at the level of Output Area) and categorised according to 2011 census categories as:

- Urban: the majority of the population lives within settlements with a population of more than 10,000 people, subcategorised according to dwelling densities for every 100m x 100m square and the density in squares at varying distances around each square as either Major conurbation, Minor conurbation, or City or town
- Rural: the majority of the population lives within settlements with a population of less than 10,000 people (combining the categories Town and fringe, Village, and Hamlet or isolated dwellings)

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

Invasive ventilation during the first 24 hours was defined as mechanical ventilation (identified by the recording of a ventilated respiratory rate, indicating that all or some of the breaths or a portion of the breaths were delivered by a mechanical device) and sedation (receiving continuous or intermittent doses of agents to produce and maintain a continuous decreased level of consciousness with or without paralysing agents) at any time during the first 24 hours and not reported as having zero days of advanced respiratory support.

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 Case Mix Programme data for patients critically ill with confirmed COVID-19, are published, in press or in 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* 2020; doi:[10.1177/1751143720961672](https://doi.org/10.1177/1751143720961672)
- 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* 2020; 46:2035-47. doi:[10.1007/s00134-020-06267-0](https://doi.org/10.1007/s00134-020-06267-0)
- 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* 2021; 49:102-11. doi:[10.1097/CCM.0000000000004740](https://doi.org/10.1097/CCM.0000000000004740)
- Doidge JC, Gould DW, Ferrando-Vivas P, Mouncey PR, Thomas K, Shankar-Hari M, Harrison DA, Rowan KM. Trends in intensive care for patients with COVID-19 in England, Wales and Northern Ireland. *Am J Respir Crit Care Med* 2021; 203:565-74. doi:[10.1164/rccm.202008-3210C](https://doi.org/10.1164/rccm.202008-3210C)
- Ferrando-Vivas P, Doidge J, Thomas K, Gould DW, Mouncey P, Shankar-Hari M, Young JD, Rowan KM, Harrison DA. Development and validation of a prediction model for 28-day in-hospital mortality in critically ill patients with COVID-19. *Preprints.org* 2021; doi:[10.20944/preprints202102.0059.v1](https://doi.org/10.20944/preprints202102.0059.v1)
- Harrison DA, Gould DW, Rowan KM. Potential impact of the UK vaccination strategy on the numbers of patients becoming critically ill with COVID-19. *OSF Preprints* 2021; doi:[10.31219/osf.io/yks8c](https://doi.org/10.31219/osf.io/yks8c)

The following publications, based on external data sources linked with Case Mix Programme data for patients critically ill with confirmed COVID-19, are published, in press or in preprint:

- Hippisley-Cox J, Young D, Coupland C, et al. Risk of severe COVID-19 disease with ACE inhibitors and angiotensin receptor blockers: cohort study including 8.3 million people. *Heart* 2020; 106:1503-11. doi:[10.1136/heartjnl-2020-317393](https://doi.org/10.1136/heartjnl-2020-317393)
- Pairo-Castineira E, Clohisey S, Klaric L, et al. Genetic mechanisms of critical illness in Covid-19. *Nature* 2021; 591:92-8. doi:[10.1038/s41586-020-03065-y](https://doi.org/10.1038/s41586-020-03065-y)
- Forbes H, Morton CE, Bacon S, et al. Association between living with children and outcomes from covid-19: OpenSAFELY cohort study of 12 million adults in England. *BMJ* 2021; 372:n628. doi:[10.1136/bmj.n628](https://doi.org/10.1136/bmj.n628)
- Aveyard P, Gao M, Lindson N, et al. Association between pre-existing respiratory disease and its treatments and severe COVID-19: a population cohort study. *Lancet Respir Med* 2021; doi:[10.1016/S2213-2600\(21\)00095-3](https://doi.org/10.1016/S2213-2600(21)00095-3)
- Mathur R, Rentsch CT, Morton C, et al. Ethnic differences in SARS-CoV-2 infection and COVID-19-related hospitalisation, intensive care unit admission, and death in 17 million adults in England: an observational cohort study using the OpenSAFELY platform. *Lancet* 2021; 397:1711-24. doi:[10.1016/S0140-6736\(21\)00634-6](https://doi.org/10.1016/S0140-6736(21)00634-6)
- Patone M, Thomas K, Hatch R, et al. Mortality and critical care unit admission associated with the SARS-CoV-2 lineage B.1.1.7 in England: an observational cohort study. *Lancet Infect Dis* 2021; doi:[10.1016/S1473-3099\(21\)00318-2](https://doi.org/10.1016/S1473-3099(21)00318-2)

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