



## **Supporting Information**

### **Supplementary results and participants**

**This appendix was part of the submitted manuscript and has been peer reviewed.  
It is posted as supplied by the authors.**

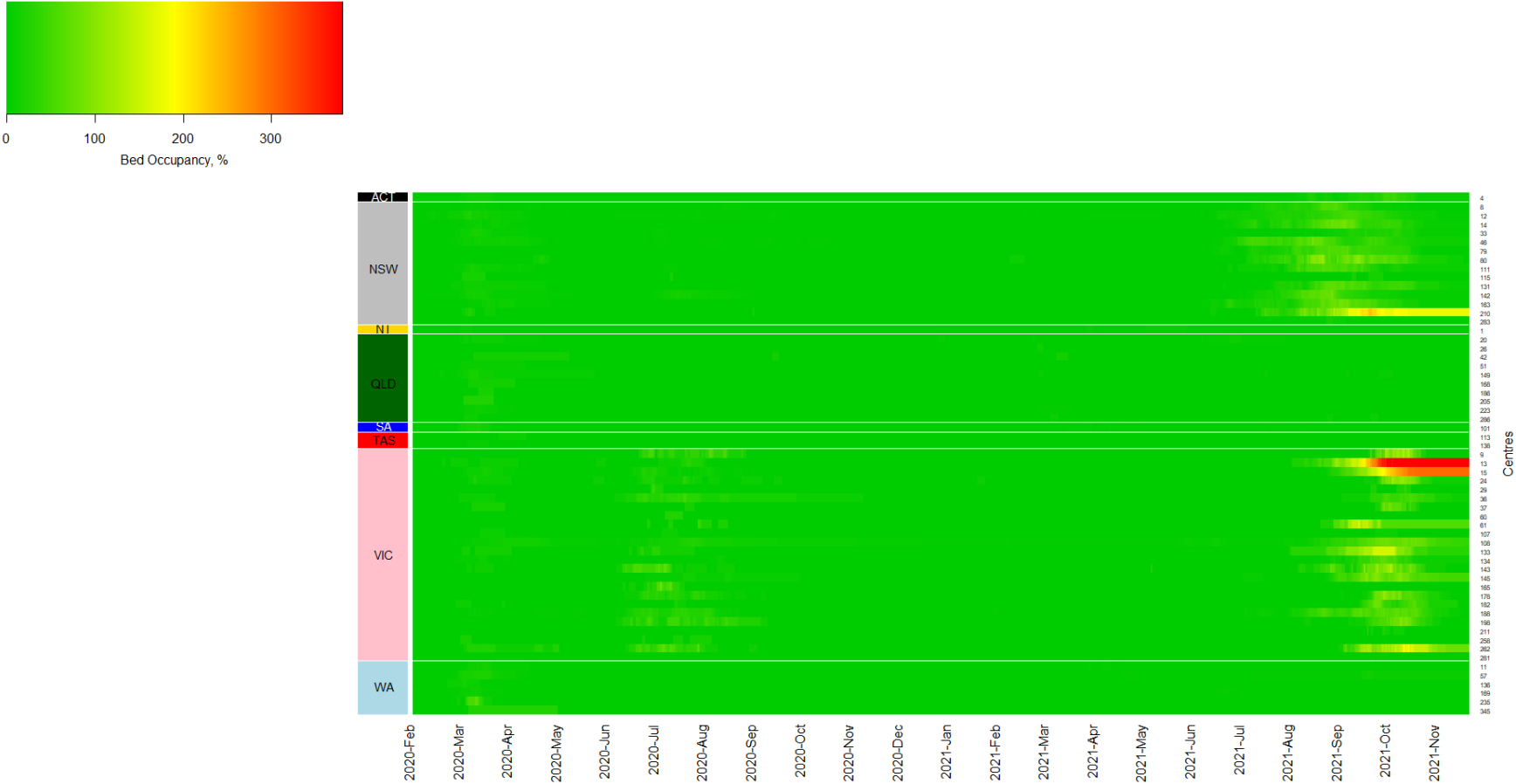
Appendix to: Begum H, Neto AS, Alliegro P, et al. People in intensive care with COVID-19: demographic and clinical features during the first, second, and third pandemic waves in Australia. *Med J Aust* 2022; doi: 10.5694/mja2.51590.

## Supplementary results

**Table 1. Numbers of hospitals that contributed data and patients, by state and COVID-19 wave**

State/territory	Contributing hospitals	Patients			
		All waves	First wave	Second wave	Third wave
ACT	1	32	2	0	30
NSW	14	1268	98	35	1135
NT	1	3	1	2	0
QLD	10	33	17	8	8
SA	1	25	18	4	3
TAS	2	2	2	0	0
VIC	24	1093	47	244	802
WA	6	37	29	3	5
Total	59	2493	214	296	1983

Figure 1. Intensive care unit bed occupancy, by state and intensive care unit: heat map\*



\* For bed occupancy > 100%, more beds were occupied by COVID-19 patients than the total number of beds reported in CHRIS.

**Table 2. Characteristics of patients admitted with COVID-19 to SPRINT-SARI intensive care units, 27 February 2020 – 1 November 2021, and of their admissions: unadjusted rate and median differences between COVID-19 waves\***

Characteristic	Effect estimate (95% CI)		
	Second v first wave	Third v first wave	Third v second wave
Age (years), median (IQR)	<b>MD, -6.00 (-9.26 to -2.74)</b>	<b>MD, -10.0 (-13.0 to -6.98)</b>	<b>MD, -4.00 (-6.21 to -1.79)</b>
Over 65 years	<b>RD, -16.0 (-24.4 to -7.46)</b>	<b>RD, -22.9 (-29.8 to -16.0)</b>	<b>RD, -6.89 (-12.6 to -1.46)</b>
Sex (men)	RD, -7.00 (-15.2 to 1.37)	<b>RD, -8.46 (-14.8 to -1.73)</b>	RD, -1.47 (-7.29 to 4.54)
Body mass index (kg/m <sup>2</sup> )	MD, 1.70 (-0.30 to 3.70)	<b>MD, 2.50 (1.00 to 4.00)</b>	MD, 0.80 (-0.67 to 2.27)
Health care workers	RD, 2.26 (-3.05 to 7.38)	<b>RD, -6.48 (-10.8 to -3.16)</b>	<b>RD, -8.74 (-12.7 to -5.42)</b>
Pregnant (women)	RD, 1.09 (-7.86 to 10.0)	<b>RD, 8.84 (1.40 to 16.3)</b>	<b>RD, 7.75 (1.88 to 13.62)</b>
APACHE II score	MD, -1.00 (-2.35 to 0.35)	MD, -1.00 (-2.05 to 0.05)	MD, -0.00 (-0.89 to 0.89)
Without age component	MD, 0.00 (-1.31 to 1.31)	MD, 0.00 (-1.20 to 1.20)	MD, -0.00 (-1.13 to 1.13)
COVID-19 vaccination	RD, 0.35 (-6.41 to 7.11)	<b>RD, 25.3 (19.9 to 30.7)</b>	<b>RD, 25.0 (19.9 to 30.0)</b>
Co-existing disorders			
Number	MD, -0.00 (-0.89 to 0.89)	MD, -0.00 (-0.89 to 0.89)	MD, 0.00 (0.00 to 0.00)
Diabetes	RD, 5.89 (-2.36 to 14.0)	RD, 1.02 (-5.59 to 7.19)	RD, -4.87 (-10.9 to 0.96)
Obesity	RD, 3.81 (-4.24 to 11.7)	<b>RD, 8.99 (2.43 to 15.0)</b>	RD, 5.19 (-0.84 to 10.9)
ACEi inhibitor/ARB used	<b>RD, -9.81 (-17.4 to -2.33)</b>	<b>RD, -8.06 (-14.7 to -1.95)</b>	RD, 1.75 (-3.35 to 6.35)
Chronic cardiac failure	<b>RD, -8.90 (-15.6 to -2.43)</b>	<b>RD, -8.77 (-14.7 to -3.47)</b>	RD, 0.14 (-4.18 to 3.87)
Smoker	RD, -0.42 (-6.66 to 5.61)	RD, 4.54 (-0.83 to 9.13)	<b>RD, 4.96 (0.27 to 9.09)</b>
Chronic pulmonary disease	RD, -1.41 (-6.61 to 3.51)	RD, -3.42 (-7.92 to 0.18)	RD, -2.01 (-5.69 to 1.00)
Asthma	RD, 5.11 (-0.99 to 11.1)	RD, 0.12 (-4.72 to 4.14)	<b>RD, -4.99 (-9.81 to -0.72)</b>
Immunosuppression	RD, 0.40 (-4.48 to 5.06)	RD, -3.35 (-7.47 to -0.19)	<b>RD, -3.75 (-7.37 to -0.84)</b>
Chronic kidney disease	RD, 1.14 (-3.37 to 5.48)	RD, -0.69 (-4.50 to 2.18)	RD, -1.84 (-5.36 to 1.00)
Chronic hematological disease	RD, -2.98 (-6.68 to 0.14)	<b>RD, -3.14 (-6.64 to -0.67)</b>	RD, -0.16 (-2.26 to 1.23)

Characteristic	Effect estimate (95% CI)		
	Second v first wave	Third v first wave	Third v second wave
Cancer	RD, 2.78 (−0.45 to 6.07)	RD, −0.39 (−2.92 to 1.13)	<b>RD, −3.17 (−6.13 to −0.97)</b>
Signs at hospital admission			
Heart rate (beats/min)	<b>MD, 7.00 (2.57 to 11.4)</b>	MD, 5.00 (1.20 to 8.80)	MD, −2.00 (−5.44 to 1.44)
Respiratory rate (breaths/min)	<b>MD, 4.00 (1.76 to 6.24)</b>	<b>MD, 4.00 (2.53 to 5.47)</b>	MD, 0.00 (−1.74 to 1.74)
Mean arterial pressure (mmHg)	<b>MD, −4.42 (−8.68 to −0.16)</b>	MD, −2.75 (−6.09 to 0.59)	MD, 1.67 (−1.54 to 4.87)
Temperature (°C)	<b>MD, −0.50 (−0.77 to −0.23)</b>	MD, −0.20 (−0.41 to 0.01)	<b>MD, 0.30 (0.06 to 0.54)</b>
Peripheral oxygen saturation (SpO <sub>2</sub> ) (%)	MD, −0.00 (−1.39 to 1.39)	MD, −1.00 (−2.06 to 0.06)	MD, −1.00 (−2.54 to 0.54)
Time between events, median (IQR)			
Symptom onset to hospital admission (days)	MD, 0.57 (−0.54 to 1.69)	MD, 0.43 (−0.31 to 1.16)	MD, −0.14 (−1.01 to 0.72)
Symptom onset to ICU admission (days)	MD, −0.62 (−1.67 to 0.44)	MD, −0.01 (−0.92 to 0.90)	<b>MD, 0.60 (0.04 to 1.17)</b>
Hospital to ICU admission (hours)	MD, −3.07 (−10.6 to 4.41)	MD, 4.94 (−2.54 to 12.4)	<b>MD, 8.00 (4.63 to 11.38)</b>
Between consecutive admissions (same ICU) (hours)	MD, 13.4 (−6.50 to 33.3)	<b>MD, −51.6 (−66.4 to −36.9)</b>	<b>MD, −65.0 (−79.4 to −50.6)</b>
ICU admission to intubation (days)	MD, −0.00 (−0.30 to 0.30)	MD, −0.00 (−0.27 to 0.27)	MD, 0.00 (−0.09 to 0.09)

APACHE: Acute Physiology and Chronic Health Evaluation; ACEi: angiotensin converting enzyme inhibitor; ARB: angiotensin II receptor blocker; COVID-19 = coronavirus disease 2019; ICU: intensive care unit; MD: median difference; RD: risk difference (percentage points). **Bold:** Statistically significant.

\* Univariable models without random effects.

**Table 3. Interventions and complications, by COVID-19 wave (unadjusted analyses)**

Characteristic	Risk difference, percentage points (95% confidence interval)		
	Second v first wave	Third v first wave	Third v second wave
<b>Drugs</b>			
Antibiotics	-2.36 (-7.77 to 3.26)	<b>-15.3 (-20.7 to -9.45)</b>	<b>-12.9 (-18.3 to -7.34)</b>
Steroids	<b>63.0 (55.7 to 69.7)</b>	<b>65.8 (59.2 to 72.0)</b>	2.82 (-0.04 to 6.37)
Hydroxychloroquine	<b>-16.8 (-22.5 to -11.8)</b>	<b>-16.8 (-22.5 to -11.9)</b>	-0.00 (-1.31 to 1.19)
Remdesivir	<b>50.4 (44.4 to 56.4)</b>	<b>11.2 (6.37 to 16.0)</b>	<b>-39.2 (-43.6 to -34.9)</b>
Tocilizumab	1.01 (-4.08 to 6.11)	<b>11.8 (7.70 to 15.9)</b>	<b>10.8 (7.08 to 14.5)</b>
Baricitinib	0.33 (-6.66 to 7.34)	<b>64.7 (58.9 to 70.5)</b>	<b>64.4 (58.9 to 69.8)</b>
Neutralising antibodies	0.00 (-2.16 to 2.16)	<b>4.84 (2.58 to 7.09)</b>	<b>4.84 (2.38 to 7.29)</b>
<b>Organ support</b>			
High-flow nasal cannula	<b>26.5 (17.6 to 35.0)</b>	<b>35.9 (28.74 to 42.9)</b>	<b>9.45 (3.81 to 15.4)</b>
Non-invasive ventilation	<b>7.67 (2.02 to 13.2)</b>	<b>34.6 (29.8 to 38.6)</b>	<b>26.9 (21.8 to 31.6)</b>
Invasive ventilation	<b>-8.82 (-17.6 to 0.02)</b>	<b>-8.39 (-15.3 to -1.27)</b>	0.43 (-5.87 to 6.72)
Inotropic or vasopressor agent	<b>-13.0 (-21.9 to -3.89)</b>	<b>-12.1 (-19.2 to -4.78)</b>	0.86 (-5.57 to 7.21)
Neuromuscular blocking agent	<b>-11.3 (-20.0 to -2.41)</b>	<b>-15.1 (-22.8 to -7.49)</b>	-3.87 (-10.6 to 2.64)
Prone positioning	7.32 (-1.14 to 15.6)	<b>35.0 (28.1 to 41.4)</b>	<b>27.7 (21.4 to 33.7)</b>
Prone (not on invasive ventilation)	<b>15.4 (9.70 to 21.1)</b>	<b>36.1 (31.8 to 39.8)</b>	<b>20.7 (15.2 to 25.9)</b>
Invasive prone	-5.55 (-13.0 to 1.71)	4.99 (-1.44 to 10.9)	<b>10.5 (5.25 to 15.4)</b>
Renal replacement therapy	-4.65 (-10.4 to 0.73)	<b>-5.31 (-10.4 to -1.04)</b>	-0.66 (-4.40 to 2.44)
Tracheostomy	1.82 (-2.98 to 6.44)	0.42 (-3.60 to 3.55)	-1.40 (-5.17 to 1.75)
Extracorporeal membrane oxygenation	2.77 (-0.13 to 5.79)	<b>3.48 (1.10 to 5.11)</b>	0.71 (-2.19 to 2.96)
<b>Complications</b>			
Bacterial pneumonia	-5.77 (-13.4 to 1.64)	<b>12.3 (5.65 to 18.4)</b>	<b>18.09 (12.6 to 23.1)</b>

Characteristic	Risk difference, percentage points (95% confidence interval)		
	Second v first wave	Third v first wave	Third v second wave
Bacteraemia	-5.84 (-12.1 to 0.06)	<b>-6.36 (-11.9 to -1.60)</b>	-0.52 (-4.56 to 2.89)
Stroke	-0.77 (-3.27 to 1.19)	-0.20 (-2.62 to 1.18)	0.57 (-0.85 to 2.00)
Arrhythmia	-6.24 (-13.0 to 0.24)	<b>-10.5 (-16.4 to -5.39)</b>	<b>-4.28 (-8.69 to -0.50)</b>
Barotrauma*	-2.30 (-6.65 to 1.60)	-0.41 (-4.44 to 2.65)	1.89 (-1.04 to 4.17)
Cardiac arrest	-0.53 (-3.39 to 1.91)	-0.00 (-2.69 to 1.66)	0.53 (-1.50 to 1.89)
Pulmonary embolism	1.02 (-3.08 to 4.83)	<b>4.61 (0.92 to 7.34)</b>	<b>3.59 (0.29 to 6.27)</b>
Deep vein thrombosis	-4.70 (-9.84 to -0.18)	<b>-5.23 (-10.0 to -1.54)</b>	-0.53 (-3.48 to 1.70)
Myocarditis	-5.11 (-11.1 to 0.46)	<b>-10.4 (-15.8 to -6.05)</b>	<b>-5.30 (-8.92 to -2.43)</b>

\* Defined as pneumothorax or pneumomediastinum or subcutaneous emphysema (chest X-ray or computed tomography).

**Bold:** Statistically significant.

**Table 4. Interventions and complications, by COVID-19 wave: risk differences (adjusted analyses)\***

Characteristic	Risk difference, percentage points (95% confidence interval)		
	Second v first wave	Third v first wave	Third v second wave
Drugs			
Antibiotics	-7.44 (-18.2 to 3.33)	-1.06 (-14.2 to 12.1)	8.78 (-3.24 to 20.8)
Steroids	<b>66.0 (60.6 to 71.4)</b>	<b>67.4 (62.4 to 72.5)</b>	0.75 (-2.84 to 4.34)
Hydroxychloroquine	<b>-10.3 (-14.4 to -6.13)</b>	<b>-11.6 (-15.9 to -7.37)</b>	0.40 (-1.15 to 1.95)
Remdesivir	<b>59.3 (47.0 to 71.6)</b>	<b>37.4 (21.0 to 53.7)</b>	-17.1 (-32.1 to -2.03)
Tocilizumab	9.45 (-0.32 to 19.2)	<b>29.3 (17.9 to 40.7)</b>	<b>19.7 (9.49 to 29.9)</b>
Baricitinib	-9.18 (-21.5 to 3.10)	<b>47.9 (32.5 to 63.3)</b>	<b>57.3 (43.2 to 71.3)</b>
Neutralising antibodies	-0.25 (-2.59 to 2.09)	2.00 (-1.11 to 5.10)	2.35 (-0.85 to 5.54)
Organ support			
High-flow nasal cannula	<b>25.3 (16.1 to 34.5)</b>	<b>35.1 (26.6 to 43.7)</b>	<b>9.44 (2.09 to 16.8)</b>
Non-invasive ventilation	2.44 (-9.63 to 14.5)	<b>30.5 (17.9 to 43.0)</b>	<b>28.3 (17.2 to 39.4)</b>
Invasive ventilation	<b>-16.6 (-29.0 to -3.91)</b>	-9.63 (-22.0 to 2.50)	5.88 (-5.73 to 17.8)
Inotropic or vasopressor agent	-5.24 (-10.9 to 0.43)	-2.42 (-7.68 to 2.83)	2.63 (-1.96 to 7.22)
Neuromuscular blocking agent	-6.63 (-14.7 to 1.49)	-5.03 (-14.6 to 4.51)	1.34 (-7.71 to 10.4)
Prone positioning	9.45 (-1.47 to 20.4)	<b>29.4 (19.1 to 39.7)</b>	<b>19.7 (10.5 to 28.8)</b>
Prone (not on invasive ventilation)	<b>18.1 (7.97 to 28.2)</b>	<b>30.4 (20.9 to 40.0)</b>	<b>11.9 (3.06 to 20.7)</b>
Invasive prone	0.23 (-7.44 to 7.90)	<b>8.19 (1.09 to 15.3)</b>	<b>9.03 (3.08 to 15.0)</b>
Renal replacement therapy	-1.68 (-7.47 to 4.11)	-1.74 (-7.11 to 3.63)	-0.53 (-5.20 to 4.14)
Tracheostomy	4.42 (-1.68 to 10.5)	5.73 (-0.12 to 11.6)	1.62 (-3.57 to 6.81)
Extracorporeal membrane oxygenation	<b>5.38 (0.21 to 10.6)</b>	4.24 (-0.83 to 9.32)	-1.62 (-6.07 to 2.83)
Complications			
Bacterial pneumonia	-9.44 (-19.0 to 0.09)	3.78 (-5.02 to 12.6)	<b>13.4 (5.42 to 21.4)</b>



Characteristic	Risk difference, percentage points (95% confidence interval)		
	Second v first wave	Third v first wave	Third v second wave
Bacteraemia	-3.06 (-10.3 to 4.23)	-2.74 (-9.87 to 4.39)	-0.87 (-6.05 to 4.31)
Stroke	-0.99 (-3.41 to 1.42)	-0.22 (-2.45 to 2.01)	0.80 (-1.05 to 2.65)
Arrhythmia	-6.13 (-12.9 to 0.59)	<b>-6.96 (-13.2 to -0.71)</b>	-1.04 (-6.15 to 4.08)
Barotrauma <sup>†</sup>	-2.11 (-7.13 to 2.90)	0.07 (-4.57 to 4.72)	2.17 (-1.80 to 6.15)
Cardiac arrest	-0.46 (-3.52 to 2.59)	0.18 (-2.65 to 3.02)	0.91 (-1.51 to 3.33)
Pulmonary embolism	0.76 (-5.80 to 7.31)	5.27 (-1.00 to 11.54)	4.45 (-0.90 to 9.80)
Deep vein thrombosis	-3.43 (-8.11 to 1.24)	-2.97 (-7.31 to 1.36)	0.46 (-3.15 to 4.08)
Myocarditis	-2.09 (-6.22 to 2.04)	<b>-7.38 (-11.2 to -3.55)</b>	<b>-5.38 (-8.32 to -2.44)</b>

\* All models adjusted for age, body mass index, APACHE II, number of co-existing disorders, time from hospital to ICU admission, use of mechanical ventilation, number of patients admitted per month; ICUs and week of admission treated as random effects. **Bold:** Statistically significant.

† Defined as pneumothorax or pneumomediastinum or subcutaneous emphysema (chest X-ray or computed tomography).

**Table 5. Clinical outcomes: unadjusted analyses**

Characteristic	Second v first wave		Third v first wave		Third v second wave	
	Effect estimate (95% CI)	<i>P</i>	Effect estimate (95% CI)	<i>P</i>	Effect estimate (95% CI)	<i>P</i>
Duration of ventilation, days	<b>MD, -4.00 (-6.12 to -1.87)</b>	< 0.001	<b>MD, -2.00 (-3.70 to -0.29)</b>	0.021	<b>MD, 2.00 (0.33 to 3.66)</b>	0.018
ICU length of stay, days	MD, -2.39 (-5.12 to 0.35)	0.09	MD, -2.26 (-4.75 to 0.23)	0.08	MD, 0.13 (-1.15 to 1.42)	0.84
	<b>SHR, 1.40 (1.17–1.66)</b>	< 0.001	<b>SHR, 1.22 (1.06–1.40)</b>	0.004	<b>SHR, 0.87 (0.77–0.99)</b>	0.045
Hospital length of stay, days	MD, -3.22 (-6.77 to 0.33)	0.08	<b>MD, -4.02 (-7.24 to -0.79)</b>	0.014	MD, -0.79 (-2.50 to 0.91)	0.36
	<b>SHR, 1.27 (1.07–1.51)</b>	0.006	<b>SHR, 1.16 (1.01–1.33)</b>	0.037	SHR, 0.91 (0.80–1.03)	0.15
ICU mortality	RD, -3.94 (-9.94 to 1.73)	0.18	RD, -0.31 (-5.63 to 4.24)	0.90	RD, 3.63 (-0.43 to 7.16)	0.06
Hospital mortality	RD, -2.22 (-8.35 to 3.64)	0.47	RD, 2.77 (-2.60 to 7.41)	0.28	<b>RD, 4.99 (0.62 to 8.84)</b>	0.017

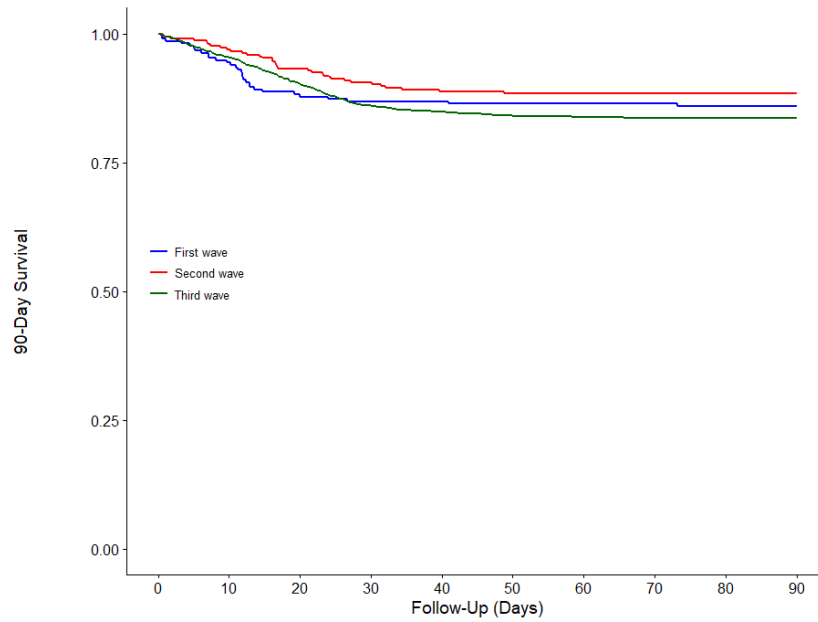
SHR: sub-distribution hazard ratio; RD: risk difference (percentage points); MD: median difference. **Bold:** Statistically significant.

**Table 6. Clinical outcomes: adjusted analyses**

Characteristic	Second v first wave		Third v first wave		Third v second wave	
	Effect estimate (95% CI)	<i>P</i>	Effect estimate (95% CI)	<i>P</i>	Effect estimate (95% CI)	<i>P</i>
Duration of ventilation, days	<b>MD, -3.90 (-6.80 to -1.00)</b>	0.008	MD, 0.05 (-2.73 to 2.82)	0.97	<b>MD, 3.98 (0.82 to 7.14)</b>	0.014
ICU length of stay	SHR, 1.29 (0.92–1.82)	0.14	SHR, 0.80 (0.55–1.15)	0.22	<b>SHR, 0.60 (0.47–0.76)</b>	< 0.001
Hospital length of stay	SHR, 1.03 (0.81–1.31)	0.83	<b>SHR, 0.67 (0.52–0.85)</b>	0.001	<b>SHR, 0.64 (0.50–0.83)</b>	< 0.001
ICU mortality	RD, 5.29 (-1.66 to 12.2)	0.13	<b>RD, 7.55 (1.14 to 13.9)</b>	0.022	RD, 2.17 (-3.62 to 8.04)	0.46
Hospital mortality	RD, 6.62 (-0.20 to 14.1)	0.09	<b>RD, 9.60 (3.52 to 16.7)</b>	0.017	RD, 2.93 (-3.65 to 9.45)	0.40

SHR: sub-distribution hazard ratio; RD: risk difference (percentage points); MD: median difference. **Bold:** Statistically significant.

**Figure 2. Patients with COVID-19 admitted to SPRINT-SARI intensive care units, 9 March 2020 – 30 October 2021: hospital survival to 90 days**



	No. at Risk									
	0	10	20	30	40	50	60	70	80	90
First wave	213	201	188	185	185	184	184	184	183	183
Second wave	295	286	275	267	262	261	261	261	261	261
Third wave	1656	1580	1495	1425	1405	1393	1388	1386	1386	1386

**Table 7. In-hospital mortality: full multivariable model**

	<b>Risk difference (95% CI)</b>	<b>P</b>
Wave		
First	Reference	
Second	6.62 (-0.16 to 14.0)	0.09
Third	9.60 (3.53 to 16.7)	0.017
Age	8.25 (6.30 to 10.1)	< 0.001
Body mass index	-0.41 (-1.98 to 1.25)	0.62
APACHE II	7.78 (5.76 to 9.95)	< 0.001
Number of comorbid conditions		
0	Reference	
1	0.17 (-4.29 to 4.62)	0.94
2	-0.31 (-5.19 to 4.67)	0.90
≥ 3	9.91 (4.62 to 15.3)	< 0.001
Time between hospital and ICU admission	0.78 (-0.52 to 2.11)	0.25
Use of invasive ventilation	13.9 (10.3 to 17.6)	< 0.001
Number of admissions per center per month	1.39 (-0.70 to 4.26)	0.29
Hours between consecutive admissions	0.54 (-0.98 to 2.08)	0.49

The hospital and the week of admission were included as random effects.

E-value for second wave estimate: 3.12; E-value for third wave estimate: 4.49.

Random effects variance and standard deviation: centre: 0.005 (0.069); weeks: 0.000 (0.019).

**Table 8. Hospital mortality: sensitivity analyses, by imputation strategy\***

	Worst case scenario		Best case scenario		Multiple imputation	
	Risk difference (95% CI)	<i>P</i>	Risk difference (95% CI)	<i>P</i>	Risk difference (95% CI)	<i>P</i>
<b>Unadjusted analysis</b>						
First wave	Reference		Reference		Reference	
Second wave	-2.32 (-8.50 to 3.59)	0.49	-2.19 (-8.30 to 3.64)	0.47	-2.96 (-10.4 to 4.50)	0.44
Third wave	15.6 (10.1 to 20.4)	< 0.001	0.15 (-5.12 to 4.66)	0.95	1.06 (-5.94 to 8.06)	0.77
<b>Adjusted analysis*</b>						
First wave	Reference		Reference		Reference	
Second wave	6.94 (-0.63 to 14.6)	0.10	6.37 (-0.99 to 13.8)	0.10	5.72 (-0.56 to 12.0)	0.07
Third wave	13.7 (6.48 to 20.9)	0.003	8.27 (1.12 to 15.3)	0.032	10.5 (4.43 to 16.6)	< 0.001

HR: hazard ratio.

\* Missing data are summarised in table 9. For the worst case and best case scenarios, only the outcome was imputed; for the worst case scenario patients with missing outcomes data were classified as dead, in the best case scenario as alive. For multiple imputation, the outcome and the covariates were imputed, categorical variables by logistic regression and continuous variables by predictive mean matching. All models were adjusted by age, body mass index, APACHE II, number of co-existing disorders, time from hospital to ICU admission, use of mechanical ventilation, number of patients admitted per month and centers and week of admission as random effects.

**Table 9. Missing data**

Characteristic	First wave	Second wave	Third wave
	214	296	1780
Age	0	0	0
Sex	0	0	1 (0.1%)
APACHE II	3 (1%)	22 (7.4%)	470 (23.7%)
Days from symptoms to hospital admission	12 (5.6%)	20 (6.8%)	356 (18.0%)
Days from symptoms to ICU admission	12 (5.6%)	20 (6.8%)	364 (18.4%)
Body mass index	15 (7.0%)	51 (17%)	673 (33.9%)
Healthcare worker*	11 (5.1%)	20 (6.8%)	1199 (60.5%)
Vaccination status	0	7 (2%)	291 (14.7%)
Co-existing disorders			
Diabetes	0	16 (5.4%)	345 (17.4%)
Obesity	4 (2%)	24 (8.1%)	385 (19.4%)
Use of ACEi or ARB	10 (4.7%)	22 (7.4%)	359 (18.1%)
Chronic cardiac failure	5 (2%)	19 (6.4%)	350 (17.7%)
Smoker*	8 (4%)	28 (9.5%)	396 (20.0%)
Chronic pulmonary disease	4 (2%)	21 (7.1%)	348 (17.5%)
Asthma	5 (2%)	21 (7.1%)	349 (17.6%)
Immunosuppression	5 (2%)	19 (6.4%)	363 (18.3%)
Chronic kidney disease	4 (2%)	19 (6.4%)	350 (17.7%)
Chronic hematological disease	5 (2%)	19 (6.4%)	346 (17.4%)
Cancer	5 (2%)	19 (6.4%)	347 (17.5%)
Signs at hospital admission			
Heart rate*	11 (5.1%)	24 (8.1%)	1358 (68.5%)
Respiratory rate*	11 (5.1%)	31 (10%)	1356 (68.4%)
Mean arterial pressure*	12 (5.6%)	22 (7.4%)	1355 (68.3%)
Temperature*	12 (5.6%)	24 (8.1%)	1350 (68.1%)
SpO <sub>2</sub> *	12 (5.6%)	40 (13.5%)	1360 (68.6%)
Drugs			
Antibiotics*	13 (6.1%)	22 (7.4%)	1533 (77.3%)
Steroids	13 (6.1%)	16 (5.4%)	501 (25.3%)
Hydroxychloroquine*	14 (6.5%)	22 (7.4%)	1535 (77.4%)
Remdesivir	0	0	0
Tocilizumab	0	0	0
Baricitinib	0	0	850 (42.9%)
Neutralising antibodies	0	0	1735 (87.5%)
Organ support*			
High-flow nasal cannula	11 (5.1%)	19 (6.4%)	448 (22.6%)
Non-invasive ventilation	10 (4.7%)	23 (7.8%)	449 (22.6%)
Invasive ventilation	0	11 (3.7%)	407 (20.5%)
Inotropic or vasopressor	11 (5.1%)	23 (7.8%)	466 (23.5%)
Neuromuscular blocking agent**	11 (5.1%)	24 (8.1%)	1343 (67.7%)
Prone positioning	11 (5.1%)	22 (7.4%)	450 (22.7%)
Prone (not on invasive ventilation)	0	15 (5.1%)	408 (20.6%)
Invasive prone	2 (0.9%)	15 (5.1%)	427 (21.5%)
Renal replacement therapy	11 (5.1%)	22 (7.4%)	470 (23.7%)
Tracheostomy	1 (0.5%)	10 (3.4%)	353 (17.8%)
Extracorporeal membrane oxygenation	1 (0.5%)	9 (3%)	346 (17.4%)
Development of complications			
Bacterial pneumonia	18 (8.4%)	40 (14%)	543 (27.4%)
Bacteremia	18 (8.4%)	28 (9.5%)	549 (27.7%)

Characteristic	First wave	Second wave	Third wave
	214	296	1780
Stroke	16 (7.5%)	26 (8.8%)	541 (27.3%)
Arrhythmia	15 (7.0%)	26 (8.8%)	543 (27.4%)
Barotrauma	15 (7.0%)	28 (9.5%)	542 (27.3%)
Cardiac arrest	16 (7.5%)	27 (9.1%)	546 (27.5%)
Pulmonary embolism	32 (15%)	29 (9.8%)	541 (27.3%)
Deep vein thrombosis	32 (15%)	27 (9.1%)	550 (27.7%)
Myocarditis	31 (14%)	28 (9.5%)	551 (27.8%)
Clinical outcomes			
Duration of ventilation	0	0	0
ICU length of stay	1 (0.5%)	0	258 (13.0%)
Hospital length of stay	1 (0.5%)	1 (0.3%)	314 (15.8%)
ICU mortality	1 (0.5%)	0	189 (9.5%)
Hospital mortality	1 (0.5%)	1 (0.3%)	316 (15.9%)

\* Data collection stopped from 11 October 2021.

\*\* Data collection stopped from 29 March 2021.

APACHE II: Acute Physiology and Chronic Health Evaluation II; ACEi: Angiotensin-converting enzyme inhibitors; ARB: angiotensin receptor blockers; SpO<sub>2</sub>: oxygen saturation.

## The SPRINT-SARI Australia investigators

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Alice Springs Hospital (**Paul Secombe**, Shan Cairnes, Elizabeth Matthews)  
Angliss Hospital, Upper Ferntree Gully, VIC (**Peter Chan**, Stephanie Hunter)  
Austin Hospital, Heidelberg, VIC (**Rinaldo Bellomo**, **Glenn Eastwood**, Leah Peck, Helen Young)  
Ballarat Base Hospital (**Khaled El-Khawas**, Dianne Hill)  
Bankstown-Lidcombe Hospital (**Manoj Saxena**, Magda Luciuk, Luke Lau, Kathleen Brennan, Diane Redmond, Magdalena Mannah)  
Barwon Health, Geelong, VIC (**Matthew Maiden**, Michelle Horton, Allison Bone, Claire Corrigan, Tania Salerno)  
Bendigo Hospital (**Cameron Knott**, **Catherine Boschert**, Julie Smith)  
Box Hill Hospital (**Peter Chan**, Stephanie Hunter)  
Bunbury Hospital (**Ravi Krishnamurthy**, **Marie Draper**)  
Bundaberg Hospital (**Anthony Eidan**, Angela Ratsch)  
Caboolture Hospital (**Mahesh Ramanan**, Julia Afleck, Kelsey Pateman, Ramsy D'souza)  
Cabrini Hospital Malvern (**David Brewster**, Shannon Simpson)  
Cairns Hospital (**Catherine Tacon**)  
Calvary Mater Newcastle (**Alan Rashid**, **Toni McKenna**, **Jessica Lugsdin**, **Paras Jain**)  
Campbelltown Hospital (**Ritesh Sanghavi**, Alyson France, Roland Eckhardt, Jodie Nema)  
Canberra Hospital (**Anil Ramnani**, Mary Nourse)  
Concord Hospital (**Mark Kol**, Helen Wong)  
Casey Hospital (**Gopal Taori**, Amanda Hulley, Joanne Lillie, John Dong Young Lee)  
Dandenong Hospital (**Gopal Taori**, **Subhash Arora**, **Ifrah Khan**, Amanda Hulley, Joanne Lillie)  
Epworth Richmond (**Jonathan Barrett**, Gabrielle Hanlon)  
Fiona Stanley Hospital, Murdoch, WA (**Edward Litton**, Annamaria Palermo)  
Flinders Medical Centre (**Shailesh Bihari**, Tapaswi Shrestha)  
Frankston Hospital (**John Botha**, **Kasha Singh**, **Ravindranath Tiruvoipati**, Jodie Prendergast)  
Gold Coast University Hospital (**Brent Richards**, **Shane George**, Mandy Tallott, Priscilla Harvey)  
Hervey Bay Hospital (**Wei Han Choy**, Angela Ratsch)  
Ipswich Hospital (**Neeraj Bhadange**, Steven Tyler)  
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Lismore Base Hospital (**Myrene Kilminster**)  
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Lyell McEwan Hospital (**Edda Jessen**, Natalie Soar)  
Maroondah Hospital (**Peter Chan**, Stephanie Hunter)  
Mater Hospital Brisbane (**Isabel Anne Leditschke**, Katherine Jongebloed)  
Mildura Base Hospital (**Alison Walker**, Andrea Bock)



Monash Children's Hospital, Clayton, VIC (**Felix Oberender**, Jess Waghorn, **Jim Buttery**)  
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 The Prince Charles Hospital, Chermside, QLD (**Jayshree Lavana**, **Amanda Corley**, India Lye, Lacey Irvine, Niki McGuinness)  
 The Queen Elizabeth Hospital, Woodville, SA (**Sandra Peake**, Patricia Williams)  
 Toowoomba Hospital (**Adam Visser**, Judy Smith)  
 Warrnambool Base Hospital (**Mark Page**, Tina Johnstone)  
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