

## COVID-19 Adverse Outcomes by Age and Vaccination Status

South Australian data, August – October 2022

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COVID-19 cases recorded in South Australia between 1 August and 31 October 2022 were analysed to ascertain the difference in likelihood of hospitalisation or death between those who had received different numbers of vaccine doses or no doses.

### **Brief Summary of Results**

The risk of adverse outcomes with COVID-19 increases with age. For all age groups, the risk of adverse outcomes decreases with vaccination, and boosters provide further protection.

Among those who had COVID-19, for all age groups:

- people who were not vaccinated were more likely to be hospitalised than those who had been vaccinated;
- people who had received three or more doses were the least likely to be hospitalised with COVID-19;
- there were very few deaths ( $n=2$ ) in those under 60 years of age; and,
- among those aged 80+, those who were not vaccinated were more likely die as a result of COVID-19 than those who had been vaccinated.

These results are presented in Tables 1 – 3.

Multivariate analyses allow for more sophisticated analyses of the influence of multiple variables simultaneously. Bayesian logistic regression (multivariate analyses) showed that:

- vaccination lowers the probability of hospitalisation and the probability of death, with increasing vaccination doses lowering the probability of each outcome further, with very high probability;
- from ages 60-69 upwards, age almost certainly raises the probability of hospitalisation and death, with increasing age increasing the probability of each outcome;
- Aboriginal and Torres Strait Islander people are almost certainly at higher risk of hospitalisation with COVID-19;
- Those with No Vaccination are about 8 times more likely to be hospitalised and about 5 times more likely to die than those with 3 or 4 doses of vaccine; and,
- Those with 1 or 2 doses of vaccine are about 3 times more likely to be hospitalised and about 2 times more likely to die than those with 3 or 4 doses of vaccine.

These results are presented in Figures 1 and 2, complemented by Tables 4 – 7.

**Table 1: Hospitalised (%), by age and vaccination status (1 Aug – 31 Oct 2022)**

Hospitalised %	Vaccination Doses			significance
Age	None	1 or 2	3+	
<b>18-39</b>	1.92	0.59	0.37	p<0.001
<b>40-49</b>	1.72	0.67	0.36	p=0.005
<b>50-59</b>	4.29	1.09	0.53	p<0.001
<b>60-69</b>	13.16	4.77	1.08	p<0.001
<b>70-79</b>	27.59	12.24	2.94	p<0.001
<b>80+</b>	50.00	27.08	7.88	p<0.001

**Table 2: Death (%), by age and vaccination status (1 Aug – 31 Oct 2022)**

Deaths %	Vaccination Doses			significance
Age	None	1 or 2	3+	
<b>18-39</b>	0	0	0	n/a
<b>40-49</b>	0	0.11	0	n/s
<b>50-59</b>	0	0	0	n/a
<b>60-69</b>	0.88	0.41	0.09	p=0.017
<b>70-79</b>	1.72	0.51	0.35	n/s
<b>80+</b>	21.21	4.86	3.40	p<0.001

**Table 3: Cases, Hospitalisations, ICU Admissions and Deaths, by age, sex, Aboriginal and Torres Strait Islander Status and Vaccination (1 Aug – 31 Oct 2022)**

	Total		Hospitalisations		ICU admissions		Deaths (due to COVID-19)	
	N	%	N	%	N	%	N	%
<b>Total</b>	70450	100	917	1.30	77	0.11	174	0.25
<b>Age Group</b>								
18-39	22322	31.68	105	0.47	10	0.045	0	0.00
40-49	9664	13.72	46	0.48	2	0.021	2	0.02
50-59	9473	13.45	65	0.69	14	0.148	0	0.00
60-69	7673	10.89	58	0.76	11	0.143	10	0.13
70-79	5864	8.32	200	3.41	17	0.290	23	0.39
80+	3825	5.43	337	8.81	18	0.471	139	3.63
				p<0.0001		p<0.001		p<0.0001
<b>Sex</b>								
Female	37664	53.46	460	1.22	33	0.088	88	0.23
Male	31998	45.42	457	1.43	44	0.138	86	0.27
				p<0.001		p=0.09		ns
<b>Indigenous</b>								
No	60127	85.35	871	1.45	72	0.120	173	0.29
Yes	1927	2.7	35	0.45	5	0.048	1	0.01
Unknown	8396	11.9	11	0.13	-	-	-	-
				p<0.001		p=0.001		p<0.001
<b>Vaccination Doses</b>								
0	5007	7.11	132	2.64	11	0.22	16	0.32
1 or 2	16111	22.9	161	1.00	20	0.12	12	0.12
3+	44613	63.3	612	1.37	45	0.10	138	0.38
unknown	4719	6.7	12	0.25	1	0.02	8	0.17
				p<0.001		p=0.023		p<0.001

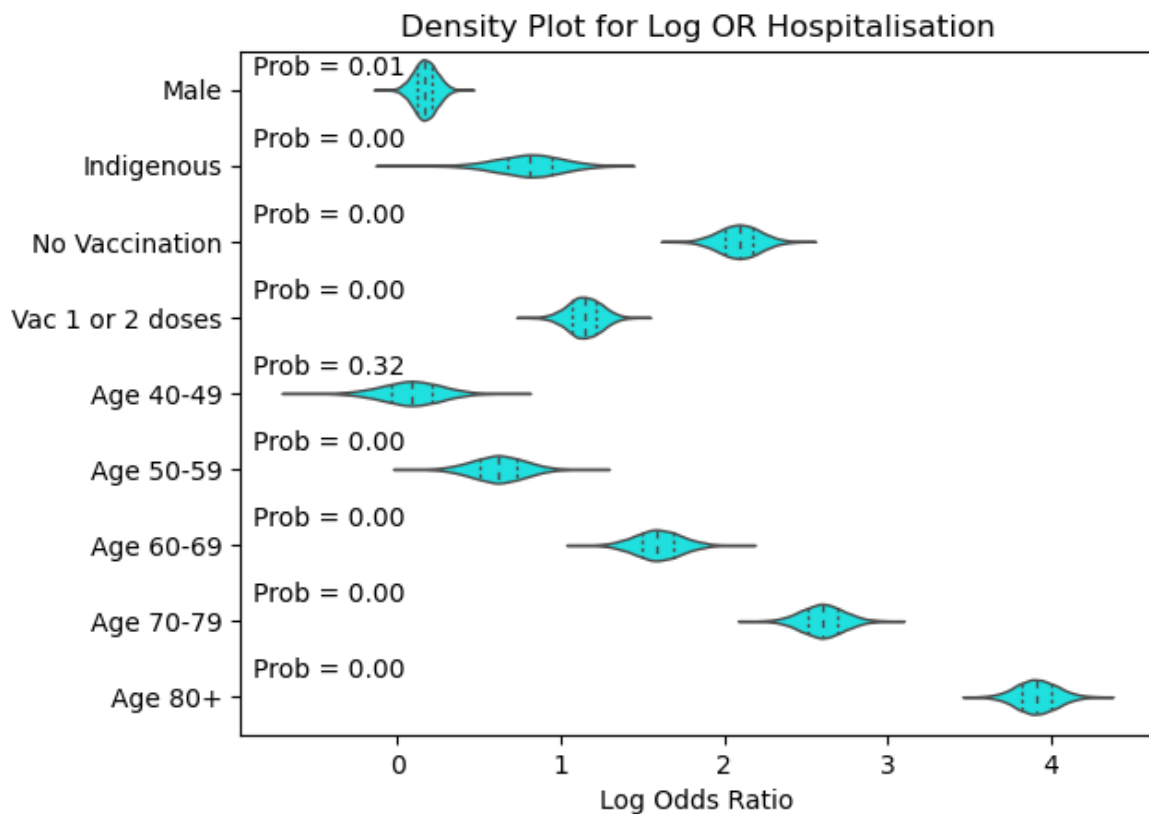
**Multivariate analyses**

To allow comparison of the impact of multiple variables together on COVID-19 outcomes, we performed a Bayesian logistic regression to assess the impact of various covariates on the probability of hospitalisation and death with COVID-19. The *baseline* individual (for comparisons) was defined as Female, Non-Indigenous, Vaccinated with 3 or 4 doses, and Aged 18-39.

Data were restricted herein to cases of COVID-19 notified between 1 August 2022 and 31 October 2022, and where the status of each covariate – Sex, Indigenous or not, Vaccination doses received, and Age were known. The prior distribution corresponded to independent  $N(0,5)$  distributions on each coefficient.

**Hospitalisation**

The posterior distribution of the log odds ratios of being Male, Indigenous, No Vaccination or Vaccinated with 1 or 2 doses, and of belonging to a different age category relative to the baseline individual are presented in Figure 1, along with the probability (Prob) of the odds ratio being less than one which corresponds to the probability of that covariate reducing your probability of hospitalisation with COVID-19.



**Figure 1.** Violin plots of the density of log odds ratio for various covariates relative to the baseline individual (Female, Non-Indigenous, Vaccinated with 3 or 4 doses, and Aged 18-39), along with the probability (Prob) of the odds ratio being less than one, for the probability of hospitalisation.

In Table 4, the median and 90% credible interval of the posterior odds ratio is presented, along with the probability of the odds ratio being less than one for the probability of hospitalisation.

**Table 4.** Median and 90% Credible Interval of Odds Ratios, and Probability of Odds Ratio being less than one for the logistic model of probability of hospitalisation.

Odds Ratio variable	Median [90% Credible Interval]	Pr(Odds Ratio < 1)
Male	1.18 [1.05, 1.33]	0.01
Indigenous	2.25 [1.60, 3.10]	0.00
No Vaccination	8.08 [6.53, 9.95]	0.00
Vac 1 or 2 doses	3.13 [2.64, 3.71]	0.00
Age 40-49	1.09 [0.80, 1.46]	0.32
Age 50-59	1.85 [1.42, 2.41]	0.00
Age 60-69	4.91 [3.89, 6.22]	0.00
Age 70-79	13.44 [10.82, 16.72]	0.00
Age 80+	49.72 [40.66, 61.36]	0.00

In Table 5, summary statistics of the posterior distribution of the coefficient of each covariate in the logistic model are presented.

**Table 5.** Summary statistics of posterior distribution of coefficients of covariates in the logistic model of probability of hospitalisation.

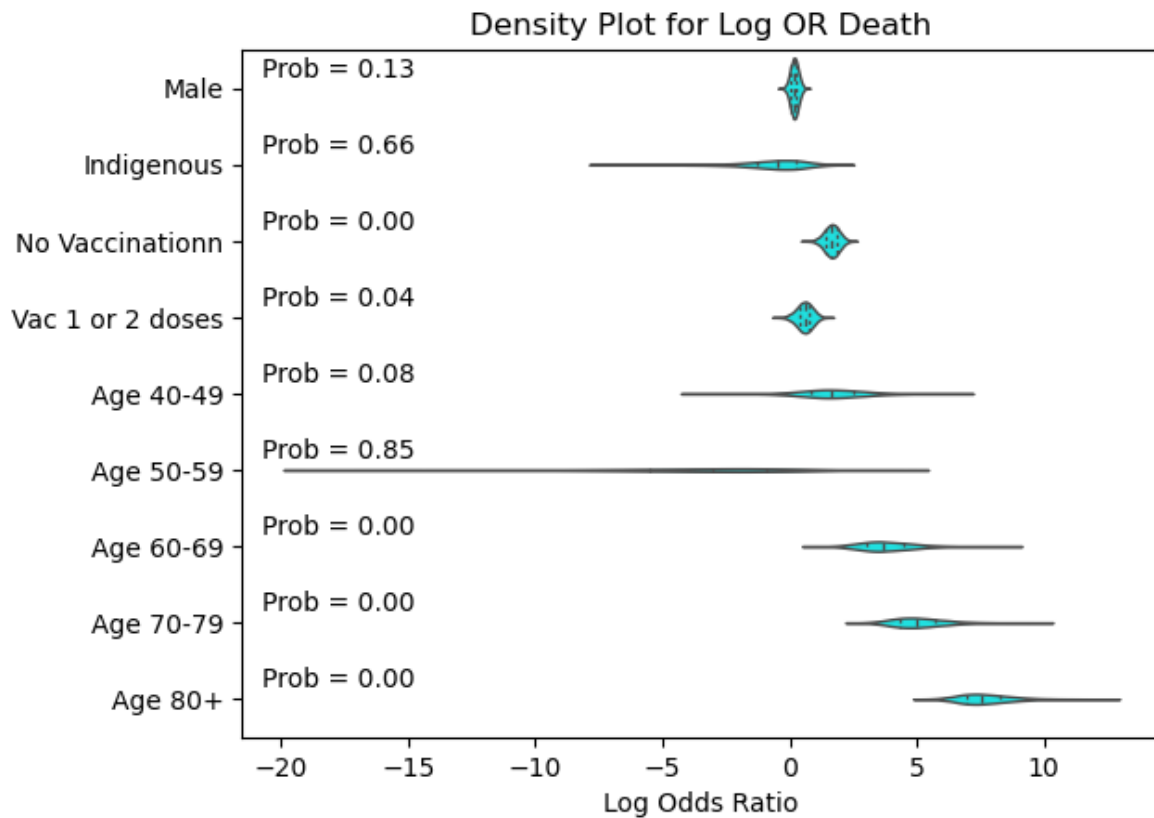
Coefficient	mean	std	min	25%	50%	75%	max
Baseline	-6.01	0.12	-6.50	-6.09	-6.01	-5.93	-5.58
Male	0.17	0.07	-0.15	0.12	0.17	0.22	0.47
Indigenous	0.81	0.20	-0.13	0.67	0.81	0.94	1.45
No Vaccination	2.09	0.13	1.61	2.00	2.09	2.18	2.56
Vac 1 or 2 doses	1.14	0.10	0.73	1.07	1.14	1.21	1.55
Age 40-49	0.08	0.18	-0.71	-0.04	0.09	0.21	0.81
Age 50-59	0.62	0.16	-0.03	0.51	0.62	0.73	1.30
Age 60-69	1.59	0.14	1.03	1.50	1.59	1.69	2.19
Age 70-79	2.60	0.13	2.08	2.51	2.60	2.69	3.10
Age 80+	3.91	0.13	3.46	3.83	3.91	3.99	4.38

**Death**

The posterior distribution of the log odds ratios of being Male, Indigenous, No Vaccination or Vaccinated with 1 or 2 doses, and of belonging to a different age category relative to the baseline individual are presented in Figure 2, along with the probability (Prob) of the odds ratio being less than one which corresponds to the probability of that covariate reducing your probability of death with COVID-19.

In Table 6, the median and 90% credible interval of the posterior odds ratio is presented, along with the probability of the odds ratio being less than one for the probability of death.

In Table 7, summary statistics of the posterior distribution of the coefficient of each covariate in the logistic model are presented.



**Figure 2.** Violin plots of the density of log odds ratio for various covariates relative to the baseline individual (Female, Non-Indigenous, Vaccinated with 3 or 4 doses, and Aged 18-39), along with the probability (Prob) of the odds ratio being less than one, for the probability of death.

**Table 6.** Median and 90% Credible Interval of Odds Ratios, and Probability of Odds Ratio being less than one for the logistic model of probability of death.

Odds Ratio variable	Median [90% Credible Interval]	Pr(Odds Ratio < 1)
<b>Male</b>	1.20 [0.92, 1.56]	0.13
<b>Indigenous</b>	0.64 [0.06, 2.87]	0.66
<b>No Vaccination</b>	5.22 [3.14, 8.29]	0.00
<b>Vac 1 or 2 doses</b>	1.80 [1.03, 2.93]	0.04
<b>Age 40-49</b>	5.25 [0.72, 46.38]	0.08
<b>Age 50-59</b>	0.05 [0.0, 3.46]	0.85
<b>Age 60-69</b>	40.53 [9.34, 303.41]	0.00
<b>Age 70-79</b>	143.24 [34.9, 1035.26]	0.00
<b>Age 80+</b>	1889.48 [482.0, 13379.19]	0.00

**Table 7.** Summary statistics of posterior distribution of coefficients of covariates in the logistic model of probability of death.

Coefficient	mean	std	min	25%	50%	75%	max
<b>Baseline</b>	-10.72	1.02	-16.08	-11.33	-10.60	-9.99	-7.83
<b>Male</b>	0.18	0.16	-0.46	0.07	0.18	0.29	0.80
<b>Indigenous</b>	-0.61	1.20	-7.88	-1.27	-0.45	0.24	2.52
<b>No Vaccination</b>	1.64	0.29	0.44	1.45	1.65	1.85	2.65
<b>Vac 1 or 2 doses</b>	0.57	0.32	-0.69	0.37	0.59	0.79	1.72
<b>Age 40-49</b>	1.69	1.26	-4.28	0.86	1.66	2.50	7.21
<b>Age 50-59</b>	-3.45	3.37	-19.90	-5.51	-2.99	-0.95	5.45
<b>Age 60-69</b>	3.81	1.07	0.49	3.06	3.70	4.48	9.12
<b>Age 70-79</b>	5.07	1.04	2.19	4.33	4.96	5.70	10.35
<b>Age 80+</b>	7.66	1.02	4.85	6.93	7.54	8.28	12.97