

Risk of background, COVID-19-related or mRNA vaccine-associated myocarditis by age, sex and vaccination status

Summary of data sources, assumptions, and prior distributions 5 October 2022

Model inputs	Assumptions
Risk of developing mRNA COVID-19 vaccine-associated myocarditis	<p>Rates of myocarditis following vaccination with an mRNA COVID-19 vaccine were estimated using publicly-available post-marketing surveillance data published by the Therapeutic Goods Administration (TGA) (1). The TGA provides rates of myocarditis following second doses and all doses (i.e. first, second or booster doses combined). Rates of myocarditis post first dose were estimated using ratios outlined in Table 3 (see below), which were derived from a US Centers for Disease Control (CDC) study that reported on sex and age group-specific rates of myocarditis post first and second doses of mRNA vaccine (2). As Australian data on rates of myocarditis rates by age, sex and vaccine type following third doses were not available, these were assumed to be equivalent to rates following second doses, which may be an overestimate given that some overseas studies have shown lower rates of myocarditis for third relative to second doses (3-6). However, in the absence of reliable local data, assuming third dose myocarditis rates approximated rates following second doses was a conservative estimate of risk. Rates of myocarditis following fourth doses of mRNA vaccines are not estimated in this chart given the paucity of data on this condition from both international and local sources.</p> <p>As rates for those aged 80 years and over were not provided by the TGA, these were assumed to be consistent with rates in patients aged 70 years and over.</p> <p>See supplementary Tables S1 and S2 for data provided by TGA on myocarditis rates post Comirnaty (Pfizer) and Spikevax (Moderna) vaccines for all doses and second doses. Of note, myocarditis rates reported by the TGA comprise cases that were reported following vaccination, however, not all cases may be vaccine-related. The TGA also notes that rates for Spikevax (Moderna) were less certain due to lower overall case numbers. Rates of myocarditis following Spikevax (Moderna) in children aged 5 to 11 years are not reported by the TGA due to insufficient data.</p>

Table 1: Estimated rates of myocarditis cases per million mRNA COVID-19 vaccine doses in Australia by age and sex, 25 January 2021 to 18 September 2022(1, 2)

Age (years)	Comirnaty (Pfizer)						Spikevax (Moderna)					
	First dose		Second dose		Third dose		First dose		Second dose		Third dose	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
5-11	0.5	0	2	0								
12-17	32	15	134	28	134	28	57	27	236	50	236	50
18-29	23	15	94	28	94	28	56	26	232	48	232	48
30-39	8	5	32	10	32	10	12	0	50	0	50	0
40-49	3	1	14	17	14	17	8	11	33	20	33	20
50-59	2	2	7	4	7	4	5	14	20	25	20	25
60-69	1	2	4	4	4	4	0	0	0	0	0	0
70-79	0	2	0	4	0	4	0	0	0	0	0	0
80+	0	2	0	4	0	4	0	0	0	0	0	0

#rates of myocarditis following second doses of mRNA vaccines are presented according to data published by the TGA. First dose rates were estimated using the ratio derived in table 2 (see below). Rates of myocarditis following third doses were assumed to approximate the rates following second doses.

Table 2: Ratio of rates of myocarditis following first and second doses of mRNA vaccine (Comirnaty and Spikevax combined) by sex (2)

Sex	Incidence of myocarditis per 100,000 persons		
	First dose	Second dose	Ratio of second to first dose
Males	8.8	36.3	4.13
Females	3.4	6.2	1.83

^As rates of myocarditis following the first dose of mRNA vaccine are not provided by the TGA, these were estimated by deriving a ratio of first to second doses from a US CDC study, which reported rates of myocarditis by age categories and sex. For the sake of simplicity, a single ratio was derived for each sex based on the overall incidence myocarditis by dose for males and for females. The ratios derived in table 2 were used to estimate the first dose rates presented in table 1.

Table S1: Rates of likely myocarditis cases following Comirnaty (Pfizer) reported by TGA, Australia, 25 January 2021 to 18 September 2022 (1)

Age (years)	All doses		Second doses	
	Rate per 100,000 doses		Rate per 100,000 doses	
	Male	Female	Male	Female
5-11	0.3	0.1	0.2	0
12-17	8.2	1.7	13.4	2.8
18-29	5.2	1.5	9.4	2.8
30-39	2.4	0.9	3.2	1.0
40-49	0.7	0.4	1.4	1.7
50-59	0.4	0.4	0.7	0.4
60-69	0.1	0.4	0.4	0.4
70+	0.1	0.2	0	0.4
All ages	2.4	0.9	4.8	1.6

Table S2: Rates of likely myocarditis cases following Spikevax (Moderna) reported by TGA, Australia, 25 January 2021 to 18 September 2022 (1)

Age (years)	All doses		Second doses	
	Rate per 100,000 doses		Rate per 100,000 doses	
	Male	Female	Male	Female
12-17	11.6	2.9	23.6	5.0
18-29	10.4	2.0	23.2	4.8
30-39	3.3	0.8	5.0	0
40-49	1.7	0.5	3.3	2
50-59	0.9	1.3	2.0	2.5
60-69	0	0.2	0	0
70+	0	0.1	0	0
All ages	3.3	1.0	11.9	2.7

Risk of developing myocarditis following SARS-CoV-2 infection

Rates of myocarditis following SARS-CoV-2 infection were estimated using data from PCORnet (the National Patient-Centered Clinical Research Network), a collaboration between 40 health care systems where data is accessed and analysed from electronic health records (2). Rates of myocarditis within 21 days of COVID-19 infection are presented below in table 3 by sex and age categories. Rates presented are agnostic of COVID-19 variant.

Table 3: Myocarditis post SARS-CoV-2 infection incidence (per 1,000,000 cases) by age and sex reported within 21 days of COVID-19 diagnosis, 20 January 2021 to 31 January 2022 (2)

Age (years)	Male	Female
5-11	176	81
12-17	590	357
18-29	637	195
≥30	630	363

References

1. Therapeutic Goods Administration. COVID-19 vaccine safety report - 23–09-2022. Department of Health and Aged Care; 2022 23 September 2022.
 2. Block JP BT, Forrest CB, et al. Cardiac Complications After SARS-CoV-2 Infection and mRNA COVID-19 Vaccination — PCORnet, United States, January 2021–January 2022. MMWR Morb Mortal Wkly Rep 2022;71:517-23.
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