Risk of myocarditis and pericarditis following COVID-19 vaccination in England and Wales

Contributions to this work

This work was conducted on behalf of the BHF Data Science Centre (Health Data Research UK) CVD-COVID-UK/COVID-IMPACT Consortium and the Longitudinal Health and Wellbeing and Data and Connectivity UK COVID-19 National Core Studies. Samantha Ip developed the analysis code and implemented the analysis in England; Fatemeh Torabi derived the dataset for Wales and implemented the analysis in Wales; and Venexia Walker derived the dataset for England, combined and visualised the results from both nations, and drafted the report. The work relied on the support of the CCU002 project group, members of which include: Angela Wood (University of Cambridge), Arun Karthikeyan Suseeladevi (University of Bristol), Ashley Akbari (Swansea University), Cathie Sudlow (BHF Data Science Centre), Emanuele Di Angelantonio (University of Cambridge), Efosa Omigie (NHS Digital), Fatemeh Torabi (Swansea University), Hoda Abbasizanjani (Swansea University), Jennifer Cooper (University of Bristol), Jonathan Sterne (University of Bristol), Rachel Denholm (University of Bristol), Rochelle Knight (University of Bristol), Sam Hollings (NHS Digital), Samantha Ip (University of Cambridge), Spencer Keene (University of Cambridge), Spiros Denaxas (University College London), Teri-Louise North (University of Bristol), Thomas Bolton (BHF Data Science Centre), Venexia Walker (University of Bristol) and William Whiteley (University of Edinburgh). The project was conceived by this group, all members of which contributed to the development of the protocol (https://github.com/BHFDSC/CCU002_03/blob/main/protocol/COVID%20vaccination%20and%20myocarditis%20and%20pericarditis.pdf). Members of the group also reviewed and discussed analysis results and their interpretation, including in the context of other relevant published studies.

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Other acknowledgements

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Sample size

Dose 1

exposure	England	Wales	total
BNT162b2	7682139	798948	8481087
ChAdOx1-S	15949979	1206764	17156743
Comparator	26354470	610141	26964611
Total	49986588	2615853	52602441

Dose 2

exposure	England	Wales	total
BNT162b2	7307617	680811	7988428
ChAdOx1-S	8057048	1163684	9220732
Comparator	8268926	174042	8442968
Total	23633591	2018537	25652128

Estimates, overall

Dose 1

nation	exposure	days_post_vaccination	estimate	conf.low	conf.high	p.value
All	BNT162b2	0-13	0.81	0.55	1.19	0.27
All	BNT162b2	14+	1.11	0.91	1.34	0.30
All	ChAdOx1-S	0-13	0.82	0.62	1.09	0.18
All	ChAdOx1-S	14+	0.96	0.81	1.14	0.62
England	BNT162b2	0-13	0.83	0.56	1.23	0.35
England	BNT162b2	14+	1.11	0.91	1.35	0.29
England	ChAdOx1-S	0-13	0.84	0.63	1.12	0.23
England	ChAdOx1-S	14+	0.95	0.80	1.13	0.56
Wales	BNT162b2	0-13	0.41	0.06	2.89	0.37
Wales	BNT162b2	14+	0.92	0.26	3.20	0.89
Wales	ChAdOx1-S	0-13	0.53	0.12	2.30	0.39
Wales	ChAdOx1-S	14+	1.15	0.53	2.48	0.72

Dose 2

nation	exposure	days_post_vaccination	estimate	conf.low	conf.high	p.value
All	BNT162b2	0-13	1.12	0.74	1.69	0.59
All	BNT162b2	14+	1.73	1.26	2.39	0.00
All	ChAdOx1-S	0-13	1.18	0.77	1.80	0.46
All	ChAdOx1-S	14+	1.26	0.80	1.97	0.33
England	BNT162b2	0-13	0.93	0.60	1.44	0.73
England	BNT162b2	14+	1.71	1.22	2.40	0.00
England	ChAdOx1-S	0-13	1.18	0.76	1.82	0.46
England	ChAdOx1-S	14+	1.24	0.78	1.97	0.37
Wales	BNT162b2	0-13	4.63	1.39	15.43	0.01
Wales	BNT162b2	14+	1.95	0.71	5.35	0.19
Wales	ChAdOx1-S	0-13	1.14	0.11	11.34	0.91
Wales	ChAdOx1-S	14+	1.65	0.24	11.26	0.61

Estimates, by sex

Reported for England only due to insufficient events in the subgroups in Wales.

Dose 1

exposure	days_post_vaccination	sex	estimate	conf.low	conf.high	p.value
BNT162b2	0-13	Male	0.54	0.29	1.02	0.06
BNT162b2	0-13	Female	2.20	1.00	4.84	0.05
BNT162b2	14+	Male	1.19	0.94	1.51	0.16
BNT162b2	14+	Female	0.85	0.60	1.20	0.35
ChAdOx1-S	0-13	Male	0.98	0.70	1.37	0.92
ChAdOx1-S	0-13	Female	0.62	0.34	1.13	0.12
ChAdOx1-S	14+	Male	1.05	0.85	1.28	0.67
ChAdOx1-S	14+	Female	0.76	0.56	1.04	0.08

Dose 2

exposure	days_post_vaccination	sex	estimate	conf.low	conf.high	p.value
BNT162b2	0-13	Male	0.79	0.43	1.46	0.45
BNT162b2	0-13	Female	1.42	0.60	3.36	0.42
BNT162b2	14+	Male	1.86	1.23	2.82	0.00
BNT162b2	14+	Female	0.81	0.45	1.47	0.49
ChAdOx1-S	0-13	Male	1.09	0.63	1.90	0.76
ChAdOx1-S	0-13	Female	1.21	0.54	2.70	0.64
ChAdOx1-S	14+	Male	0.94	0.49	1.80	0.85
ChAdOx1-S	14+	Female	1.78	0.76	4.21	0.19

Estimates, by age group

Reported for England only due to insufficient events in the subgroups in Wales.

Dose 1

exposure	days_post_vaccination	age_group	estimate	conf.low	conf.high	p.value
BNT162b2	0-13	<40	1.90	0.67	5.36	0.23
BNT162b2	0-13	40-69	0.90	0.52	1.57	0.71
BNT162b2	0-13	70+	0.61	0.26	1.46	0.27
BNT162b2	14+	<40	1.17	0.68	2.02	0.56
BNT162b2	14+	40-69	1.24	0.96	1.60	0.10
BNT162b2	14+	70+	0.71	0.48	1.04	0.08
ChAdOx1-S	0-13	<40	2.05	0.97	4.31	0.06
ChAdOx1-S	0-13	40-69	0.81	0.57	1.16	0.26
ChAdOx1-S	0-13	70+	0.72	0.35	1.47	0.37
ChAdOx1-S	14+	<40	1.41	0.90	2.22	0.14
ChAdOx1-S	14+	40-69	0.98	0.79	1.21	0.86
ChAdOx1-S	14+	70+	0.76	0.53	1.09	0.14

Dose 2

exposure	days_post_vaccination	age_group	estimate	conf.low	conf.high	p.value
BNT162b2	0-13	<40	3.68	0.96	14.10	0.06
BNT162b2	0-13	40-69	0.46	0.17	1.25	0.13
BNT162b2	0-13	70+	2.43	0.78	7.62	0.13
BNT162b2	14+	<40	1.78	0.64	4.98	0.27
BNT162b2	14+	40-69	0.99	0.50	1.95	0.97
BNT162b2	14+	70+	2.26	1.05	4.87	0.04
ChAdOx1-S	0-13	<40	0.60	0.14	2.69	0.51
ChAdOx1-S	0-13	40-69	1.81	1.06	3.08	0.03
ChAdOx1-S	0-13	70+	0.38	0.16	0.94	0.04
ChAdOx1-S	14+	<40	0.62	0.07	5.30	0.66
ChAdOx1-S	14+	40-69	1.10	0.48	2.53	0.82
ChAdOx1-S	14+	70+	1.26	0.47	3.33	0.64

Heterogeneity p-values

Reported for England only due to insufficient events in the subgroups in Wales.

Dose 1

Sex

exposure	days_post_vaccination	p.value
BNT162b2	0-13	0.05
BNT162b2	14+	0.36
ChAdOx1-S	0-13	0.11
ChAdOx1-S	14+	0.08

Age group

exposure	days_post_vaccination	p.value
BNT162b2	0-13	0.14
BNT162b2	14+	0.09
ChAdOx1-S	0-13	0.06
ChAdOx1-S	14+	0.06

Dose 2

Sex

exposure	days_post_vaccination	p.value
BNT162b2	0-13	0.42
BNT162b2	14+	0.48
ChAdOx1-S	0-13	0.65
ChAdOx1-S	14+	0.20

Age group

exposure	days_post_vaccination	p.value
BNT162b2	0-13	0.15
BNT162b2	14+	0.12
ChAdOx1-S	0-13	0.10
ChAdOx1-S	14+	0.79