



OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

The Honorable Roger F. Wicker
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

JUL 25 2025

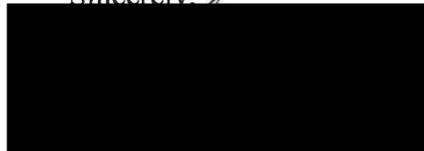
Dear Mr. Chairman:

The Department's response to section 725 of the National Defense Authorization Act for Fiscal Year 2024 (Public Law 118-31), "Study and Report on Health Conditions of Members of the Armed Forces on Active Duty Developed after Administration of COVID-19 Vaccine," is enclosed.

This report covers findings of the requested study assessing health conditions among active duty Service members following coronavirus disease 2019 (COVID-19) vaccination. The Department conducted a study assessing health conditions that represent potential adverse events arising in active duty Service members following COVID-19 vaccination. Fifteen conditions were analyzed for the period of 2017-2023, including cardiac diagnoses, acute kidney injury, thrombotic disorders, neurovascular events, other neurologic conditions, and appendicitis. The study found that incidence of myocarditis and pericarditis increased in the short term after vaccination, but this was not sustained over a 1-year period and the increase was small relative to post-infection incidence rates. Incidence of 6 conditions decreased following vaccination, while incidence of 14 conditions increased following SARS-CoV-2 infection; for most conditions, incidence was highest among those who had been infected but not vaccinated. Among the vaccinated population, incidence sometimes varied by vaccine type or by age.

Thank you for your continued strong support for the health and well-being of our Service members. I am sending a similar letter to the Committee on Armed Services of the House of Representatives.

Sincerely,



Marilynn Carson, MD
Performing the Duties of the Deputy Under
Secretary of Defense for Personnel and
Readiness

Enclosure:
As stated

cc:
The Honorable Jack Reed
Ranking Member



OFFICE OF THE UNDER SECRETARY OF DEFENSE

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WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

The Honorable Mike D. Rogers
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

JUL 25 2025

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Thank you for your continued strong support for the health and well-being of our Service members. I am sending a similar letter to the Committee on Armed Services of the Senate.

Sincerely,



Melynn Carson, MD
Performing the Duties of the Deputy Under
Secretary of Defense for Personnel and
Readiness

Enclosure:
As stated

cc:
The Honorable Adam Smith
Ranking Member

Report to the Committees on Armed Services of the Senate and the House of Representatives



Study and Report on Health Conditions of Members of the Armed Forces Developed after Administration of COVID–19 Vaccine

July 2025

The estimated cost of this report for the Department of Defense (DoD) is approximately \$56,000 in Fiscal Year 2024. This includes \$0 in expenses and \$56,000 in DoD labor.
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Purpose

Section 725 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2024 (Public Law 118–31), “Study and Report on Health Conditions of Members of the Armed Forces on Active Duty Developed After Administration of COVID-19 Vaccine,” required the following:⁽¹⁾

(a) **STUDY.**—The Secretary of Defense shall conduct a study to assess and evaluate any health conditions arising in members of the Armed Forces on active duty one year after receiving the first dose of a COVID-19 vaccine.

(b) **STUDY PARAMETERS.**—In conducting the study under sub-section (a), the Secretary shall—

(1) disaggregate data collected by—

(A) vaccine type and manufacturer;

(B) age group at the time such first dose was administered;

(C) any health condition developed after receiving such first dose, regardless of whether the condition is attributable to the receipt of such first dose; and

(D) an accounting of adverse events (including hyperimmune response), including further disaggregation by history of infection; and

(2) assess the prevalence of each such health condition by each age group specified in paragraph (1)(B) among the unvaccinated population for each of years 2017, 2018, and 2019.

(c) **REPORT.**—Not later than one year after the date of the enactment of this Act and each year thereafter for the subsequent four years, the Secretary shall submit to the Committees on Armed Services of the House of Representatives and the Senate a report on the results of each study conducted under subsection (a).

(d) **COVID-19 VACCINE DEFINED.**—The term “COVID-19 vaccine” means a vaccine licensed under section 351 of the Public Health Service Act (42 U.S.C. 262) or authorized for emergency use under section 564 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360bbb-3) for immunization against the virus responsible for COVID-19.

Background

Since the coronavirus disease 2019 (COVID-19) vaccinations became available in December 2020, more than 13.7 billion vaccine doses have been administered globally.⁽²⁾ COVID-19 vaccination has resulted in substantial reduction in the burden of disease-related hospitalizations and deaths worldwide, with more than 14 million lives estimated to be saved in the first year of vaccine availability.⁽³⁾ In addition to evaluations of effectiveness, evaluations of the safety of COVID-19 vaccines have been implemented globally. Multiple large population studies have evaluated health outcomes following vaccination, and thousands of studies have been published on the topic of COVID-19 vaccine safety.⁽⁴⁻⁷⁾ These evaluations demonstrate that severe adverse events following immunization with COVID-19 vaccine are rare.

Available Vaccine Types and Manufacturers

There are three primary types of COVID-19 vaccines that have been, or are currently, available in the United States. These include messenger RNA (mRNA) vaccines manufactured by Moderna and Pfizer-BioNTech, a viral vector vaccine manufactured by Janssen/Johnson & Johnson, and a protein subunit vaccine manufactured by Novavax. In May 2023, the manufacturer requested the voluntary withdrawal of the emergency use authorization (EUA) of the Janssen COVID-19 vaccine, and the EUA was subsequently revoked by the Food and Drug Administration (FDA) in June 2023. As a result, Moderna, Pfizer, and Novavax are the three COVID-19 vaccines currently available in the United States.

Service Member Vaccinations

COVID-19 vaccine distribution within the Military Health System began in December 2020, and was made available to all Service members who chose to be vaccinated under EUA. Voluntary vaccination represented 70.5 percent of the Active Component population. Following FDA licensure of Moderna and Pfizer vaccines in August 2021, Service members were required to be vaccinated. This mandate was repealed in January 2023, once again making COVID-19 vaccination voluntary. Of the COVID-19 vaccine doses that were administered to Service members between 2021 and 2023, approximately two-thirds were manufactured by Pfizer-BioNTech, and one-third were manufactured by Moderna.

Study Approach

Health Conditions and Adverse Events

Section 725 of the NDAA for FY 2024 requires this report to “evaluate any health conditions arising in members of the Armed Forces on active duty one year after receiving the first dose of a COVID-19 vaccine.”⁽¹⁾ The Department of Defense (DoD) selected a range of health conditions to evaluate based on a review of existing DoD surveillance data and broader scientific literature on vaccines and health outcomes, biologic plausibility of various health outcomes from vaccines, and concerns previously expressed by the House Armed Services Committee regarding vaccine safety.⁽⁸⁻¹¹⁾ This report addresses 15 outcomes: cardiac conditions (myocarditis, pericarditis, acute myocardial infarction, life-threatening arrhythmias, non-life-threatening arrhythmias), acute kidney injury, thrombotic disorders (immune thrombocytopenia, pulmonary embolism, deep venous thrombosis), neurovascular events (ischemic stroke, hemorrhagic stroke), other neurologic conditions (Bell’s palsy, Guillain-Barre Syndrome, acute disseminated encephalomyelitis), and appendicitis.⁽⁸⁻¹⁰⁾ All data presented in this report represent Active Component Service members.

Section 725 of the NDAA for FY 2024 further requires, “an accounting of adverse events (including hyperimmune response).”⁽¹⁾ “Hyperimmune reaction” or “hyperimmune response” are non-specific terms used in the literature to apply to various autoimmune disorders, cytokine storm-like reactions, or robust/aberrant immune-mediated reactions.⁽¹³⁻¹⁶⁾ For the purposes of this report, we took a broad view, assessing the incidence of many types of potential adverse events or health conditions following immunization. All health conditions evaluated for this

report are potential hyperimmune reactions because they could be vaccine-associated adverse events.⁽⁸⁻¹⁰⁾

Incidence Rates

Section 725 of the NDAA for FY 2024 requires an assessment of the “prevalence of health conditions by age group among the unvaccinated population for each of years 2017, 2018, 2019.” From the perspective of epidemiologic analysis, “prevalence” is the measure of how many people in a population have a condition at one specific point in time. In contrast, “incidence” measures new-onset conditions over a defined time range. When trying to evaluate the potential relationship between an exposure (such as vaccination) and an outcome (such as a health condition), incidence metrics are most appropriate for encompassing risk over comparable time periods because incidence excludes cases of disease that occur prior to being exposed.^(4,7) It is important to exclude cases of disease that occur prior to exposure because it would be impossible for these cases to have been caused by the exposure. Therefore, this study evaluates incidence of a range of health conditions rather than prevalence.

Incidence rates are a metric representing the number of new cases of a disease per 100,000 person-years of military service. They allow outcomes to be compared at a population level for different periods of time. Adjusted incidence rate ratios were calculated for this report. A rate ratio allows incidence rates of two groups to be compared to each other, after adjusting for differences in demographic features or other health factors. Interpretation of a rate ratio is straightforward: a rate ratio of 1.0 indicates equal rates within the groups being compared, a rate ratio greater than 1.0 indicates increased risk associated with the exposure (infection or vaccination), and a rate ratio less than 1.0 indicates decreased risk or a protective effect of the exposure (infection or vaccination).

Disaggregation of Vaccination and Infection Effects

Because of requirements specified in section 725, part (1)(D), to provide “disaggregation by history of infection,”⁽¹⁾ this analysis looked separately at incidence following the first COVID-19 vaccine dose, following severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, as well as all possible combinations (i.e., vaccinated and infected, vaccinated and not infected, not vaccinated and infected, not vaccinated and not infected). In addition to analyzing incidence following the first vaccine dose as specified in section 725, the analyses provided within this report evaluated incidence following all vaccine doses and all diagnosed SARS-CoV-2 infections. This enables a more holistic understanding of potential vaccine-associated risks by illuminating the impacts of infection during similar timeframes. It is important to note that infection data are likely to represent a more limited sample in later years, as more infections were likely to be self-diagnosed using at-home rapid antigen tests, not laboratory-tested or otherwise officially reported.

Multivariable Poisson regression models were used to calculate the adjusted incidence rate ratios for each of the outcomes in Table 2. The time period for these models was restricted to Calendar Years 2021-2023 (the period during which COVID-19 vaccines were available to Service members) to evaluate independent associations of recent SARS-CoV-2 infection and

recent COVID-19 vaccination with each of the outcomes, compared to those who had never before been infected or vaccinated, respectively. These models were adjusted for age, sex, race and ethnicity, obesity status, and either SARS-CoV-2 infection within the risk window or COVID-19 vaccination within the risk window. Table 2 results present the best possible information based on existent data for determining associations of vaccination and infection with health outcome because the associations identified between vaccination and subsequent health conditions were not confounded by these variables.

Risk Windows

In addition to evaluating incidence of health conditions 1 year after vaccination, the study assessed incidence within a brief “risk window” for each outcome following vaccination (Appendix, Table A1). The consensus among epidemiological experts is that risk window analysis provides the best possible scientific evidence of a cause-and-effect association between the exposure (e.g., COVID-19 vaccine or SARS-CoV-2 infection) and the health outcome, in the absence of medical chart review. However, it should be noted that even if a health condition is diagnosed during the risk window, that health condition may still be caused by some other factor that is unrelated to SARS-CoV-2 or COVID-19 vaccination because these exposures do not rule out other clinical causes of disease. The specific risk windows for each health condition were selected based on a literature review of more than 50 published studies, review of pre-existing surveillance data,^(8,9) and consultation with military clinicians.

Limitations

Epidemiologic analyses, like the evaluations in this report, may be impacted by data quality. Exposure variables assessed from electronic health systems, including SARS-CoV-2 infections and COVID-19 vaccinations, may under-represent or over-represent true exposures. In the first 2 years of the COVID-19 pandemic, intense interest and investment of resources likely strengthened these data.⁽¹⁷⁾ Changes in clinical practice over time, especially the wide adoption of home-testing for SARS-CoV-2 in 2022, make ongoing evaluation of infection exposures more challenging.⁽¹⁸⁾ Data on outcomes, including the health conditions evaluated in this report, are also subject to limitations. Clinicians may over-report, under-report, or miscode these conditions. Methodology applied in these analyses, including the requirement for repeat coding and clinical review of coding, mitigate these data challenges.

In addition, SARS-CoV-2 infections have substantially evolved based on the emergence of many viral variants. Earlier variants of SARS-CoV-2 viruses, especially in the beta lineage, caused greater morbidity and mortality than more recent variants in the omicron lineage.⁽¹⁹⁾ Similarly, COVID-19 vaccinations have been updated and reformulated over time to better target emerging viral variants. Changes in both SARS-CoV-2 infections and COVID-19 vaccinations must be considered when evaluating medical conditions associated with these exposures over time.

When evaluating uncommon medical conditions in military Service members, analyses may be limited by small numbers of cases, especially in relatively young, healthy populations. For vaccinations, surveillance data indicated that only 1.6 percent of Active Component Service

members had received an updated 2023-2024 Formula COVID-19 vaccine dose as of December 2023. Continued changes in vaccine uptake will limit future evaluations of potentially rare adverse events following immunization.

Results

Overview and Key Findings

Per section 725(b)(2) of the NDAA for FY 2024, this report will provide an overview of the overall incidence of each health condition by age group for 2017-2019 — the pre-pandemic period representing when Service members were unvaccinated and never-before-infected. It additionally examines the incidence of each condition for 2020 (when COVID-19 began but vaccines were not yet available) and 2021-2023 (when both infections and vaccinations occurred) to allow for observation of trends and address section 725(1)(C). For most conditions, the overall incidence rates trended higher in 2021-2023 than incidence rates in 2017-2019.

To explore this trend and address section 725(1)(D), the report then provides ratios and disaggregation of incidence rates in 2021-2023 for each condition following vaccination and infection. The adjusted analysis demonstrates that incidence of all but one of the health conditions increased following SARS-CoV-2 infection, incidence of myocarditis and pericarditis increased following COVID-19 vaccination, and incidence of six conditions (life threatening arrhythmias, acute kidney failure, immune thrombocytopenia, pulmonary embolism, deep vein thrombosis, and Bell's palsy) decreased following COVID-19 vaccination. For most conditions, incidence was highest among those who had been infected but not vaccinated.

Finally, the report further disaggregates the post-vaccination incidence rates for each condition by vaccine type and manufacturer and age group, to address sections 725(1)(A) and (1)(B), respectively. While small numbers precluded performing detailed analyses by vaccine type, results were consistent in demonstrating a small increase in myocarditis incidence after mRNA vaccination; this incidence remained lower than incidence of myocarditis after SARS-CoV-2 infection. When evaluating age effects, the incidence of most conditions appeared to increase with increasing age while myocarditis incidence rates appeared to be higher in younger persons. These findings were consistent with established age-based risks in the general population.

These analyses are consistent with the experiences of the U.S. and global public health communities in evaluations of the safety of COVID-19 vaccines.

Overall Incidence Rates in 2017-2023

As shown in Figure 1, for 11 conditions, incidence rates generally appear to trend higher overall in 2021-2023 compared to pre-COVID, though this pattern was not observed for pericarditis, immune thrombocytopenia, Bell's palsy, and acute disseminated encephalomyelitis. Table 1 breaks down incidence for 2017-2023 by age group, per section 725(b)(2).

Figure 1: Unadjusted incidence rate of each health condition per 100,000 person-years, 2017-2023.

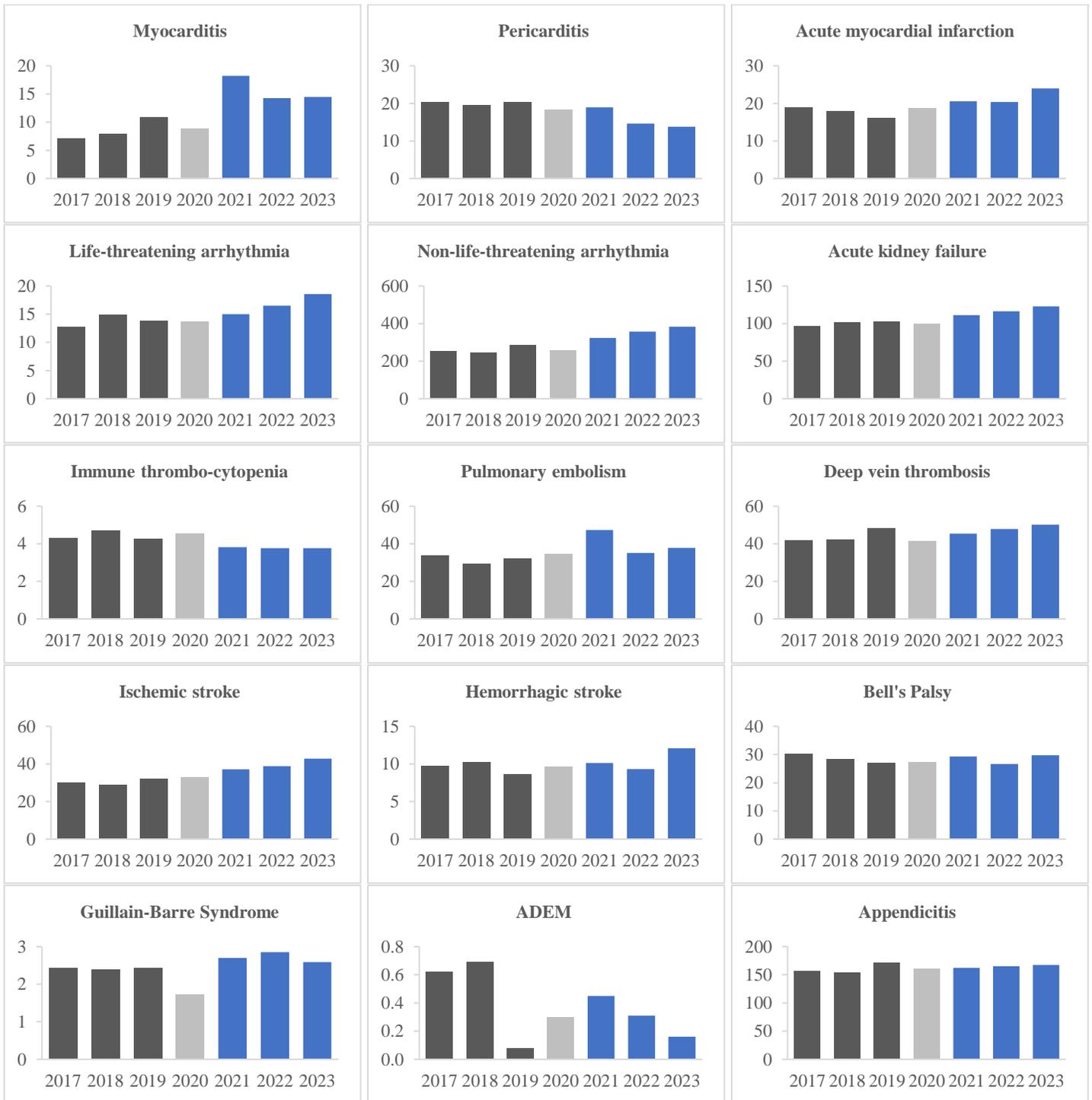


Table 1: Unadjusted incidence of health conditions per 100,000 person-years by age group, 2017-2023.

	2017		2018		2019		2020		2021		2022		2023	
	N	Rate												
Myocarditis														
All ages	92	7.17	102	7.87	143	10.88	117	8.82	243	18.22	185	14.25	184	14.47
<20 years	10	10.29	7	6.88	9	8.66	6	6.02	22	23.48	15	17.92	8	9.86
20-24 years	33	8.08	38	9.12	64	15.12	50	11.72	96	22.37	59	14.30	71	18.08
25-29 years	19	6.42	22	7.38	31	10.20	17	5.53	51	16.45	38	12.51	40	13.39
30-34 years	11	5.33	14	6.83	17	8.25	14	6.70	29	13.68	33	15.65	24	11.41
35-39 years	10	6.78	11	7.33	10	6.53	15	9.56	22	13.75	20	12.54	27	16.83
40-44 years	5	6.43	3	3.95	8	10.44	10	12.65	16	19.71	15	18.40	10	12.06
45+ years	4	8.02	7	14.42	4	8.41	5	10.48	7	14.71	5	10.87	4	8.87
Pericarditis														
All ages	260	20.28	254	19.62	267	20.33	242	18.26	253	18.98	190	14.65	175	13.77
<20 years	16	16.46	14	13.76	26	25.01	20	20.06	6	6.40	10	11.95	7	8.62
20-24 years	95	23.26	97	23.30	104	24.57	90	21.09	105	24.47	63	15.28	57	14.51
25-29 years	56	18.95	61	20.47	59	19.43	56	18.23	47	15.17	50	16.47	34	11.38
30-34 years	32	15.52	31	15.14	32	15.55	37	17.72	45	21.24	28	13.29	34	16.18
35-39 years	34	23.08	29	19.37	25	16.36	19	12.13	25	15.64	27	16.95	18	11.24
40-44 years	17	21.92	15	19.78	13	17.01	11	13.94	16	19.75	7	8.60	17	20.54
45+ years	10	20.09	7	14.45	8	16.85	9	18.89	9	18.95	5	10.89	8	17.77
Acute myocardial infarction														
All ages	244	19.02	231	17.83	213	16.21	249	18.78	274	20.55	264	20.35	305	23.99
<20 years	4	4.11	7	6.88	3	2.89	7	7.02	5	5.34	6	7.17	5	6.16
20-24 years	15	3.67	32	7.68	28	6.61	32	7.50	46	10.72	32	7.76	29	7.38
25-29 years	36	12.17	20	6.71	21	6.91	31	10.08	38	12.26	42	13.82	41	13.72
30-34 years	28	13.56	31	15.13	34	16.50	35	16.74	28	13.20	38	18.02	45	21.39
35-39 years	49	33.22	42	28.01	44	28.75	54	34.44	56	35.01	49	30.73	68	42.41
40-44 years	63	81.17	44	58.00	41	53.62	41	51.96	47	57.99	35	43.00	56	67.66
45+ years	49	98.73	55	113.82	42	88.70	49	103.08	54	113.95	62	135.43	61	135.83
Life-threatening arrhythmia														
All ages	163	12.70	192	14.82	181	13.77	181	13.65	200	15.00	214	16.49	236	18.56
<20 years	8	8.23	9	8.85	3	2.89	9	9.03	6	6.40	9	10.75	6	7.39
20-24 years	25	6.12	33	7.92	35	8.27	30	7.03	25	5.82	52	12.60	46	11.71
25-29 years	22	7.44	24	8.05	32	10.53	32	10.41	32	10.32	31	10.20	35	11.71
30-34 years	28	13.56	26	12.69	40	19.41	28	13.40	30	14.15	21	9.96	19	9.03
35-39 years	28	18.98	40	26.67	31	20.25	27	17.22	40	25.00	35	21.95	57	35.54
40-44 years	28	36.05	29	38.20	12	15.68	28	35.45	32	39.44	34	41.74	45	54.33
45+ years	24	48.25	31	64.02	28	59.02	27	56.69	35	73.72	32	69.74	28	62.21
Non-life-threatening arrhythmia														
All ages	3,206	252.49	3,132	244.22	3,731	286.85	3,389	258.30	4,270	323.83	4,580	357.28	4,803	382.75
<20 years	172	177.09	166	163.31	205	197.36	172	172.73	212	226.50	218	260.75	175	215.91
20-24 years	784	192.58	836	201.43	1,017	241.14	952	223.97	1,102	257.87	1,236	301.11	1,248	319.44
25-29 years	631	214.93	635	214.55	757	250.96	676	221.61	860	279.62	939	311.83	1,070	361.48
30-34 years	489	239.81	439	216.93	548	269.45	479	232.17	661	315.94	728	350.23	781	376.96
35-39 years	477	329.75	488	331.98	556	370.68	486	316.41	678	433.03	674	432.23	717	457.72
40-44 years	358	473.59	287	388.49	333	447.19	333	433.65	420	532.91	433	547.89	483	601.46
45+ years	295	617.08	281	603.70	315	691.42	291	636.99	337	741.10	352	802.17	329	765.30

	2017		2018		2019		2020		2021		2022		2023	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Acute kidney failure														
All ages	1,235	96.49	1,312	101.53	1,347	102.79	1,320	99.84	1,478	111.22	1,506	116.50	1,555	122.80
<20 years	99	101.90	112	110.15	100	96.24	92	92.34	88	93.96	82	98.02	94	115.89
20-24 years	340	83.33	395	94.99	405	95.83	406	95.30	437	102.00	409	99.33	403	102.79
25-29 years	266	90.15	272	91.48	268	88.44	268	87.46	293	94.83	344	113.65	340	114.21
30-34 years	196	95.23	189	92.56	203	98.92	184	88.41	229	108.49	229	109.15	236	112.78
35-39 years	169	115.01	160	107.16	182	119.48	170	108.98	207	130.15	218	137.61	225	141.28
40-44 years	99	127.99	92	121.75	99	129.99	112	142.60	148	183.63	124	153.28	170	206.81
45+ years	66	133.16	92	190.74	90	190.63	88	185.85	76	161.13	100	219.55	87	194.84
Immune thrombo-cytopenia														
All ages	55	4.29	61	4.71	56	4.26	60	4.52	51	3.82	49	3.77	48	3.77
<20 years	6	6.17	4	3.93	2	1.92	4	4.01	3	3.20	4	4.78	2	2.46
20-24 years	21	5.14	16	3.84	14	3.31	17	3.98	11	2.56	12	2.91	12	3.05
25-29 years	13	4.39	19	6.37	16	5.26	16	5.20	12	3.87	12	3.95	15	5.02
30-34 years	9	4.36	8	3.90	11	5.34	8	3.83	11	5.19	12	5.69	13	6.18
35-39 years	4	2.71	9	6.00	9	5.88	10	6.37	6	3.75	6	3.76	5	3.12
40-44 years	1	1.29	3	3.95	1	1.30	4	5.06	3	3.69	2	2.45	0	0.00
45+ years	1	2.01	2	4.12	3	6.31	1	2.09	5	10.50	1	2.17	1	2.22
Pulmonary embolism														
All ages	430	33.54	380	29.35	421	32.05	458	34.55	631	47.35	455	35.09	481	37.86
<20 years	9	9.26	5	4.91	9	8.66	6	6.02	19	20.28	7	8.36	9	11.09
20-24 years	58	14.20	72	17.29	74	17.48	66	15.47	90	20.97	79	19.15	64	16.29
25-29 years	79	26.72	65	21.81	68	22.38	86	27.98	125	40.33	99	32.60	100	33.47
30-34 years	78	37.81	63	30.77	67	32.54	87	41.66	108	50.98	68	32.28	80	38.06
35-39 years	88	59.75	78	52.09	90	58.89	82	52.37	139	87.03	93	58.43	101	63.09
40-44 years	56	72.24	53	69.95	59	77.23	72	91.36	78	96.40	59	72.63	73	88.33
45+ years	62	125.14	44	91.23	54	114.28	59	124.39	72	152.24	50	109.39	54	120.44
Deep vein thrombosis														
All ages	535	41.74	548	42.34	631	48.06	549	41.44	605	45.42	620	47.83	638	50.24
<20 years	18	18.52	16	15.73	20	19.24	15	15.05	13	13.87	12	14.34	10	12.32
20-24 years	93	22.76	87	20.89	112	26.46	87	20.39	96	22.37	92	22.31	100	25.46
25-29 years	95	32.14	98	32.89	98	32.26	104	33.85	112	36.15	122	40.18	109	36.49
30-34 years	87	42.18	91	44.45	97	47.14	91	43.59	88	41.56	106	50.34	109	51.88
35-39 years	108	73.37	97	64.82	140	91.68	107	68.39	122	76.43	121	76.06	145	90.63
40-44 years	61	78.76	78	103.06	83	108.80	78	99.12	87	107.64	93	114.63	88	106.66
45+ years	73	147.43	81	168.13	81	171.68	67	141.48	87	184.29	74	162.20	77	172.14
Ischemic stroke														
All ages	386	30.11	375	28.96	420	31.98	437	32.97	495	37.14	504	38.87	545	42.90
<20 years	5	5.14	5	4.91	8	7.69	8	8.02	10	10.67	9	10.75	5	6.16
20-24 years	39	9.54	54	12.97	42	9.92	69	16.17	52	12.12	76	18.42	60	15.27
25-29 years	47	15.89	61	20.46	54	17.77	59	19.20	75	24.19	80	26.34	78	26.10
30-34 years	65	31.50	61	29.78	72	34.96	77	36.86	81	38.23	76	36.07	98	46.62
35-39 years	65	44.13	76	50.75	97	63.46	87	55.56	114	71.36	94	59.04	123	76.84
40-44 years	78	100.70	65	85.86	71	93.03	72	91.43	95	117.50	88	108.39	84	101.72
45+ years	87	175.79	53	109.99	76	161.00	65	137.20	68	143.99	81	177.51	97	216.86

	2017		2018		2019		2020		2021		2022		2023	
	N	Rate												
Hemorrhagic stroke														
All ages	125	9.74	132	10.19	113	8.60	127	9.57	135	10.12	121	9.32	154	12.11
<20 years	8	8.23	4	3.93	3	2.89	11	11.03	4	4.27	8	9.56	5	6.16
20-24 years	43	10.52	47	11.28	38	8.98	31	7.26	49	11.42	46	11.15	48	12.22
25-29 years	16	5.41	22	7.38	22	7.24	22	7.16	29	9.35	26	8.56	34	11.38
30-34 years	22	10.66	16	7.81	24	11.65	22	10.53	18	8.49	13	6.17	23	10.93
35-39 years	18	12.20	16	10.67	10	6.53	20	12.75	19	11.87	8	5.01	23	14.34
40-44 years	10	12.86	16	21.06	8	10.44	11	13.92	8	9.86	11	13.50	16	19.30
45+ years	8	16.05	11	22.68	8	16.83	10	20.96	8	16.82	9	19.57	5	11.08
Bell's palsy														
All ages	387	30.21	365	28.21	355	27.05	361	27.25	391	29.36	346	26.70	378	29.77
<20 years	7	7.20	9	8.85	11	10.58	15	15.05	13	13.87	7	8.36	9	11.09
20-24 years	91	22.28	96	23.06	71	16.77	88	20.62	85	19.81	84	20.37	104	26.48
25-29 years	99	33.50	63	21.15	73	24.04	68	22.14	102	32.93	96	31.62	94	31.48
30-34 years	81	39.31	69	33.74	70	34.04	64	30.68	76	35.91	62	29.46	60	28.57
35-39 years	54	36.73	59	39.47	76	49.80	69	44.14	66	41.38	53	33.34	55	34.40
40-44 years	30	38.77	42	55.54	29	38.04	32	40.67	27	33.41	26	32.04	35	42.40
45+ years	25	50.41	27	55.94	25	52.88	25	52.69	22	46.50	18	39.36	21	46.81
Guillain-Barre Syndrome														
All ages	31	2.42	31	2.39	32	2.43	23	1.73	36	2.70	37	2.85	33	2.59
<20 years	3	3.09	7	6.88	2	1.92	3	3.01	3	3.20	3	3.58	5	6.16
20-24 years	8	1.96	10	2.40	9	2.13	10	2.34	11	2.56	14	3.39	2	0.51
25-29 years	6	2.03	4	1.34	2	0.66	4	1.30	6	1.93	6	1.97	12	4.01
30-34 years	6	2.90	5	2.44	8	3.88	2	0.96	7	3.30	5	2.37	5	2.38
35-39 years	4	2.71	2	1.33	3	1.96	2	1.27	6	3.75	6	3.76	4	2.49
40-44 years	3	3.86	2	2.63	5	6.53	2	2.53	2	2.46	1	1.23	2	2.41
45+ years	1	2.01	1	2.06	3	6.31	0	0.00	1	2.10	2	4.35	3	6.65
Acute disseminated encephalomyelitis														
All ages	8	0.62	9	0.69	1	0.08	4	0.30	6	0.45	4	0.31	2	0.16
<20 years	0	0.00	1	0.98	0	0.00	1	1.00	1	1.07	2	2.39	0	0.00
20-24 years	1	0.24	2	0.48	1	0.24	0	0.00	3	0.70	0	0.00	0	0.00
25-29 years	3	1.01	2	0.67	0	0.00	3	0.98	1	0.32	1	0.33	1	0.33
30-34 years	0	0.00	2	0.98	0	0.00	0	0.00	0	0.00	1	0.47	1	0.48
35-39 years	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
40-44 years	2	2.57	0	0.00	0	0.00	0	0.00	1	1.23	0	0.00	0	0.00
45+ years	2	4.01	2	4.12	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Appendicitis														
All ages	1,988	156.29	1,972	153.54	2,224	170.73	2,113	160.79	2,144	162.30	2,124	165.29	2,104	167.16
<20 years	169	174.04	153	150.52	172	165.58	152	152.61	149	159.16	112	133.93	125	154.15
20-24 years	724	177.88	691	166.57	755	179.05	767	180.46	777	181.78	788	191.87	725	185.40
25-29 years	463	157.77	467	157.88	560	185.74	478	156.74	491	159.66	500	165.92	497	167.69
30-34 years	270	132.45	306	151.26	342	168.18	332	160.96	316	151.05	324	155.77	331	159.48
35-39 years	203	139.90	216	146.54	236	156.95	222	144.18	238	151.54	243	155.30	262	166.51
40-44 years	102	133.45	79	105.84	101	134.30	121	156.04	109	137.02	104	130.31	111	136.82
45+ years	57	116.22	60	125.79	58	124.27	41	87.59	64	137.23	53	117.67	53	120.04

Disaggregation by Vaccination and Infection

To examine the increased incidence of several health conditions during the pandemic and address section 725(1)(D), DoD first compared incidence following infections and vaccinations in 2021-2023 with incidence among those who had never previously been infected or vaccinated, respectively. The adjusted incidence rate ratios, as shown in Table 2, show that:

- Incidence of 14 of the 15 conditions (excluding immune thrombocytopenia) significantly increased in the risk window following SARS-CoV-2 infection. Of those 14 conditions, 10 had significantly increased incidence beyond the risk window.
- Incidence of two conditions, myocarditis and pericarditis, significantly increased in the risk window (21 days) following COVID-19 vaccination. The increases were smaller than those for infection and were not observed beyond the risk window.
- Incidence of six conditions — life-threatening arrhythmias, acute kidney failure, immune thrombocytopenia, pulmonary embolism, deep vein thrombosis, and Bell's palsy — significantly decreased in the risk window following COVID-19 vaccination. For three of these conditions — acute kidney failure, pulmonary embolism, and Bell's palsy — significant decreases were observed beyond the risk window.

The unadjusted incidence rates following vaccination and infection are shown in Figure 2, along with incidence rates disaggregated across all four combinations of vaccination and infection history. Observations of incidence in Figure 2 are often based on small numbers, not adjusted for demographic differences, and without tests of statistical significance for comparing differences. With these caveats, Figure 2 yields additional observations:

- Incidence following infection exceeded incidence following vaccination for all conditions within the risk window and for all but acute disseminated encephalomyelitis within 1 year.
- When disaggregated by vaccination and infection history, the highest incidence of nine conditions occurred among those who had been infected within the risk window but not vaccinated, and among those who had been both infected and vaccinated within the risk window for six conditions. For all these increases in incidence during the risk window, incidence substantially decreased within 1 year. Looking 1 year out, incidence of 11 conditions was highest among those infected but not vaccinated, and among those both vaccinated and infected for four conditions.
- Within the risk window, the lowest incidence rates were either among those who had been vaccinated regardless of infection status or those who had been neither vaccinated nor infected. Within 1 year, the lowest incidence of 10 conditions was among those who had been vaccinated but not infected.

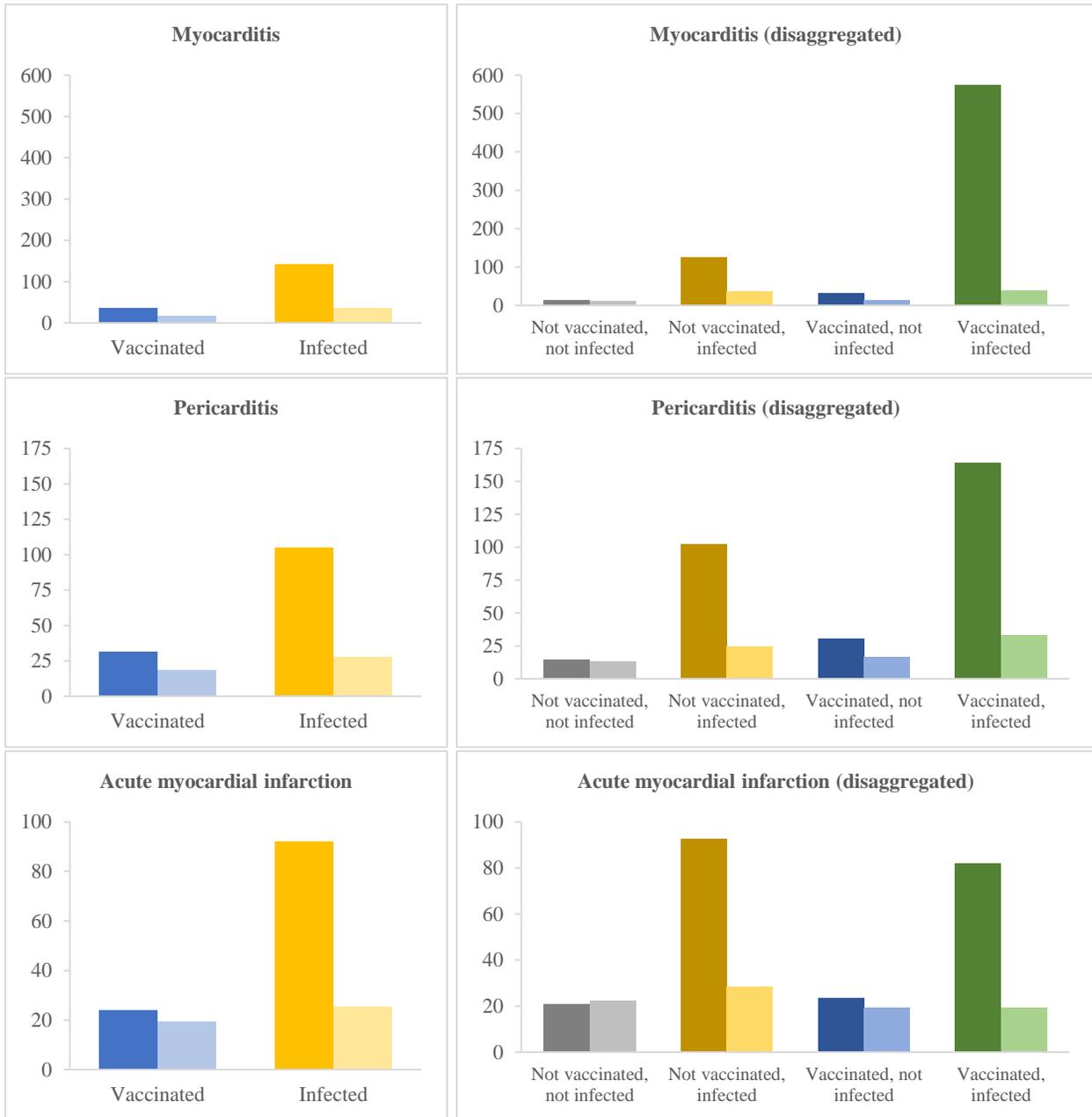
A full accounting of incidence for each health condition following vaccination, infection, and every combination thereof, broken out by year, is provided in Table A2 in the Appendix.

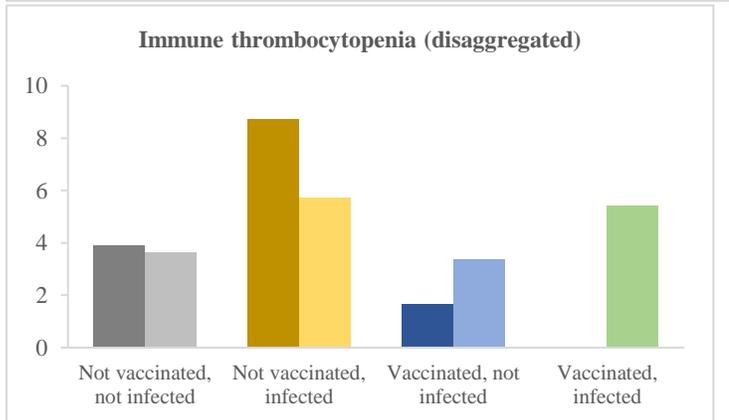
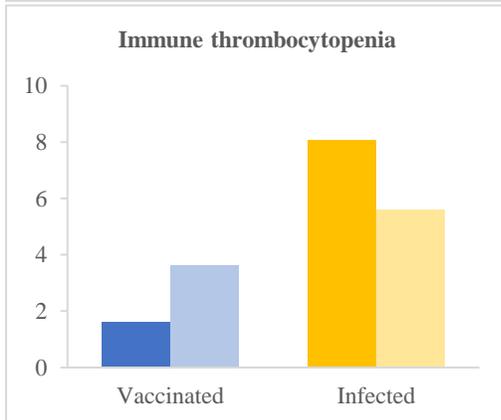
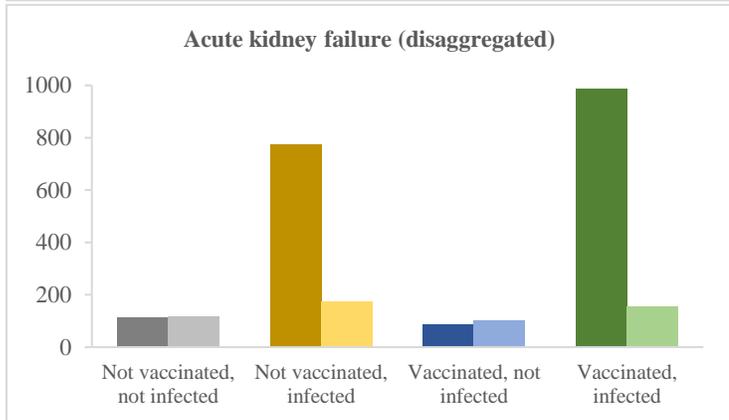
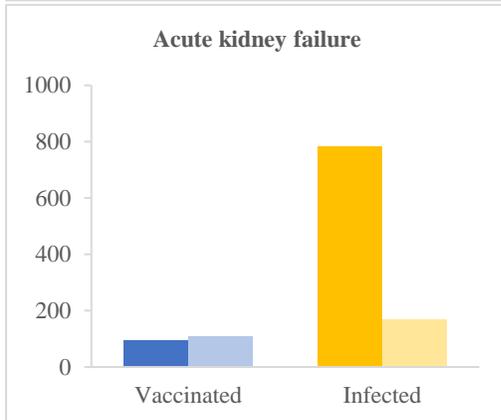
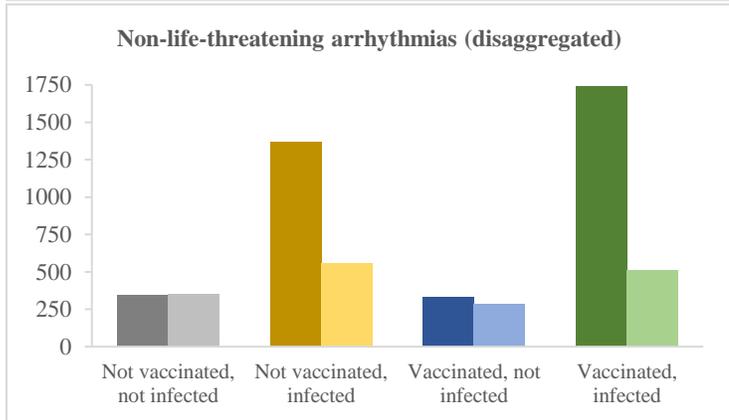
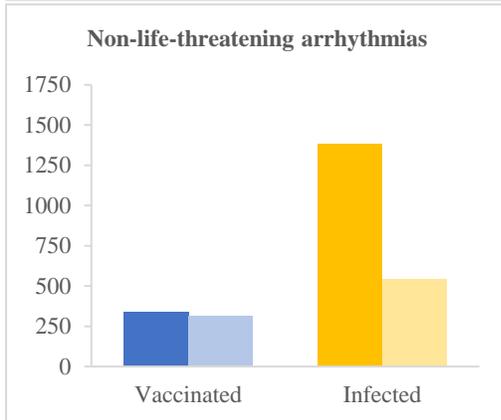
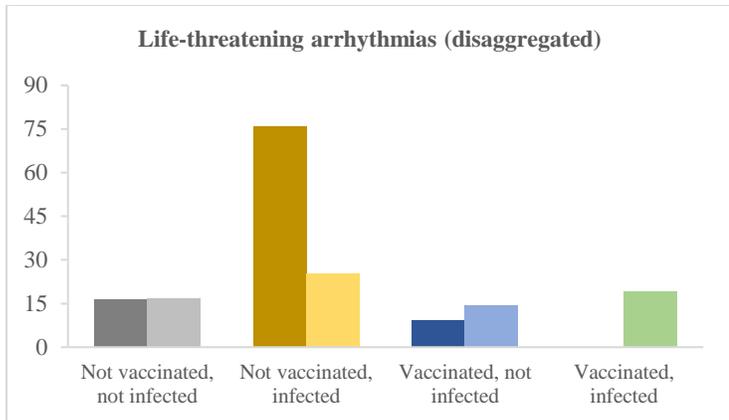
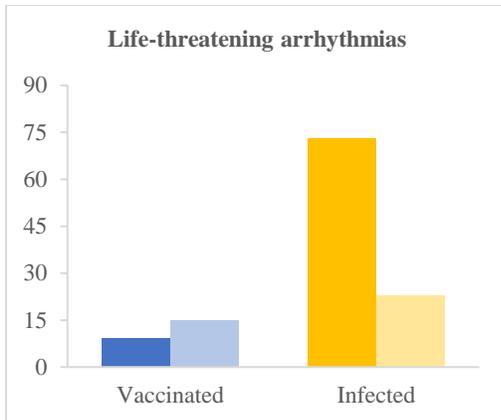
Table 2: Adjusted incidence rate ratios (IRRs) for health conditions, by SARS-CoV-2 infection and COVID-19 vaccination, 2021-2023.

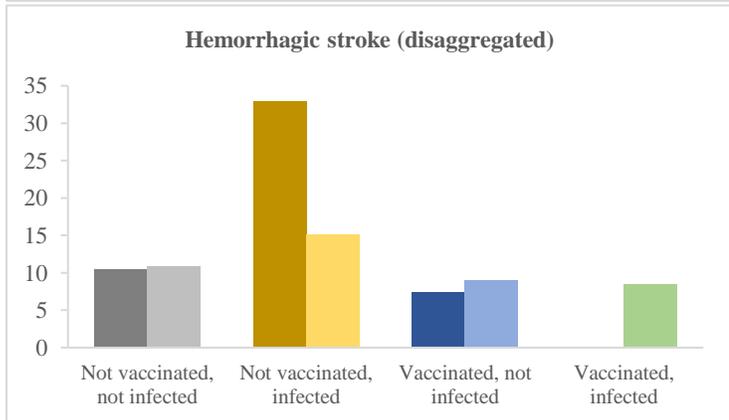
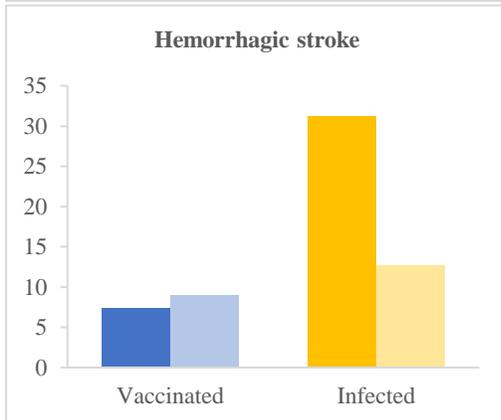
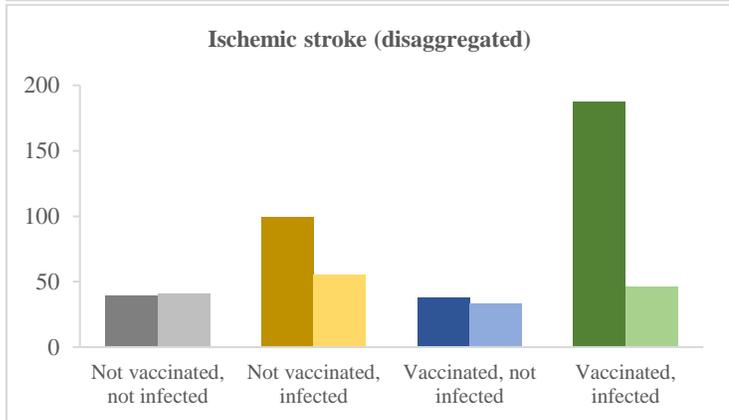
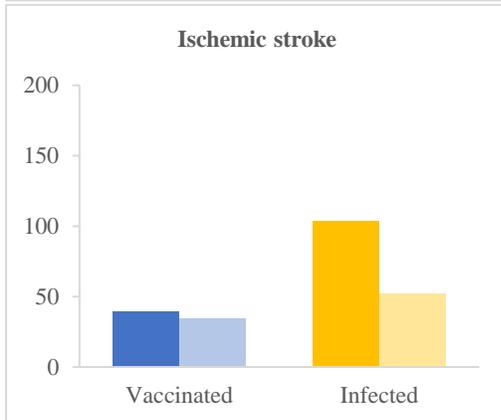
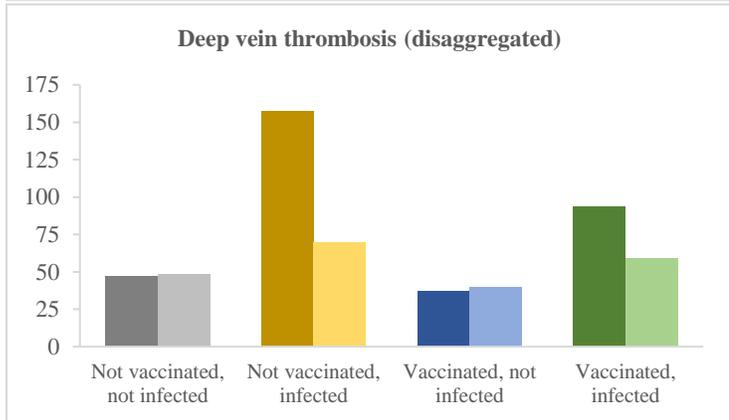
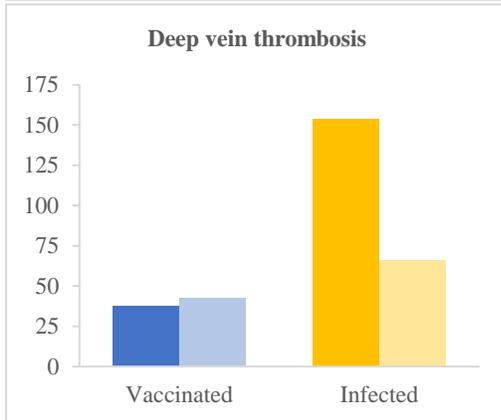
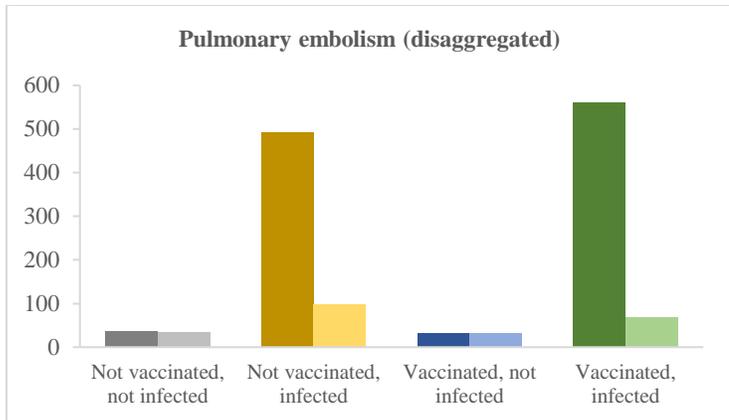
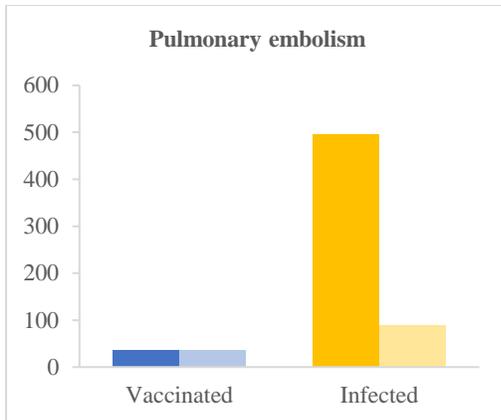
	SARS-CoV-2 Infection		COVID-19 Vaccination	
	IRR	95% confidence limits	IRR	95% confidence limits
Myocarditis				
Within 21 days	11.89*	8.71 - 16.22	2.26*	1.67 - 3.06
>21 days	2.13*	1.78 - 2.53	0.83	0.66 - 1.03
Pericarditis				
Within 21 days	7.37*	5.17 - 10.51	2.08*	1.50 - 2.87
>21 days	1.38*	1.15 - 1.65	0.96	0.77 - 1.20
Acute myocardial infarction				
Within 21 days	4.45*	3.07 - 6.46	1.03	0.73 - 1.46
>21 days	1.14	0.98 - 1.34	0.98	0.80 - 1.20
Life-threatening arrhythmias				
Within 21 days	4.56*	3.00 - 6.93	0.54*	0.32 - 0.90
>21 days	1.24*	1.04 - 0.48	1.06	0.85 - 1.33
Non-life-threatening arrhythmias				
Within 21 days	4.04*	3.66 - 4.45	0.92	0.85 - 1.01
>21 days	1.40*	1.35 - 1.46	0.96	0.92 - 1.01
Acute kidney failure				
Within 21 days	7.22*	6.34 - 8.23	0.72*	0.61 - 0.85
>21 days	1.27*	1.18 - 1.35	0.91*	0.84 - 0.98
Immune thrombocytopenia				
Within 42 days	1.95	0.80 - 4.80	0.35*	0.13 - 0.90
>42 days	1.20	0.83 - 1.74	0.85	0.56 - 1.30
Pulmonary embolism				
Within 28 days	13.92*	11.97 - 16.19	0.67*	0.53 - 0.85
>28 days	1.36*	1.21 - 1.54	0.68*	0.60 - 0.77
Deep vein thrombosis				
Within 28 days	3.30*	2.57 - 4.25	0.71*	0.56 - 0.90
>28 days	1.27*	1.15 - 1.41	0.94	0.82 - 1.07
Ischemic stroke				
Within 28 days	2.75*	2.03 - 3.73	0.99	0.78 - 1.27
>28 days	1.36*	1.22 - 1.52	1.05	0.91 - 1.22
Hemorrhagic stroke				
Within 28 days	2.99*	1.72 - 5.22	0.73	0.43 - 1.25
>28 days	1.18	0.94 - 1.48	1.15	0.88 - 1.51
Bell's palsy				
Within 42 days	1.73*	1.21 - 2.48	0.72*	0.55 - 0.93
>42 days	1.20*	1.04 - 1.37	0.79*	0.68 - 0.93
Guillain-Barre Syndrome				
Within 42 days	5.05*	2.43 - 10.51	1.65	0.78 - 3.50
>42 days	1.25	0.79 - 1.98	1.21	0.70 - 2.11
Acute disseminated encephalomyelitis				
Within 42 days	11.49*	2.42 - 54.62	8.32	0.86 - 80.43
>42 days	0.98	0.20 - 4.76	3.15	0.38 - 26.11
Appendicitis				
Within 21 days	3.61*	3.11 - 4.20	1.01	0.88 - 1.15
>21 days	1.24*	1.17 - 1.31	1.02	0.95 - 1.10
<i>Models were adjusted for age, sex, race/ethnicity, obesity status, and either SARS-CoV-2 infection or COVID-19 vaccination. The reference group is "Never" previously infected or vaccinated, respectively.</i>				
<i>*Statistically significant, p-value <0.05</i>				

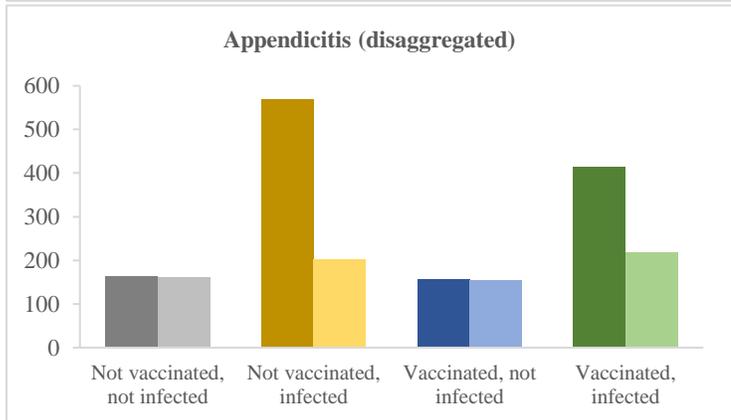
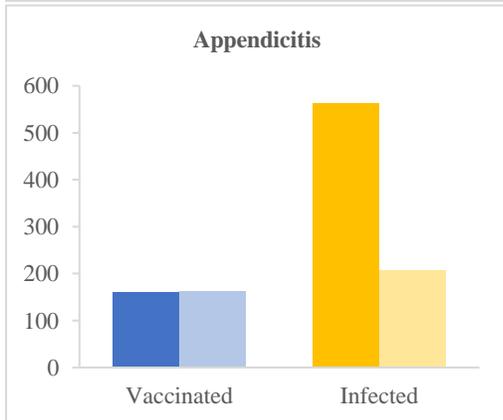
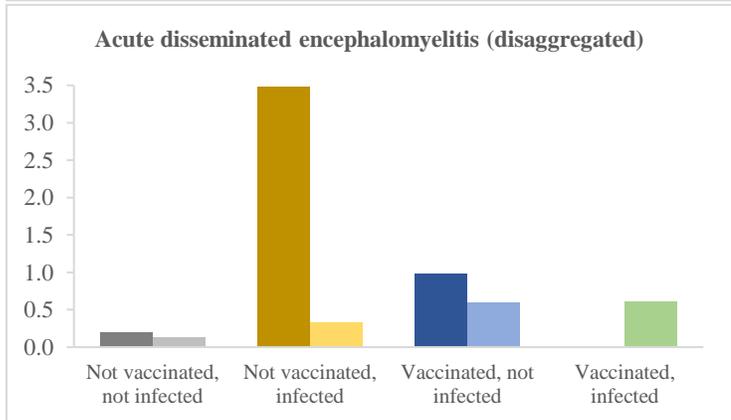
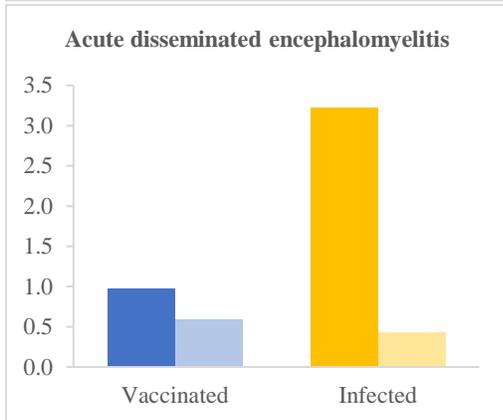
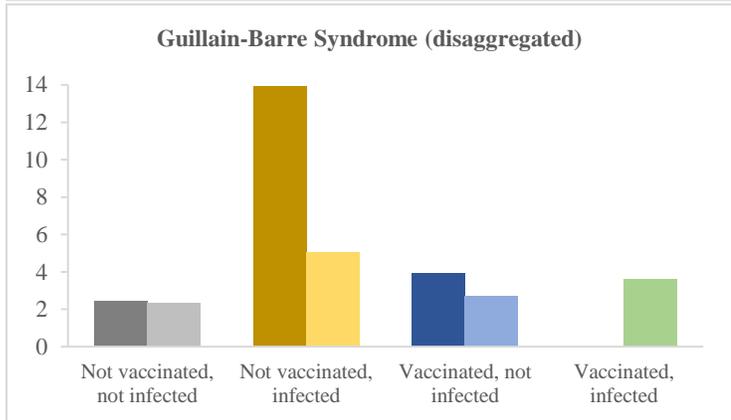
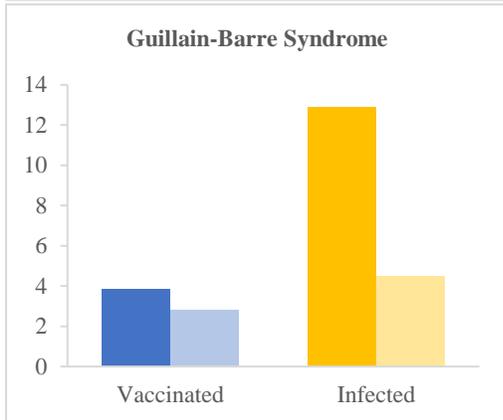
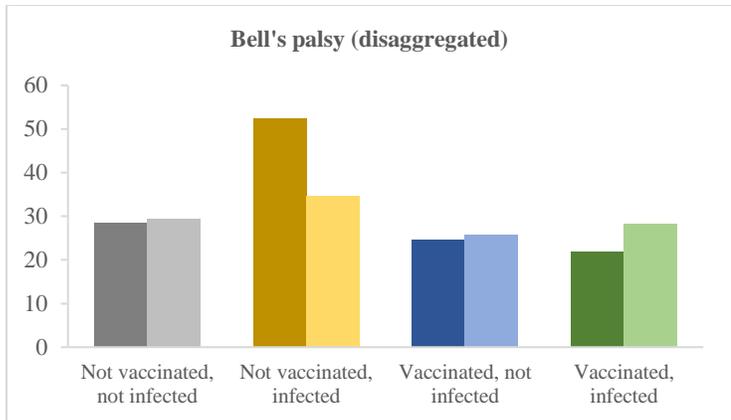
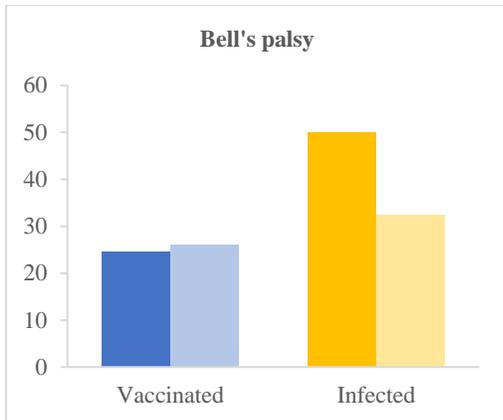
Figure 2: Unadjusted incidence of each health condition per 100,000 person-years in 2021-2023, after vaccination or infection (left) and disaggregated by vaccination and infection history (right), within risk windows (dark bars) and within 1 year* (light bars).

*Represents 1 year after first vaccine dose. All other categories are following any vaccine dose or infection.









Post-Vaccination Incidence by Vaccine Type and Manufacturer

Table 3 shows post-vaccination incidence by vaccine type and manufacturer. As most vaccines administered to Service members were mRNA vaccines, small sample sizes of other vaccine types precluded meaningful comparisons between groups. In addition, the results in Table 3 are unadjusted and do not account for demographic differences; no statistical significance testing was applied for comparing differences. However, results were consistent in demonstrating a small increase in myocarditis incidence after mRNA vaccination; this incidence remained lower than incidence of myocarditis after SARS-CoV-2 infection.

Table 3: Unadjusted incidence of health conditions per 100,000 person-years in 2021-2023 following vaccination, by vaccine type and manufacturer.

	All vaccines		mRNA Moderna		mRNA Pfizer		Janssen		Novavax		Other	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Myocarditis												
Within 21 days of any dose	67	36.23	25	41.96	41	34.92	1	12.77	0	0.00	0	0.00
Within 365 days of first dose	233	17.22	75	18.75	144	17.41	13	10.36	1	186.92	0	0.00
Pericarditis												
Within 21 days of any dose	58	31.39	28	47.03	25	21.31	5	63.87	0	0.00	0	0.00
Within 365 days of first dose	247	18.26	70	17.51	152	18.39	25	19.94	0	0.00	0	0.00
Acute myocardial infarction												
Within 21 days of any dose	44	23.80	16	26.86	27	23.00	1	12.77	0	0.00	0	0.00
Within 365 days of first dose	259	19.14	87	21.75	146	17.66	26	20.72	0	0.00	0	0.00
Life-threatening arrhythmias												
Within 21 days of any dose	17	9.19	7	11.75	9	7.67	1	12.76	0	0.00	0	0.00
Within 365 days of first dose	201	14.85	76	19.00	111	13.42	14	11.16	0	0.00	0	0.00
Non-life-threatening arrhythmias												
Within 21 days of any dose	624	341.36	208	353.60	387	333.27	28	360.73	1	1,492.54	0	0.00
Within 365 days of first dose	4,169	311.51	1,225	310.11	2,574	314.59	366	294.46	4	761.90	0	0.00
Acute kidney failure												
Within 21 days of any dose	171	92.79	42	70.72	121	103.43	8	102.42	0	0.00	0	0.00
Within 365 days of first dose	1,451	107.60	365	91.54	956	116.04	128	102.32	1	186.92	1	362.32
Immune thrombocytopenia												
Within 42 days of any dose	5	1.61	1	0.97	3	1.56	1	6.52	0	0.00	0	0.00
Within 365 days of first dose	49	3.62	17	4.25	28	3.39	4	3.19	0	0.00	0	0.00
Pulmonary embolism												
Within 28 days of any dose	86	37.05	23	29.68	59	40.92	4	38.74	0	0.00	0	0.00
Within 365 days of first dose	486	35.94	133	33.27	303	36.68	50	39.86	0	0.00	0	0.00
Deep vein thrombosis												
Within 28 days of any dose	87	37.50	30	38.74	55	38.16	2	19.38	0	0.00	0	0.00
Within 365 days of first dose	571	42.24	174	43.55	340	41.16	57	45.46	0	0.00	0	0.00
Ischemic stroke												
Within 28 days of any dose	91	39.21	29	37.43	56	38.84	6	58.12	0	0.00	0	0.00
Within 365 days of first dose	468	34.61	131	32.77	300	36.31	36	28.70	0	0.00	1	362.32
Hemorrhagic stroke												
Within 28 days of any dose	17	7.32	4	5.16	13	9.01	0	0.00	0	0.00	0	0.00
Within 365 days of first dose	121	8.94	25	6.25	87	10.52	8	6.37	1	186.22	0	0.00
Bell's palsy												
Within 42 days of any dose	76	24.54	21	20.48	50	26.08	5	32.68	0	0.00	0	0.00
Within 365 days of first dose	353	26.12	101	25.28	220	26.64	32	25.54	0	0.00	0	0.00
Guillain-Barre Syndrome												
Within 42 days of any dose	12	3.87	1	0.97	11	5.73	0	0.00	0	0.00	0	0.00
Within 365 days of first dose	38	2.81	11	2.75	23	2.78	4	3.19	0	0.00	0	0.00

Acute disseminated encephalomyelitis												
Within 42 days of any dose	3	0.97	0	0.00	2	1.04	1	6.52	0	0.00	0	0.00
Within 365 days of first dose	8	0.59	3	0.75	4	0.48	1	0.80	0	0.00	0	0.00
Appendicitis												
Within 42 days of any dose	291	158.86	104	176.40	174	149.52	13	167.46	0	0.00	0	0.00
Within 365 days of first dose	2,176	162.29	660	166.70	1,323	161.39	191	153.61	2	377.36	0	0.00

Post-Vaccination Incidence by Age Group

Table 4 shows post-vaccination incidence by age group. Small numbers precluded meaningful comparisons between groups. The results in Table 4 are unadjusted and do not account for demographic differences; no statistical significance testing was applied for comparing differences. With these caveats, the incidence of most conditions appeared to increase with increasing age, while myocarditis incidence rates appeared to be higher in younger persons. These findings were consistent with established age-based risks in the general population.

Table 4: Unadjusted incidence following vaccination per 100,000 person-years, by health condition, age group (in years), and year.

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
Myocarditis						
By age (in years), within 21 days after any vaccine dose						
<20	7	59.05	1	22.06	0	0.00
20-24	30	62.64	1	13.63	0	0.00
25-29	12	33.96	1	19.84	0	0.00
30-34	4	16.18	0	0.00	0	0.00
35-39	6	31.47	1	31.44	0	0.00
40-44	4	40.31	0	0.00	0	0.00
45+	0	0.00	0	0.00	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	12	24.06	10	18.92	3	19.42
20-24	67	26.88	22	12.53	1	7.88
25-29	31	16.08	14	12.58	1	31.19
30-34	19	13.63	14	20.55	0	0.00
35-39	13	11.71	8	17.69	1	194.88
40-44	9	15.17	4	20.59	0	0.00
45+	4	10.79	0	0.00	0	0.00
Pericarditis						
By age (in years), within 21 days after any vaccine dose						
<20	2	16.87	3	66.19	0	0.00
20-24	20	41.77	2	27.26	0	0.00
25-29	11	31.14	2	39.69	0	0.00
30-34	9	36.44	1	26.25	0	0.00
35-39	5	26.27	0	0.00	0	0.00
40-44	2	20.20	0	0.00	1	284.92
45+	0	0.00	0	0.00	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	2	4.01	4	7.57	0	0.00
20-24	69	27.69	28	15.95	3	23.64
25-29	35	18.16	24	21.57	1	31.23

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
30-34	30	21.54	11	16.16	0	0.00
35-39	15	13.53	6	13.29	0	0.00
40-44	11	18.58	0	0.00	0	0.00
45+	8	21.62	0	0.00	0	0.00
Acute myocardial infarction						
By age (in years), within 21 days after any vaccine dose						
<20	1	8.43	1	22.06	0	0.00
20-24	7	14.62	0	0.00	0	0.00
25-29	7	19.81	0	0.00	0	0.00
30-34	8	32.36	0	0.00	0	0.00
35-39	5	26.24	0	0.00	0	0.00
40-44	6	60.58	0	0.00	1	284.93
45+	5	80.86	3	221.83	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	4	8.02	5	9.46	3	19.42
20-24	30	12.03	9	5.13	0	0.00
25-29	25	12.96	16	14.37	1	31.19
30-34	17	12.19	12	17.62	1	86.48
35-39	32	28.84	14	30.97	1	194.96
40-44	28	47.28	11	56.72	0	0.00
45+	34	92.09	16	183.26	0	0.00
Life-threatening arrhythmias						
By age (in years), within 21 days after any vaccine dose						
<20	1	8.43	0	0.00	0	0.00
20-24	4	8.35	0	0.00	1	194.68
25-29	1	2.83	0	0.00	0	0.00
30-34	2	8.09	0	0.00	0	0.00
35-39	2	10.49	0	0.00	0	0.00
40-44	2	20.17	0	0.00	0	0.00
45+	3	48.43	1	73.82	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	2	4.01	5	9.46	4	25.90
20-24	15	6.02	25	14.24	2	15.76
25-29	19	9.85	13	11.68	0	0.00
30-34	18	12.91	6	8.81	0	0.00
35-39	25	22.53	8	17.69	0	0.00
40-44	23	38.80	13	66.97	0	0.00
45+	17	45.97	6	68.56	0	0.00
Non-life-threatening arrhythmias						
By age (in years), within 21 days after any vaccine dose						
<20	27	227.97	16	353.16	1	356.79
20-24	145	304.02	13	177.76	2	390.74
25-29	91	259.55	14	279.77	2	461.56
30-34	90	368.90	10	265.51	3	677.31
35-39	72	385.84	16	514.27	1	224.37
40-44	52	539.72	8	448.25	0	0.00
45+	46	775.79	13	1,002.86	2	629.64
By age (in years), within 365 days after first vaccine dose						
<20	106	212.77	130	246.27	23	149.04
20-24	586	236.04	524	299.85	21	165.77
25-29	468	244.56	355	321.79	5	156.57
30-34	377	273.93	242	360.51	3	261.89

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
35-39	413	380.08	190	429.99	4	797.49
40-44	284	492.85	121	642.65	2	1,185.39
45+	240	677.73	75	895.47	0	0.00

Acute kidney failure						
By age (in years), within 21 days after any vaccine dose						
<20	15	126.58	11	242.76	0	0.00
20-24	46	96.22	1	13.64	0	0.00
25-29	24	68.13	4	79.53	2	458.36
30-34	19	77.20	3	79.01	0	0.00
35-39	16	84.44	4	126.57	1	220.38
40-44	14	142.09	3	164.46	0	0.00
45+	6	97.48	1	74.29	1	301.38
By age (in years), within 365 days after first vaccine dose						
<20	42	84.26	59	111.72	18	116.61
20-24	259	104.09	166	94.72	14	110.40
25-29	167	86.88	129	116.33	7	218.82
30-34	138	99.43	79	116.58	2	173.40
35-39	108	97.88	67	149.25	2	390.63
40-44	89	151.06	30	155.76	2	1,179.65
45+	47	127.88	26	299.69	0	0.00
Immune thrombocytopenia						
By age (in years), within 42 days after any vaccine dose						
<20	1	5.23	0	0.00	0	0.00
20-24	1	1.29	0	0.00	0	0.00
25-29	1	1.76	0	0.00	0	0.00
30-34	1	2.53	0	0.00	0	0.00
35-39	0	0.00	0	0.00	0	0.00
40-44	0	0.00	0	0.00	0	0.00
45+	1	10.09	0	0.00	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	3	6.02	2	3.78	0	0.00
20-24	5	2.01	6	3.42	1	7.88
25-29	5	2.59	7	6.29	1	31.19
30-34	5	3.59	4	5.87	0	0.00
35-39	4	3.60	2	4.42	0	0.00
40-44	2	3.37	0	0.00	0	0.00
45+	2	5.39	0	0.00	0	0.00
Pulmonary embolism						
By age (in years), within 28 days after any vaccine dose						
<20	2	13.61	0	0.00	0	0.00
20-24	12	20.20	2	20.53	0	0.00
25-29	13	29.71	0	0.00	0	0.00
30-34	14	45.80	0	0.00	0	0.00
35-39	16	67.96	2	45.88	0	0.00
40-44	11	89.86	0	0.00	0	0.00
45+	12	156.80	1	53.76	1	226.21
By age (in years), within 365 days after first vaccine dose						
<20	9	18.05	3	5.68	2	12.95
20-24	48	19.26	29	16.52	2	15.76
25-29	50	25.94	35	31.46	0	0.00
30-34	54	38.77	20	29.39	0	0.00

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
35-39	67	60.47	36	79.80	2	390.57
40-44	51	86.23	19	98.18	1	578.62
45+	48	130.27	10	114.74	0	0.00
Deep vein thrombosis						
By age (in years), within 28 days after any vaccine dose						
<20	3	20.41	2	34.01	0	0.00
20-24	14	23.57	1	10.26	1	138.82
25-29	10	22.86	1	14.69	0	0.00
30-34	12	39.27	2	38.49	0	0.00
35-39	9	38.25	2	45.90	0	0.00
40-44	11	89.97	5	197.61	0	0.00
45+	13	170.18	1	53.83	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	3	6.02	8	15.14	0	0.00
20-24	46	18.46	49	27.91	2	15.76
25-29	56	29.05	43	38.65	0	0.00
30-34	46	33.04	35	51.44	0	0.00
35-39	71	64.12	42	93.15	1	195.22
40-44	61	103.27	33	170.69	0	0.00
45+	62	168.59	13	149.39	0	0.00
Ischemic stroke						
By age (in years), within 28 days after any vaccine dose						
<20	1	6.80	0	0.00	0	0.00
20-24	12	20.20	0	0.00	0	0.00
25-29	15	34.27	2	29.36	0	0.00
30-34	10	32.70	2	38.46	0	0.00
35-39	12	50.97	2	45.86	1	163.15
40-44	14	114.47	1	39.46	0	0.00
45+	14	183.22	1	53.86	4	908.99
By age (in years), within 365 days after first vaccine dose						
<20	5	10.03	6	11.35	0	0.00
20-24	34	13.64	32	18.23	3	23.64
25-29	35	18.15	30	26.96	0	0.00
30-34	47	33.73	24	35.26	0	0.00
35-39	70	63.17	29	64.25	0	0.00
40-44	65	110.02	23	118.86	0	0.00
45+	53	144.06	12	137.86	0	0.00
Hemorrhagic stroke						
By age (in years), within 28 days after any vaccine dose						
<20	1	6.80	0	0.00	0	0.00
20-24	3	5.05	0	0.00	0	0.00
25-29	6	13.71	0	0.00	0	0.00
30-34	2	6.54	1	19.22	0	0.00
35-39	1	4.24	0	0.00	0	0.00
40-44	1	8.15	2	78.69	0	0.00
45+	0	0.00	0	0.00	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	4	8.02	4	7.57	1	6.47
20-24	26	10.43	20	11.39	1	7.88
25-29	20	10.37	9	8.08	0	0.00
30-34	9	6.46	3	4.40	0	0.00

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
35-39	10	9.01	1	2.21	1	194.98
40-44	4	6.74	3	15.44	0	0.00
45+	4	10.79	1	11.40	0	0.00
Bell's palsy						
By age (in years), within 42 days after any vaccine dose						
<20	1	5.23	0	0.00	1	153.24
20-24	12	15.52	3	20.76	0	0.00
25-29	14	24.71	3	28.66	0	0.00
30-34	11	27.90	1	12.26	0	0.00
35-39	14	46.24	2	28.83	0	0.00
40-44	7	44.56	2	48.88	0	0.00
45+	4	40.61	0	0.00	1	149.61
By age (in years), within 365 days after first vaccine dose						
<20	4	8.02	4	7.57	1	6.47
20-24	53	21.27	32	18.23	1	7.88
25-29	49	25.43	41	36.87	2	62.38
30-34	39	28.03	30	44.13	1	86.55
35-39	44	39.76	11	24.40	0	0.00
40-44	16	27.10	8	41.39	0	0.00
45+	14	37.99	3	34.39	0	0.00
Guillain-Barre Syndrome						
By age (in years), within 42 days after any vaccine dose						
<20	2	10.47	1	12.32	0	0.00
20-24	3	3.88	1	6.92	0	0.00
25-29	0	0.00	0	0.00	0	0.00
30-34	2	5.06	1	12.23	0	0.00
35-39	1	3.29	0	0.00	0	0.00
40-44	1	6.33	0	0.00	0	0.00
45+	0	0.00	0	0.00	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	3	6.02	2	3.78	1	6.47
20-24	7	2.81	5	2.85	0	0.00
25-29	4	2.07	3	2.69	0	0.00
30-34	4	2.87	2	2.93	0	0.00
35-39	4	3.60	1	2.21	0	0.00
40-44	2	3.37	0	0.00	0	0.00
45+	0	0.00	0	0.00	0	0.00
Acute disseminated encephalomyelitis						
By age (in years), within 42 days after any vaccine dose						
<20	1	5.23	0	0.00	0	0.00
20-24	1	1.29	0	0.00	0	0.00
25-29	0	0.00	0	0.00	0	0.00
30-34	0	0.00	1	12.23	0	0.00
35-39	0	0.00	0	0.00	0	0.00
40-44	0	0.00	0	0.00	0	0.00
45+	0	0.00	0	0.00	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	1	2.01	2	3.78	0	0.00
20-24	2	0.80	0	0.00	0	0.00
25-29	1	0.52	0	0.00	0	0.00
30-34	0	0.00	1	1.47	0	0.00

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
35-39	0	0.00	0	0.00	0	0.00
40-44	1	1.68	0	0.00	0	0.00
45+	0	0.00	0	0.00	0	0.00
Appendicitis						
By age (in years), within 21 days after any vaccine dose						
<20	13	109.75	4	88.27	0	0.00
20-24	87	182.38	11	150.39	0	0.00
25-29	51	145.49	9	179.77	2	459.99
30-34	33	135.28	6	159.26	0	0.00
35-39	30	160.33	6	192.21	0	0.00
40-44	18	185.10	7	388.73	1	290.03
45+	11	180.73	2	150.43	0	0.00
By age (in years), within 365 days after first vaccine dose						
<20	79	158.57	73	138.25	24	155.48
20-24	458	184.49	338	193.29	23	181.39
25-29	275	143.75	199	180.25	5	156.24
30-34	191	138.87	103	153.20	1	86.95
35-39	166	152.36	73	164.51	1	197.86
40-44	77	132.45	28	147.14	1	598.96
45+	48	132.17	13	151.28	0	0.00

Conclusion

This study examined the overall incidence of 15 health conditions in 2017-2023, and specifically analyzed the incidence rates following COVID-19 vaccination, SARS-CoV-2 infection, or any combination thereof. Incidence of all but one of the health conditions increased following SARS-CoV-2 infection, incidence of myocarditis and pericarditis increased following COVID-19 vaccination, and incidence of six conditions decreased following COVID-19 vaccination. For most conditions, incidence was highest among those who had been infected but not vaccinated. Post-vaccination incidence rates were also broken down by age and vaccine type/manufacturer. Findings and analyses were consistent with prior COVID-19 vaccine safety evaluations among the U.S. and global public health communities.

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Appendix: Supplementary Tables

Table A1: Conditions of interest and corresponding risk windows.

Condition	COVID vaccine risk window	COVID infection risk window
Myocarditis	21 days	21 days
Pericarditis	21 days	21 days
Acute myocardial infarction	21 days	21 days
Life-threatening arrhythmias	21 days	21 days
Non-life-threatening arrhythmias	21 days	21 days
Immune thrombocytopenia	42 days	42 days
Pulmonary embolism	28 days	28 days
Deep vein thrombosis	28 days	28 days
Acute kidney failure	21 days	21 days
Ischemic stroke	28 days	28 days
Hemorrhagic stroke	28 days	28 days
Bell's Palsy	42 days	42 days
Guillain-Barre Syndrome	42 days	42 days
Acute disseminated encephalomyelitis	42 days	42 days
Appendicitis	21 days	21 days

Table A2: Unadjusted incidence of each health condition per 100,000 person-years, by vaccination and infection history, 2021-2023.

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
Myocarditis						
Recent SARS-CoV-2 infection history						
Never infected	158	13.37	99	10.78	100	11.57
Within 21 days after infection	17	196.62	17	88.87	11	294.52
>21 days after infection	68	47.54	69	19.17	73	18.08
Recent COVID-19 vaccination history						
Never vaccinated	88	17.67	12	31.24	10	12.41
Within 21 days after any vaccine dose	63	40.64	4	14.76	0	0.00
>21 days after any vaccine dose	92	13.51	169	13.71	174	14.64
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	168	14.35	166	13.26	173	13.68
Not vaccinated, infected	12	150.54	15	80.67	11	295.25
Vaccinated, not infected	58	37.58	2	7.53	0	0.00
Vaccinated, infected	5	741.32	2	373.38	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days after first vaccine dose or infection						
Not vaccinated, not infected	48	10.88	68	10.41	157	13.57
Not vaccinated, infected	40	74.02	45	27.57	21	25.91
Vaccinated, not infected	116	15.26	48	12.15	5	15.78
Vaccinated, infected	39	49.47	24	27.82	1	63.87
Pericarditis						
Recent SARS-CoV-2 infection history						
Never infected	191	16.17	112	12.20	112	12.97
Within 21 days after infection	10	115.75	12	62.78	11	294.76
>21 days after infection	52	36.37	66	18.35	52	12.89
Recent COVID-19 vaccination history						
Never vaccinated	83	16.68	6	15.63	11	13.65
Within 21 days after any vaccine dose	49	31.64	8	29.54	1	35.43

	2021		2022		2023	
	N	Rate	N	Rate	N	Rate
>21 days after any vaccine dose	121	17.79	176	14.29	163	13.73
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	196	16.75	170	13.59	163	12.89
Not vaccinated, infected	8	100.43	12	64.59	11	295.50
Vaccinated, not infected	47	30.48	8	30.14	1	35.54
Vaccinated, infected	2	296.88	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	61	13.84	89	13.63	148	12.80
Not vaccinated, infected	22	40.74	28	17.17	23	28.41
Vaccinated, not infected	133	17.51	55	13.93	4	12.63
Vaccinated, infected	37	46.96	18	20.88	0	0.00
Acute myocardial infarction						
Recent SARS-CoV-2 infection history						
Never infected	241	20.39	168	18.29	188	21.76
Within 21 days after infection	8	92.54	18	94.12	3	80.32
>21 days after infection	25	17.48	78	21.67	114	28.24
Recent COVID-19 vaccination history						
Never vaccinated	104	20.89	12	31.24	5	6.20
Within 21 days after any vaccine dose	39	25.17	4	14.76	1	35.43
>21 days after any vaccine dose	131	19.25	248	20.13	299	25.17
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	228	19.48	242	19.33	301	23.80
Not vaccinated, infected	7	87.82	18	96.83	3	80.52
Vaccinated, not infected	38	24.63	4	15.06	1	35.55
Vaccinated, infected	1	148.25	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	89	20.19	129	19.75	281	24.29
Not vaccinated, infected	15	27.76	52	31.87	18	22.22
Vaccinated, not infected	156	20.53	65	16.46	6	18.94
Vaccinated, infected	14	17.76	18	20.87	0	0.00
Life-threatening arrhythmias						
Recent SARS-CoV-2 infection history						
Never infected	166	14.04	144	15.68	140	16.20
Within 21 days after infection	8	92.52	11	57.50	4	107.07
>21 days after infection	26	18.17	59	16.39	92	22.79
Recent COVID-19 vaccination history						
Never vaccinated	81	16.27	11	28.64	6	7.44
Within 21 days after any vaccine dose	15	9.68	1	3.69	1	35.43
>21 days after any vaccine dose	104	15.28	202	16.39	229	19.27
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	177	15.12	202	16.13	231	18.26
Not vaccinated, infected	8	100.35	11	59.15	4	107.34
Vaccinated, not infected	15	9.72	1	3.76	1	35.54
Vaccinated, infected	0	0.00	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	66	14.97	103	15.77	205	17.71
Not vaccinated, infected	15	27.75	35	21.44	25	30.85
Vaccinated, not infected	104	13.69	59	14.94	6	18.94
Vaccinated, infected	15	19.02	17	19.70	0	0.00

Non-life-threatening arrhythmias						
Recent SARS-CoV-2 infection history						
Never infected	3,461	296.10	2,869	315.69	2,834	331.44
Within 21 days after infection	168	1,968.75	183	971.87	77	2,104.91
>21 days after infection	641	453.98	1,528	431.27	1,892	477.59
Recent COVID-19 vaccination history						
Never vaccinated	1,796	364.48	231	610.54	234	291.66
Within 21 days after any vaccine dose	523	341.34	90	335.74	11	396.90
>21 days after any vaccine dose	1,951	290.07	4,259	349.88	4,558	388.95
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	3,595	310.59	4,312	348.64	4,715	377.67
Not vaccinated, infected	152	1,932.02	178	972.68	77	2,110.14
Vaccinated, not infected	507	332.34	85	323.48	11	398.20
Vaccinated, infected	16	2,402.66	5	943.77	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	1,439	329.72	2,142	332.03	4,264	373.30
Not vaccinated, infected	357	668.76	801	499.32	481	605.45
Vaccinated, not infected	2,084	277.50	1,198	306.17	52	164.50
Vaccinated, infected	390	501.42	439	515.93	6	384.76
Acute kidney failure						
Recent SARS-CoV-2 infection history						
Never infected	1,163	98.73	977	106.73	963	111.85
Within 21 days after infection	125	1,452.05	83	435.67	37	995.60
>21 days after infection	190	133.41	446	124.48	555	138.21
Recent COVID-19 vaccination history						
Never vaccinated	629	126.77	64	167.24	128	159.02
Within 21 days after any vaccine dose	140	90.64	27	99.93	4	142.23
>21 days after any vaccine dose	709	104.52	1,415	115.28	1,423	120.29
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	1,223	104.84	1,398	112.09	1,514	120.18
Not vaccinated, infected	115	1,448.97	81	437.42	37	998.10
Vaccinated, not infected	130	84.54	25	94.39	4	142.70
Vaccinated, infected	10	1,488.44	2	374.85	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	458	104.22	732	112.49	1,381	119.84
Not vaccinated, infected	170	315.93	218	134.16	129	159.92
Vaccinated, not infected	733	96.80	420	106.69	42	132.70
Vaccinated, infected	117	149.05	136	158.32	3	191.89
Immune thrombocytopenia						
Recent SARS-CoV-2 infection history						
Never infected	42	3.55	33	3.59	28	3.24
Within 42 days after infection	2	11.73	0	0.00	3	40.28
>42 days after infection	7	5.20	16	4.68	17	4.25
Recent COVID-19 vaccination history						
Never vaccinated	26	5.23	1	2.64	3	3.72
Within 42 days after any vaccine dose	5	2.01	0	0.00	0	0.00
>42 days after any vaccine dose	20	3.40	48	3.98	45	3.80
SARS-CoV-2 infection and vaccination status, within 42 days after any vaccine dose or infection						
Not vaccinated, not infected	44	4.11	49	4.06	45	3.58
Not vaccinated, infected	2	13.76	0	0.00	3	40.48
Vaccinated, not infected	5	2.03	0	0.00	0	0.00
Vaccinated, infected	0	0.00	0	0.00	0	0.00

SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	20	4.53	22	3.37	40	3.46
Not vaccinated, infected	5	9.25	6	3.67	6	7.40
Vaccinated, not infected	22	2.89	16	4.05	2	6.31
Vaccinated, infected	4	5.07	5	5.79	0	0.00
Pulmonary embolism						
Recent SARS-CoV-2 infection history						
Never infected	410	34.71	268	29.19	280	32.43
Within 28 days after infection	151	1,328.44	38	150.40	17	343.96
>28 days after infection	70	49.96	149	42.16	184	45.77
Recent COVID-19 vaccination history						
Never vaccinated	304	61.15	16	41.98	16	19.87
Within 28 days after any vaccine dose	80	41.70	5	13.74	1	25.97
>28 days after any vaccine dose	247	38.38	434	35.51	464	39.12
SARS-CoV-2 infection and vaccination status, within 28 days after any vaccine dose or infection						
Not vaccinated, not infected	412	36.44	412	33.34	463	36.70
Not vaccinated, infected	139	1,365.69	38	156.17	17	345.10
Vaccinated, not infected	68	35.66	5	14.10	1	26.08
Vaccinated, infected	12	1,009.46	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	159	36.09	204	31.25	423	36.58
Not vaccinated, infected	145	268.70	99	60.72	51	63.00
Vaccinated, not infected	255	33.58	110	27.87	6	18.94
Vaccinated, infected	72	91.47	42	48.76	1	63.84
Deep vein thrombosis						
Recent SARS-CoV-2 infection history						
Never infected	487	41.25	392	42.72	399	46.23
Within 28 days after infection	35	307.86	23	91.06	6	121.42
>28 days after infection	83	59.23	205	58.01	233	57.98
Recent COVID-19 vaccination history						
Never vaccinated	261	52.52	18	47.24	21	26.07
Within 28 days after any vaccine dose	72	37.54	14	38.49	1	25.99
>28 days after any vaccine dose	272	42.28	588	48.13	616	51.96
SARS-CoV-2 infection and vaccination status, within 28 days after any vaccine dose or infection						
Not vaccinated, not infected	500	44.24	583	47.19	631	50.03
Not vaccinated, infected	33	324.18	23	94.55	6	121.82
Vaccinated, not infected	70	36.72	14	39.50	1	26.10
Vaccinated, infected	2	168.16	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	204	46.31	297	45.52	583	50.44
Not vaccinated, infected	56	103.74	100	61.35	52	64.26
Vaccinated, not infected	296	39.00	174	44.09	3	9.47
Vaccinated, infected	49	62.24	49	56.87	0	0.00
Ischemic stroke						
Recent SARS-CoV-2 infection history						
Never infected	426	36.07	308	33.55	309	35.79
Within 28 days after infection	13	114.26	15	59.37	15	303.41
>28 days after infection	56	39.93	181	51.20	221	54.97
Recent COVID-19 vaccination history						
Never vaccinated	186	37.41	13	34.09	13	16.14
Within 28 days after any vaccine dose	78	40.65	8	21.99	5	129.89
>28 days after any vaccine dose	231	35.89	483	39.52	527	44.44

SARS-CoV-2 infection and vaccination status, within 28 days after any vaccine dose or infection						
Not vaccinated, not infected	406	35.91	482	39.00	526	41.69
Not vaccinated, infected	11	107.98	14	57.53	14	284.13
Vaccinated, not infected	76	39.86	7	19.74	4	104.36
Vaccinated, infected*	2	168.10	1	107.24	1	6,072.20
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	159	36.08	268	41.06	485	41.95
Not vaccinated, infected	27	49.99	80	49.07	57	70.43
Vaccinated, not infected	272	35.83	116	29.38	3	9.47
Vaccinated, infected	37	46.96	40	46.40	0	0.00
Hemorrhagic stroke						
Recent SARS-CoV-2 infection history						
Never infected	111	9.39	80	8.71	100	11.57
Within 28 days after infection	7	61.47	2	7.91	4	80.80
>28 days after infection	17	12.11	39	11.02	50	12.42
Recent COVID-19 vaccination history						
Never vaccinated	58	11.66	3	7.86	6	7.45
Within 28 days after any vaccine dose	14	7.29	3	8.24	0	0.00
>28 days after any vaccine dose	63	9.78	115	9.40	148	12.47
SARS-CoV-2 infection and vaccination status, within 28 days after any vaccine dose or infection						
Not vaccinated, not infected	114	10.07	116	9.38	150	11.88
Not vaccinated, infected	7	68.65	2	8.21	4	81.07
Vaccinated, not infected	14	7.34	3	8.45	0	0.00
Vaccinated, infected	0	0.00	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	44	9.98	62	9.49	138	11.92
Not vaccinated, infected	14	25.90	18	11.02	13	16.04
Vaccinated, not infected	69	9.08	35	8.86	3	9.47
Vaccinated, infected	8	10.14	6	6.95	0	0.00
Bell's palsy						
Recent SARS-CoV-2 infection history						
Never infected	341	28.89	225	24.52	221	25.61
Within 42 days after infection	8	47.01	17	45.37	6	80.71
>42 days after infection	42	31.23	104	30.49	151	37.82
Recent COVID-19 vaccination history						
Never vaccinated	172	34.65	11	29.10	18	22.36
Within 42 days after any vaccine dose	63	25.37	11	19.92	2	32.64
>42 days after any vaccine dose	156	26.57	324	26.93	358	30.26
SARS-CoV-2 infection and vaccination status, within 42 days after any vaccine dose or infection						
Not vaccinated, not infected	320	29.93	319	26.47	370	29.45
Not vaccinated, infected	8	55.15	16	45.11	6	81.12
Vaccinated, not infected	63	25.63	10	18.79	2	32.84
Vaccinated, infected	0	0.00	1	49.94	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	143	32.47	172	26.36	344	29.77
Not vaccinated, infected	29	53.73	45	27.62	29	35.84
Vaccinated, not infected	202	26.62	101	25.60	3	9.47
Vaccinated, infected	17	21.59	28	32.50	2	127.78
Guillain-Barre Syndrome						
Recent SARS-CoV-2 infection history						
Never infected	30	2.54	22	2.39	20	2.31
Within 42 days after infection	2	11.73	4	10.65	2	26.85
>42 days after infection	4	2.97	11	3.22	11	2.75

Recent COVID-19 vaccination history						
Never vaccinated	12	2.41	1	2.64	3	3.72
Within 42 days after any vaccine dose	9	3.62	3	5.42	0	0.00
>42 days after any vaccine dose	15	2.55	33	2.74	30	2.53
SARS-CoV-2 infection and vaccination status, within 42 days after any vaccine dose or infection						
Not vaccinated, not infected	25	2.33	30	2.48	31	2.46
Not vaccinated, infected	2	13.76	4	11.25	2	26.99
Vaccinated, not infected	9	3.65	3	5.63	0	0.00
Vaccinated, infected	0	0.00	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	11	2.49	14	2.14	28	2.42
Not vaccinated, infected	1	1.85	10	6.12	4	4.93
Vaccinated, not infected	19	2.50	12	3.04	1	3.16
Vaccinated, infected	5	6.34	1	1.16	0	0.00
Acute disseminated encephalomyelitis						
Recent SARS-CoV-2 infection history						
Never infected	5	0.42	1	0.11	2	0.23
Within 42 days after infection	1	5.86	1	2.66	0	0.00
>42 days after infection	0	0.00	2	0.59	0	0.00
Recent COVID-19 vaccination history						
Never vaccinated	1	0.20	0	0.00	0	0.00
Within 42 days after any vaccine dose	2	0.80	1	1.81	0	0.00
>42 days after any vaccine dose	3	0.51	3	0.25	2	0.17
SARS-CoV-2 infection and vaccination status, within 42 days after any vaccine dose or infection						
Not vaccinated, not infected	3	0.28	2	0.17	2	0.16
Not vaccinated, infected	1	6.88	1	2.81	0	0.00
Vaccinated, not infected	2	0.81	1	1.87	0	0.00
Vaccinated, infected	0	0.00	0	0.00	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	0	0.00	1	0.15	2	0.17
Not vaccinated, infected	1	1.85	0	0.00	0	0.00
Vaccinated, not infected	5	0.66	2	0.51	0	0.00
Vaccinated, infected	0	0.00	1	1.16	0	0.00
Appendicitis						
Recent SARS-CoV-2 infection history						
Never infected	1,836	156.81	1,327	145.75	1,327	154.89
Within 21 days after infection	48	560.62	100	529.07	27	730.90
>21 days after infection	260	183.59	697	195.98	750	188.33
Recent COVID-19 vaccination history						
Never vaccinated	855	173.20	57	149.75	88	109.50
Within 21 days after any vaccine dose	243	158.29	45	167.47	3	107.40
>21 days after any vaccine dose	1,046	155.22	2,022	165.73	2,013	171.24
SARS-CoV-2 infection and vaccination status, within 21 days after any vaccine dose or infection						
Not vaccinated, not infected	1,855	159.97	1,982	159.87	2,074	165.63
Not vaccinated, infected	46	582.75	97	528.03	27	732.73
Vaccinated, not infected	241	157.67	42	159.45	3	107.76
Vaccinated, infected	2	299.26	3	565.27	0	0.00
SARS-CoV-2 infection and vaccination status, within 365 days following first vaccine dose or infection						
Not vaccinated, not infected	726	166.07	971	150.16	1907	166.48
Not vaccinated, infected	124	231.58	326	202.41	142	177.50
Vaccinated, not infected	1,145	152.20	623	158.95	49	154.86
Vaccinated, infected	149	190.98	204	238.99	6	383.98