

ORIGINAL RESEARCH ARTICLE

Immediate onset signatures of autoimmune diseases after vaccination

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Supplementary File

Table S1. Autoimmune adverse events by vaccine type for COVID-19, FLU, HEP, HPV, PNC, and VARZOS

Adverse event	COVID-19	FLU	HEP	HPV	PNC	VARZOS
Common adverse events: Headache, fatigue, pyrexia (fever), chills, and pain	898,859	92,682	36,222	21,437	23,491	69,901
	240,413	34,067	13,914	9,107	10,859	23,118
	26.75%	36.76%	38.41%	42.48%	46.23%	33.07%
Acute disseminated encephalomyelitis	280	205	75	79	34	17
	90	85	31	30	13	7
	0.01%	0.09%	0.09%	0.14%*	0.06%	0.01%
Alopecia	3,991	156	390	653	37	102
	1,621	62	146	369	16	60
	0.18%	0.07%	0.40%*	1.72%*	0.07%	0.09%
Arthritis	4,199	501	655	223	51	188
	1,759	191	264	64	29	122
	0.20%	0.21%	0.73%*	0.30%	0.12%	0.18%
Autoimmune disorder	1,709	142	131	336	-	84
	770	54	66	171	-	55
	0.09%	0.06%	0.18%*	0.80%*	-	0.08%
Autoimmune hepatitis	439	14	49	22	-	-
	162	6	36	9	-	-
	0.02%	0.01%	0.10%	0.04%	-	-
Autoimmune thyroiditis	770	-	84	117	-	-
	299	-	17	31	-	-
	0.03%	-	0.05%	0.15%*	-	-
Bell's palsy	7,331	205	-	-	-	146
	2,129	37	-	-	-	82
	0.24%*	0.04%	-	-	-	0.12%*
Chronic fatigue syndrome	905	30	89	276	-	-
	451	12	49	178	-	-
	0.05%	0.01%	0.14%*	0.83%*	-	-
Complex regional pain syndrome	168	-	-	150	-	-
	96	-	-	64	-	-
	0.01%	-	-	0.30%*	-	-

(Cont'd...)

Table S1. (Continued)

Adverse event	COVID-19	FLU	HEP	HPV	PNC	VARZOS
Crohn's disease	799	19	62	80	-	9
	382	6	39	36	-	6
	0.04%	0.00%	0.11%*	0.17%*	-	0.01%
Diabetes mellitus	1,159	116	176	44	45	17
	485	46	47	19	24	11
	0.05%	0.05%	0.13%	0.09%	0.10%	0.02%
Eczema	2,117	174	244	107	306	86
	872	68	96	44	165	41
	0.10%	0.07%	0.27%*	0.21%*	0.70%*	0.06%
Guillain-Barré syndrome (GBS)	3,451	3,045	439	276	172	396
	1,278	869	106	126	47	201
	0.14%	0.94%*	0.29%*	0.59%*	0.20%	0.29%*
Henoch-Schonlein purpura	259	153	109	107	65	-
	85	26	12	19	18	-
	0.01%	0.03%	0.03%	0.09%	0.08%	-
Immune thrombocytopenia	1,667	39	33	-	64	-
	581	11	8	-	13	-
	0.06%	0.01%	0.02%	-	0.06%	-
Juvenile idiopathic arthritis	56	-	-	78	11	-
	17	-	-	43	5	-
	0.00%	-	-	0.20%*	0.02%	-
Kawasaki's disease	57	39	100	-	263	-
	16	11	24	-	101	-
	0.00%	0.01%	0.07%	-	0.43%*	-
Lyme disease	517	-	-	54	-	15
	198	-	-	28	-	15
	0.02%	-	-	0.13%*	-	0.02%
Multiple sclerosis	1230	151	885	306	-	32
	535	56	427	186	-	26
	0.06%	0.06%	1.18%*	0.87%*	-	0.04%
Multiple sclerosis relapse	842	28	37	13	-	21
	365	12	16	6	-	16
	0.04%	0.01%	0.04%	0.03%	-	0.02%
Myasthenia gravis	624	30	-	36	-	-
	233	8	-	18	-	-
	0.03%	0.01%	-	0.08%	-	-
Myositis	760	183	115	52	22	21
	337	70	34	15	7	9
	0.04%	0.08%	0.09%	0.07%	0.03%	0.01%
Narcolepsy	158	170	15	116	-	-
	71	93	7	73	-	-
	0.01%	0.10%	0.02%	0.34%*	-	-

(Cont'd...)

Table S1. (Continued)

Adverse event	COVID-19	FLU	HEP	HPV	PNC	VARZOS
Neutropenia	494	53	85	29	106	-
	148	17	7	7	52	-
	0.02%	0.02%	0.02%	0.03%	0.22%*	-
Optic neuritis	831	181	335	155	-	31
	271	8	128	51	-	17
	0.03%	0.01%	0.35%*	0.24%*	-	0.02%
Polymyalgia rheumatica	1,994	186	28	-	17	146
	691	75	12	-	11	75
	0.08%	0.08%	0.03%	-	0.05%	0.11%
Postural orthostatic tachycardia syndrome (POTS)	838	35	13	665	-	-
	334	6	5	409	-	-
	0.04%	0.01%	0.01%	1.91%*	-	-
Raynaud's phenomenon	586	20	44	83	-	-
	218	10	13	42	-	-
	0.02%	0.01%	0.04%	0.20%*	-	-
Restless legs syndrome	742	-	29	48	-	21
	399	-	16	27	-	11
	0.04%	-	0.04%	0.20%*	-	0.02%
Rheumatoid arthritis	3,411	195	337	113	25	161
	1,552	92	155	47	15	107
	0.17%*	0.10%	0.43%*	0.22%*	0.06%	0.15%*
Sjogren's syndrome	354	-	45	37	-	-
	132	-	32	23	-	-
	0.02%	-	0.09%*	0.11%*	-	-
Systemic lupus erythematosus	802	112	242	256	-	38
	377	61	112	149	-	24
	0.04%	0.07%	0.31%*	0.70%*	-	0.03%
Type 1 diabetes mellitus	647	65	68	108	31	-
	208	11	23	34	7	-
	0.02%	0.01%	0.06%	0.16%*	0.03%	-
Uveitis	726	42	125	72	-	43
	273	25	96	45	-	23
	0.03%	0.03%	0.27%*	0.21%*	-	0.03%
Vasculitis	1,085	213	279	62	61	37
	377	90	117	29	27	21
	0.04%	0.10%	0.32%*	0.14%*	0.12%*	0.03%

Notes: First row: total number of reports; second row: number of reports on day 0; third row: percentage of the number of reports on day 0 over total number of reports for the relevant vaccine type. *The percentage that is high compared to other percentages for the same adverse event. VAERS data include adverse event reports from 1990 to May 19, 2023. FLU: Influenza, HEP: Hepatitis A and B, HPV: Human papillomavirus, PNC: Pneumococcal, and VARZOS: Varicella-zoster.

Table S2. Adverse event enrichment estimates over background expected for onset within the first 24 h

Adverse event	Vaccine	Background per 100,000/year	b ^x	AE ₀ reports	AE ₀ per 100,000/year	V ₀ (r ₀ = 1/20)	V ₀ (r ₀ = 1/40)
Alopecia	COVID-19	20.75 ^[1]	0.057	1,621	288	15.7	31.5
Bell's palsy	COVID-19	23.8 ^[2]	0.065	2,129	378	20.6	41.3
Chronic fatigue syndrome	COVID-19	13.16 ^[3]	0.036	451	80	4.3	8.7
Complex regional pain syndrome	COVID-19	5.46 ^[4]	0.015	96	17	0.9	1.9
Guillain-Barré syndrome	COVID-19	2.1 ^[2]	5.75E-03	1,278	227	12.4	24.8
Henoch-Schonlein purpura	COVID-19	1.93 ^[5]	5.29E-03	85	15	0.8	1.6
Immune thrombocytopenia	COVID-19	21.7 ^[2]	5.95E-02	581	103	5.6	11.2
Myositis	COVID-19	22	0.060	337	60	3.2	6.5
Multiple sclerosis	COVID-19	2.1 ^[6]	0.006	535	95	5.2	10.4
Narcolepsy	COVID-19	1.1 ^[2]	3.01E-03	71	13	0.7	1.4
Optic neuritis	COVID-19	3.9 ^[7]	0.011	271	48	2.6	5.3
POTS	COVID-19	10.1 ^[8]	0.028	334	59	3.2	6.5
Rheumatoid arthritis	COVID-19	41 ^[9]	0.112	1,552	275	15.0	30.1
Systemic lupus erythematosus	COVID-19	5.3 ^[2]	0.015	377	67	3.7	7.3
Type 1 diabetes mellitus	COVID-19	15 ^[10]	0.041	208	37	2.0	4.0
Guillain-Barré syndrome	Influenza	2.1	0.01	84	17	1.0	1.9
Alopecia	Hepatitis	30.75	0.08	146	53	2.8	5.8
Chronic fatigue syndrome	Hepatitis	13.16	3.61E-02	49	18	0.9	1.9
Guillain-Barré syndrome	Hepatitis	2.1	5.75E-03	106	39	2.1	4.2
Multiple sclerosis	Hepatitis	2.1	0.01	427	156	8.5	17.1
Optic neuritis	Hepatitis	3.9	1.07E-02	128	47	2.5	5.1
Systemic lupus erythematosus	Hepatitis	5.3	0.01	112	41	2.2	4.5
Vasculitis	Hepatitis	0.0034	9.32E-06	117	43	2.3	4.7
Alopecia	HPV	20.75	0.06	369	101	5.5	11.0
Chronic fatigue syndrome	HPV	13.16	3.61E-02	178	49	2.6	5.3
Complex regional pain syndrome	HPV	5.46	1.50E-02	64	18	0.9	1.9
Guillain-Barré syndrome	HPV	2.1	5.75E-03	126	34	1.9	3.8
Multiple sclerosis	HPV	2.1	0.01	186	51	2.8	5.6
Narcolepsy	HPV	1.1	3.01E-03	73	20	1.1	2.2
Optic neuritis	HPV	3.9	1.07E-02	51	14	0.8	1.5
POTS	HPV	10.1	2.77E-02	334	91	5.0	10.0
Systemic lupus erythematosus	HPV	5.3	0.01	149	41	2.2	4.5
Guillain-Barré syndrome	PNC	2.1	5.75E-03	47	33	1.8	3.6
Kawasaki disease	PNC	18.1 ^[11]	4.96E-02	101	71	3.8	7.7
Neutropenia	PNC	1 ^[12]	2.74E-03	52	36	2.0	4.0
Bell's palsy	VARZOS	23.8	0.065	82	67	3.6	7.3
Guillain-Barré syndrome	VARZOS	2.1	5.75E-03	201	164	9.0	18.0
Rheumatoid arthritis	VARZOS	41	0.112	107	87	4.7	9.4

Notes: Immunized population estimates used: COVID-19: 617,135,227 doses with three shots per person; Influenza: 175 million (averaged 2021, 2022, and 2023 reports); Hepatitis: 30% of the U.S. adult population of 333,287,557; Human papillomavirus (HPV): 40% of the U.S. adult population of 333,287,557; Pneumococcal (PNC): 70% of older adults of 74.6 million; Varicella-zoster (VARZOS): 60% of older adults of 74.6 million. AE₀: adverse event reported on day 0; B^x: background adverse events; V₀: Vaccine-associated adverse events reported on day 0 (within 24 hours) of immunization.

Table S3. Autoimmune adverse events induced by other vaccines

Adverse event	6VAX-F	ANTH	HIBV	IPV	LYME	MENB	MNQ	PPV	RV	TYP
Common adverse events	1,683	4,792	20,668	11,990	1,788	10,055	9,356	35,144	6,400	4,944
Arthritis	-	104	52	-	-	-	-	117	-	-
	-	50	19	-	-	-	-	71	-	-
	-	1.04%*	0.09%	-	-	-	-	0.20%*	-	-
Guillain-Barré syndrome	-	-	49	81	-	23	134	207	-	77
	-	-	19	18	-	12	14	71	-	19
	-	-	0.09%	0.15%*	-	0.17%	0.15%*	0.20%*	-	0.38%*
Henoch-Schonlein purpura	-	-	29	41	-	26	-	22	-	-
	-	-	13	12	-	8	-	10	-	-
	-	-	0.06%	0.10%	-	0.11%	-	0.03%	-	-
Kawasaki disease	65	-	124	-	-	88	-	14	181	-
	30	-	47	-	-	50	-	12	53	-
	1.78%*	-	0.23%	-	-	0.69%*	-	0.03%	0.83%*	-
Neutropenia	33	-	44	32	-	34	-	25	54	-
	18	-	20	12	-	12	-	18	21	-
	1.07%*	-	0.10%	0.10%	-	0.17%	-	0.05%	0.33%*	-
Rheumatoid arthritis	-	28	-	-	84	-	-	38	-	-
	-	7	-	-	34	-	-	24	-	-
	-	0.15%	-	-	1.90%*	-	-	0.07%	-	-
Vasculitis	-	-	45	32	-	-	-	39	-	16
	-	-	21	16	-	-	-	17	-	5
	-	-	0.10%	0.13%	-	-	-	0.05%	-	0.10%

Notes: First row: Total number of reports; second row: Number of reports on day 0; third row: Percentage of the number of reports on day 0 over total number of reports for the relevant vaccine type. *The percentage that is high compared to other percentages for the same adverse event. VAERS data include adverse event reports from 1990 to May 19, 2023. 6-VAX-F: Diphtheria and tetanus toxoids and acellular pertussis absorbed+inactivated poliovirus+hepatitis B+Haemophilus B conjugate vaccine; ANTH: Anthrax vaccine; HIBV: *Haemophilus influenzae* type B vaccine; IPV: Inactivated poliovirus vaccine; LYME: Lyme disease vaccine; MENB: Meningococcal group B, rDNA absorbed vaccine; MNQ: Meningococcal conjugate vaccine; PPV: Pneumococcal, polyvalent vaccine; RV: Rotavirus vaccine; TYP: Typhoid vaccine.

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