

Herpes Zoster Risk Among Immunocompromised Adults in the United States: A Retrospective Cohort Analysis

Justin Gatwood¹; Yong Zhu²; Andrea Steffens²; Stephanie Gallagher²; Mary DuCharme²; Nikita Stempniewicz¹

¹GSK, Philadelphia, PA, United States ²Optum Life Sciences, Eden Prairie, MN, United States

Supplementary data

Table 1: Patient demographics and baseline clinical characteristics

Demographics		IS cohort (N=517,514)	Non-IS cohort (N=517,514)	IS cohort vs Non-IS cohort standardized difference (%)	Clinical characteristics		IS cohort (N=517,514)	Non-IS cohort (N=517,514)	IS cohort vs Non-IS cohort standardized difference (%)
Age (continuous)	mean	62.60	63.27	-4.14	Baseline Charlson comorbidity score ¹ (continuous)	mean	2.78	0.82	87.12
	SD	16.05	16.18			SD	2.82	1.46	
	p25	52.00	53.00			p25	1.00	0.00	
	median	66.00	66.00			median	2.00	0.00	
	p75	75.00	76.00			p75	4.00	1.00	
Age group (7 categories)					Baseline Charlson comorbidity score (categorical)				
18-29	n	19,648	19,648	0.00	0	n	128,843	335,188	-87.51
	%	3.8	3.8			%	24.9	64.8	
30-39	n	31,947	31,947	0.00	1-2	n	182,968	124,349	24.98
	%	6.2	6.2			%	35.4	24.0	
40-49	n	56,765	56,765	0.00	3-4	n	77,630	40,242	22.89
	%	11.0	11.0			%	15.0	7.8	
50-59	n	89,721	89,721	0.00	5+	n	128,073	17,735	64.38
	%	17.3	17.3			%	24.8	3.4	
60-69	n	115,523	115,523	0.00	Other HZ-related comorbidities				
	%	22.3	22.3		Ankylosing spondylitis	n	6,062	468	13.68
70-79	n	129,416	129,416	0.00		%	1.2	0.1	
	%	25.0	25.0		Asthma	n	54,873	32,075	15.93
80+	n	74,494	74,494	0.00		%	10.6	6.2	
	%	14.4	14.4		Chronic kidney diseases/end-stage renal disease	n	155,374	88,027	31.05
Race/ethnicity						%	30.0	17.0	
Non-Hispanic White	n	363,380	363,380	0.00	Chronic obstructive pulmonary disease	n	82,710	43,388	23.39
	%	70.2	70.2			%	16.0	8.4	
Non-Hispanic Black	n	63,157	63,157	0.00	Depression	n	92,822	67,301	13.67
	%	12.2	12.2			%	17.9	13.0	
Non-Hispanic Asian	n	14,700	14,700	0.00	Idiopathic pulmonary fibrosis/interstitial lung disease	n	28,820	7,265	22.85
	%	2.8	2.8			%	5.6	1.4	
Hispanic	n	50,645	50,645	0.00	Sarcoidosis	n	4,629	903	9.89
	%	9.8	9.8			%	0.9	0.2	
Missing/unknown	n	25,632	25,632	0.00	Scleroderma	n	2,042	294	7.12
	%	5.0	5.0			%	0.4	0.7	
Insurance type					Sicca syndrome	n	8,001	1,513	13.17
Commercial	n	237,194	237,194	0.00		%	1.6	0.3	
	%	45.8	45.8		Type 1 Diabetes	n	16,003	6,931	11.93
MAPD	n	280,320	280,320	0.00		%	3.1	1.3	
	%	54.2	54.2		Type 2 Diabetes	n	151,635	111,100	18.07
Region						%	29.3	21.5	
Northeast	n	67,472	67,472	0.00	Others giant cell arteritis	n	1,998	304	6.95
	%	13.0	13.0			%	0.4	0.1	
Midwest	n	142,129	142,129	0.00	Wegener's granulomatosis	n	1,046	47	5.95
	%	27.5	27.5			%	0.2	0.0	
South	n	239,996	239,996	0.00					
	%	46.4	46.4						
West	n	67,692	67,692	0.00					
	%	13.1	13.1						
Other	n	225	225	0.00					
	%	0.0	0.0						

Z-test using robust standard errors in an OLS regression was used for continuous measures.
Rao-Scott test was used for binary measures.

Abbreviations

IS, Immunosuppressive; MAPD, Medicare Advantage Part D; OLS, Ordinary Least Squares;
p25, 25th Percentile; p75, 75th Percentile; SD, Standard Deviation.

References

¹Quan H, Li B, Couris CM, et al. Am J Epidemiol. 2011;173(6):676-82.

Herpes Zoster Risk Among Immunocompromised Adults in the United States: A Retrospective Cohort Analysis

Justin Gatwood¹; Yong Zhu²; Andrea Steffens²; Stephanie Gallagher²; Mary DuCharme²; Nikita Stempniewicz¹
¹GSK, Philadelphia, PA, United States ²Optum Life Sciences, Eden Prairie, MN, United States

Supplementary data

Table 2: Baseline immunocompromising and autoimmune conditions

Baseline IC and AI conditions		IS cohort (N=517,514)	Non-IS cohort (N=517,514)	IS cohort vs Non-IS cohort standardized difference (%)
Rheumatoid arthritis	n	64,478	5,448	46.67
	%	12.5	1.1	
Inflammatory bowel disease (Crohn's disease and ulcerative colitis)	n	28,398	3,266	28.48
	%	5.5	0.6	
Psoriatic arthritis	n	17,094	475	25.05
	%	3.3	0.1	
Psoriasis	n	42,747	4,428	36.07
	%	8.3	0.9	
Solid organ or bone marrow transplant	n	28,097	3,696	27.58
	%	5.4	0.7	
Systemic lupus erythematosus	n	11,571	1,402	17.73
	%	2.2	0.3	
Multiple Sclerosis	n	15,501	1,420	21.58
	%	3.0	0.3	
HIV/AIDS	n	1,586	1,420	0.60
	%	0.3	0.3	
Malignancy (solid, hematologic)	n	302,887	149,242	62.73
	%	58.5	28.8	

Rao-Scott test was used for binary measures.

Table 3: Baseline AHRQ CCS comorbidities

Baseline AHRQ CCS comorbidities		IS cohort (N=517,514)	Non-IS cohort (N=517,514)	IS cohort vs Non-IS cohort standardized difference (%)
Most common AHRQ CCS comorbidities (top 20 in the IS Cohort)				
Hypertension	n	320,324	261,298	23.14
	%	61.9	50.5	
Disorders of lipid metabolism	n	285,909	249,971	13.93
	%	55.3	48.3	
Non-traumatic joint disorders	n	253,737	159,707	37.75
	%	49.0	30.9	
Diseases of the heart	n	250,460	160,589	36.06
	%	48.4	31.0	
Other connective tissue disease	n	243,022	161,527	32.70
	%	47.0	31.2	
Other nutritional, endocrine, and metabolic disorders	n	242,193	161,896	32.22
	%	46.8	31.3	
Eye disorders	n	239,380	168,211	28.43
	%	46.3	32.5	
Diseases of the urinary system	n	238,730	152,014	35.09
	%	46.1	29.4	
Other lower respiratory disease	n	236,873	121,242	48.32
	%	45.8	23.4	
Other skin disorders	n	206,390	138,143	28.26
	%	39.9	26.7	
Other nervous system disorders	n	203,465	118,831	35.88
	%	39.3	23.0	
Diabetes mellitus without complication	n	193,347	150,885	17.48
	%	37.4	29.2	
Spondylosis; intervertebral disc disorders; other back problems	n	191,224	133,936	24.02
	%	37.0	25.9	
Other gastrointestinal disorders	n	184,211	85,201	44.68
	%	35.6	16.5	
Respiratory infections	n	165,312	115,380	21.83
	%	31.9	22.3	
Diseases of arteries; arterioles; and capillaries	n	162,958	99,440	28.50
	%	31.5	19.2	
Upper gastrointestinal disorders	n	162,466	95,365	30.32
	%	31.4	18.4	
Anemia	n	150,276	65,120	41.39
	%	29.0	12.6	
Benign neoplasms	n	144,221	96,092	22.16
	%	27.9	18.6	
Nutritional deficiencies	n	142,383	93,334	22.75
	%	27.5	18.0	

Abbreviations

AHRQ, Agency for Healthcare Research and Quality; AI, Autoimmune; AIDS, Acquired Immunodeficiency Syndrome; CCS, Clinical Classification Software; HIV, Human Immunodeficiency Virus; IC, Immunocompromising; IS, Immunosuppressive.

References

¹Clinical Classification Software (CCS) for ICD-9-CM/ICD-10-CM. Agency for Healthcare Research and Quality, Rockville, MD. <https://hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>; <https://hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp>. Accessed Apr 15, 2024.

Herpes Zoster Risk Among Immunocompromised Adults in the United States: A Retrospective Cohort Analysis

Justin Gatwood¹; Yong Zhu²; Andrea Steffens²; Stephanie Gallagher²; Mary DuCharme²; Nikita Stempniewicz¹

¹GSK, Philadelphia, PA, United States ²Optum Life Sciences, Eden Prairie, MN, United States

Supplementary data

Table 4: Pre-match baseline immunocompromising and autoimmune conditions by index medication class

Baseline IC and AI conditions by index medication class		Total (N=528,283)	Interleukin inhibitors (N=23,498)	Janus kinase inhibitors (N=1,696)	TNF inhibitors (N=38,690)	Other selective immunosuppressants (N=44,885)	Azathioprine (N=11,383)	Calcineurin inhibitors (N=6,579)	Mycophenolic acid (N=8,527)	Anthracyclines (N=1,697)	Checkpoint inhibitors (N=12,206)	Cyclophosphamide (N=809)	Protein kinase inhibitors (N=17,634)	Other cancer therapies (N=170,154)	Rituximab (N=7,820)	Targeted cancer therapies (N=90,812)	Oral glucocorticoids (N=45,393)	Multiple (N=46,500)
Rheumatoid arthritis	n	66,119	1,301	1,173	11,234	9,141	1,495	144	776	28	186	43	364	33,770	926	1,439	2,695	1,404
	%	12.5	5.5	69.2	29.0	20.4	13.1	2.2	9.1	1.7	1.5	5.3	2.1	19.9	11.8	1.6	5.9	3.0
Inflammatory bowel disease (Crohn's disease and ulcerative colitis)	n	28,852	1,107	89	10,495	2,707	3,770	166	129	29	129	8	195	4,696	118	739	3,735	740
	%	5.5	4.7	5.3	27.1	6.0	33.1	2.5	1.5	1.7	1.1	1.0	1.1	2.8	1.5	0.8	8.2	1.6
Psoriatic arthritis	n	17,371	2,015	81	6,465	2,874	92	41	39	6	11	2	39	5,220	27	108	198	153
	%	3.3	8.6	4.8	16.7	6.4	0.8	0.6	0.5	0.4	0.1	0.3	0.2	3.1	0.4	0.1	0.4	0.3
Psoriasis	n	43,445	9,613	76	10,007	9,818	214	413	182	26	156	9	216	10,114	122	1,060	786	633
	%	8.2	40.9	4.5	25.9	21.9	1.9	6.3	2.1	1.5	1.3	1.1	1.2	5.9	1.6	1.2	1.7	1.4
Solid organ or bone marrow transplant	n	28,758	160	13	300	1,606	455	3,850	2,050	140	713	104	945	6,766	770	2,048	1,899	6,939
	%	5.4	0.7	0.8	0.8	3.6	4.0	58.5	24.0	8.3	5.8	12.9	5.4	4.0	9.9	2.3	4.2	14.9
Systemic lupus erythematosus	n	11,796	173	67	513	1,741	1,545	138	1,661	7	29	38	73	3,712	263	246	1,122	468
	%	2.2	0.7	4.0	1.3	3.9	13.6	2.1	19.5	0.4	0.2	4.7	0.4	2.2	3.4	0.3	2.5	1.0
Multiple Sclerosis	n	15,755	64	7	36	13,687	119	15	95	5	28	16	64	596	367	191	321	144
	%	3.0	0.3	0.4	0.1	30.5	1.1	0.2	1.1	0.3	0.2	2.0	0.4	0.4	4.7	0.2	0.7	0.3
HIV/AIDS	n	1,608	76	2	73	110	18	40	28	32	37	7	39	558	47	155	177	209
	%	0.3	0.3	0.1	0.2	0.3	0.2	0.6	0.3	1.9	0.3	0.9	0.2	0.3	0.6	0.2	0.4	0.5
Malignancy (solid, hematologic)	n	309,789	7,953	493	12,155	18,723	4,601	3,350	3,604	1,632	12,118	655	16,478	121,605	6,070	36,329	21,695	42,328
	%	58.6	33.9	29.1	31.4	41.7	40.4	50.9	42.3	96.2	99.3	81.0	93.4	71.5	77.6	40.0	47.8	91.0

Abbreviations

AI, Autoimmune; AIDS, Acquired Immunodeficiency Syndrome; HIV, Human Immunodeficiency Virus; IC, Immunocompromising; IS, Immunosuppressive; TNF, Tumor Necrosis Factor.

Herpes Zoster Risk Among Immunocompromised Adults in the United States: A Retrospective Cohort Analysis

Justin Gatwood¹; Yong Zhu²; Andrea Steffens²; Stephanie Gallagher²; Mary DuCharme²; Nikita Stempniewicz¹

¹GSK, Philadelphia, PA, United States ²Optum Life Sciences, Eden Prairie, MN, United States

Supplementary data

Table 5: Incidence of HZ cases per 1,000 person-years at risk

	IS cohort (N=517,514)					Non-IS cohort (N=517,514)					IS cohort vs Non-IS cohort			
	Events	Person-time	Rate per 1,000	Lower 95% CI	Upper 95% CI	Events	Person-time	Rate per 1,000	Lower 95% CI	Upper 95% CI	Ratio	Lower 95% CI	Upper 95% CI	p-value
All patients	17,309	957,239	18.0822	17.8138	18.3536	10,074	1,027,567	9.8037	9.6132	9.9971	1.8444	1.7997	1.8903	<0.001
Age group (7 categories)														
18-29	179	33,116	5.4053	4.6424	6.2577	51	31,452	1.6215	1.2073	2.1320	3.3334	2.4406	4.5528	<0.001
30-39	685	59,199	11.5712	10.7208	12.4712	255	57,146	4.4622	3.9313	5.0449	2.5931	2.2468	2.9929	<0.001
40-49	1,613	115,738	13.9366	13.2647	14.6338	699	115,245	6.0653	5.6240	6.5321	2.2978	2.1028	2.5108	<0.001
50-59	3,073	174,564	17.6039	16.9869	18.2375	1,515	180,906	8.3745	7.9581	8.8071	2.1021	1.9767	2.2354	<0.001
60-69	3,991	198,808	20.0746	19.4566	20.7073	2,163	211,988	10.2034	9.7779	10.6427	1.9674	1.8669	2.0734	<0.001
70-79	5,030	241,316	20.8440	20.2719	21.4282	3,302	279,289	11.8229	11.4230	12.2332	1.7630	1.6874	1.8420	<0.001
80+	2,738	134,498	20.3572	19.6017	21.1343	2,089	151,543	13.7849	13.2000	14.3890	1.4768	1.3948	1.5636	<0.001
Age group (3 categories)														
18-49	2,477	208,052	11.9056	11.4414	12.3839	1,005	203,843	4.9303	4.6301	5.2448	2.4148	2.2445	2.5981	<0.001
50-64	4,863	262,609	18.5180	18.0011	19.0459	2,172	248,329	8.7464	8.3824	9.1222	2.1172	2.0128	2.2271	<0.001
65+	9,969	486,577	20.4880	20.0878	20.8942	6,897	575,395	11.9865	11.7053	12.2728	1.7093	1.6575	1.7626	<0.001
Age group (2 categories)														
18-49	2,477	208,052	11.9056	11.4414	12.3839	1,005	203,843	4.9303	4.6301	5.2448	2.4148	2.2445	2.5981	<0.001
50+	14,832	749,187	19.7975	19.4801	20.1187	9,069	823,724	11.0097	10.7843	11.2387	1.7982	1.7518	1.8458	<0.001
Gender														
Male	6,080	398,356	15.2627	14.8815	15.6513	3,562	440,700	8.0826	7.8193	8.3525	1.8883	1.8119	1.9680	<0.001
Female	11,229	558,883	20.0919	19.7219	20.4670	6,512	586,867	11.0962	10.8283	11.3690	1.8107	1.7562	1.8668	<0.001
Race/ethnicity														
Non-Hispanic White	12,598	682,335	18.4631	18.1420	18.7883	7,394	733,058	10.0865	9.8579	10.3191	1.8305	1.7786	1.8838	<0.001
Non-Hispanic Black	1,887	118,640	15.9053	15.1957	16.6395	1,069	127,836	8.3623	7.8684	8.8790	1.9020	1.7645	2.0503	<0.001
Non-Hispanic Asian	465	26,482	17.5590	15.9991	19.2299	272	27,838	9.7710	8.6442	11.0038	1.7971	1.5477	2.0867	<0.001
Hispanic	1,713	94,100	18.2040	17.3521	19.0870	1,005	99,142	10.1370	9.5198	10.7836	1.7958	1.6617	1.9407	<0.001
Missing/unknown	646	35,682	18.1045	16.7351	19.5560	334	39,693	8.4145	7.5362	9.3671	2.1516	1.8874	2.4527	<0.001
Insurance type														
Commercial	6,707	431,322	15.5499	15.1799	15.9265	3,164	441,581	7.1652	6.9177	7.4193	2.1702	2.0805	2.2637	<0.001
MAPD	10,602	525,917	20.1591	19.7771	20.5465	6,910	585,986	11.7921	11.5157	12.0735	1.7095	1.6585	1.7622	<0.001
Geographic region														
Northeast	2,194	124,316	17.6486	16.9178	18.4029	1,325	137,315	9.6493	9.1367	10.1832	1.8290	1.7088	1.9577	<0.001
Midwest	5,000	269,817	18.5311	18.0210	19.0520	2,908	291,051	9.9914	9.6315	10.3612	1.8547	1.7721	1.9412	<0.001
South	8,005	439,096	18.2306	17.8334	18.6344	4,702	470,770	9.9879	9.7044	10.2775	1.8253	1.7607	1.8923	<0.001
West	2,108	123,646	17.0487	16.3286	17.7924	1,139	128,102	8.8914	8.3825	9.4231	1.9174	1.7839	2.0610	<0.001
Other	2	365	5.4848	0.6642	19.8131	0	329	0.0000	0.0000	9.0987	–	–	–	–
Index year														
2016	5,560	300,914	18.4770	17.9945	18.9692	2,927	304,949	9.5983	9.2537	9.9525	1.9250	1.8410	2.0129	<0.001
2017	3,180	179,093	17.7562	17.1443	18.3843	1,990	198,525	10.0239	9.5883	10.4742	1.7714	1.6751	1.8732	<0.001
2018	2,676	145,905	18.3407	17.6523	19.0490	1,640	162,974	10.0630	9.5818	10.5620	1.8226	1.7139	1.9382	<0.001
2019	2,213	128,574	17.2118	16.5021	17.9442	1,424	141,822	10.0408	9.5260	10.5762	1.7142	1.6033	1.8327	<0.001
2020	1,682	94,503	17.7984	16.9579	18.6698	995	104,111	9.5571	8.9724	10.1699	1.8623	1.7216	2.0146	<0.001
2021	1,394	75,293	18.5143	17.5551	19.5124	783	81,071	9.6581	8.9934	10.3590	1.9170	1.7562	2.0924	<0.001
2022	604	32,957	18.3271	16.8944	19.8487	315	34,115	9.2335	8.2419	10.3116	1.9848	1.7327	2.2737	<0.001
Index medication class														
Interleukin inhibitors	387	37,044	10.4471	9.4320	11.5416	–	–	–	–	–	–	–	–	–
Janus kinase inhibitors	103	3,444	29.9053	24.4097	36.2689	–	–	–	–	–	–	–	–	–
TNF inhibitors	1,291	86,492	14.9263	14.1231	15.7632	–	–	–	–	–	–	–	–	–
Other selective immunosuppressants	1,555	93,391	16.6504	15.8330	17.4991	–	–	–	–	–	–	–	–	–
Azathioprine	521	25,788	20.2034	18.5056	22.0151	–	–	–	–	–	–	–	–	–
Calcineurin inhibitors	260	14,405	18.0491	15.9217	20.3816	–	–	–	–	–	–	–	–	–
Mycophenolic acid	407	17,067	23.8470	21.5862	26.2802	–	–	–	–	–	–	–	–	–
Anthracyclines	32	2,430	13.1664	9.0058	18.5870	–	–	–	–	–	–	–	–	–
Checkpoint inhibitors	260	13,684	19.0002	16.7606	21.4556	–	–	–	–	–	–	–	–	–
Cyclophosphamide	36	1,290	27.9078	19.5463	38.6362	–	–	–	–	–	–	–	–	–
Protein kinase inhibitors	580	29,183	19.8745	18.2898	21.5598	–	–	–	–	–	–	–	–	–
Other cancer therapies	5,386	291,264	18.4918	18.0012	18.9924	–	–	–	–	–	–	–	–	–
Rituximab	408	14,739	27.6816	25.0604	30.5024	–	–	–	–	–	–	–	–	–
Targeted cancer therapies	2,419	176,271	13.7232	13.1817	14.2812	–	–	–	–	–	–	–	–	–
Oral glucocorticoids	1,760	76,549	22.9918	21.9301	24.0917	–	–	–	–	–	–	–	–	–
Multiple	1,904	74,198	25.6612	24.5214	26.8403	–	–	–	–	–	–	–	–	–
Index COVID-19 time period														
Pre-pandemic	14,051	779,699	18.0210	17.7243	18.3215	8,252	836,046	9.8703	9.6585	10.0856	1.8258	1.7769	1.8761	<0.001
Early pandemic	1,198	65,413	18.3144	17.2919	19.3816	689	72,222	9.5400	8.8409	10.2797	1.9197	1.7478	2.1086	<0.001
Vaccination	807	44,552	18.1138	16.8854	19.4079	455	48,332	9.4141	8.5689	10.3202	1.9241	1.7153	2.1584	<0.001
Delta surge	580	30,582	18.9654	17.4532	20.5737	320	32,660	9.7980	8.7537	10.9325	1.9357	1.6881	2.2195	<0.001
Omicron surge	673	36,993	18.1925	16.8438	19.6204	358	38,308	9.3453	8.4022	10.3653	1.9467	1.7130	2.2122	<0.001
Time-varying immunosuppression: use of any immunosuppressive therapy														
Any immunosuppressive therapy: Yes	11,550	535,404	21.5725	21.1809	21.9696	–	–	–	–	–	–	–	–	–
Any immunosuppressive therapy: No	5,759	421,836	13.6522	13.3019	14.0095	–	–	–	–	–	–	–	–	–
Time-varying immunosuppression: counts of immunosuppressive medication classes														
0	5,759	421,836	13.6522	13.3019	14.0095	–	–	–	–	–	–	–	–	–
1	7,619	412,828	18.4556	18.0435	18.8748	–	–	–	–	–	–	–	–	–
2+	3,931	122,576	32.0700	31.0752	33.0885	–	–	–	–	–	–	–	–	–
Time-varying immunosuppression: use of index medication class														
Index medication class: Yes	7,717	408,861	18.8744	18.4556	19.3003	–	–	–	–	–	–	–	–	–
Index medication class: No	9,592	548,379	17.4916	17.1433	17.8452	–	–	–	–	–	–	–	–	–

Exact Poisson 95% confidence limits were used for incidence rates, Wald 95% confidence limits using robust standard errors were used for incidence rate ratios. Z-test using robust standard errors in a Poisson regression was used for assessing significance of incidence rate ratios.

Abbreviations

CI, confidence interval; COVID-19, Coronavirus Disease 2019; HZ, Herpes Zoster; IS, Immunosuppressive; MAPD, Medicare Advantage Part D; TNF, Tumor Necrosis Factor.

Herpes Zoster Risk Among Immunocompromised Adults in the United States: A Retrospective Cohort Analysis

Justin Gatwood¹; Yong Zhu²; Andrea Steffens²; Stephanie Gallagher²; Mary DuCharme²; Nikita Stempniewicz¹
¹GSK, Philadelphia, PA, United States ²Optum Life Sciences, Eden Prairie, MN, United States

Supplementary data

Table 6: Adjusted proportional hazards models of HZ for the overall cohort

Independent variables	Follow-up HZ				p-value
	Hazard ratio	Lower 95% CI	Upper 95% CI		
Cohort					
IS cohort	1.387		1.349	1.425	<0.001
Non-IS cohort	ref.	–	–	–	–
Baseline Charlson comorbidity score (categorical)					<0.001
0	ref.	–	–	–	–
1-2	1.146	1.110	1.183		<0.001
3-4	1.221	1.170	1.274		<0.001
5+	1.292	1.237	1.350		<0.001
Other HZ-related comorbidities					
Depression	0.971	0.940	1.004		0.084
Idiopathic pulmonary fibrosis/interstitial lung disease	1.121	1.058	1.187		<0.001
Type 2 Diabetes	0.890	0.863	0.916		<0.001
AHRQ CCS comorbidities					
Disorders of lipid metabolism	1.091	1.062	1.122		<0.001
Other connective tissue disease	1.052	1.025	1.080		<0.001
Eye disorders	1.094	1.066	1.122		<0.001
Other skin disorders	1.130	1.102	1.159		<0.001
Respiratory infections	1.174	1.144	1.205		<0.001
Upper gastrointestinal disorders	1.062	1.033	1.093		<0.001
Nutritional deficiencies	1.053	1.024	1.082		<0.001
Baseline all-cause utilization					
Emergency room visit	1.044	1.015	1.072		0.002
Count of ambulatory visits (quartiles)					<0.001
0 - 6	ref.	–	–	–	–
7 - 15	1.236	1.184	1.291		<0.001
16 - 31	1.343	1.283	1.407		<0.001
32+	1.467	1.393	1.544		<0.001
Count of pharmacy fills (quartiles)					<0.001
0 - 8	ref.	–	–	–	–
9 - 21	1.147	1.101	1.194		<0.001
22 - 40	1.181	1.132	1.232		<0.001
41+	1.224	1.171	1.280		<0.001

Observations read=1,035,028. Observations used=1,035,028.
Proportional hazards test (overall - log(time) with Schoenfeld residuals): p-value=<0.001.
Proportional hazards sub-test (log(time) with Schoenfeld residuals): p-value=<0.001.

Abbreviations

AHRQ, Agency for Healthcare Research and Quality; CCS, Clinical Classification Software; CI, Confidence Interval; HZ, Herpes Zoster; IS, Immunosuppressive.