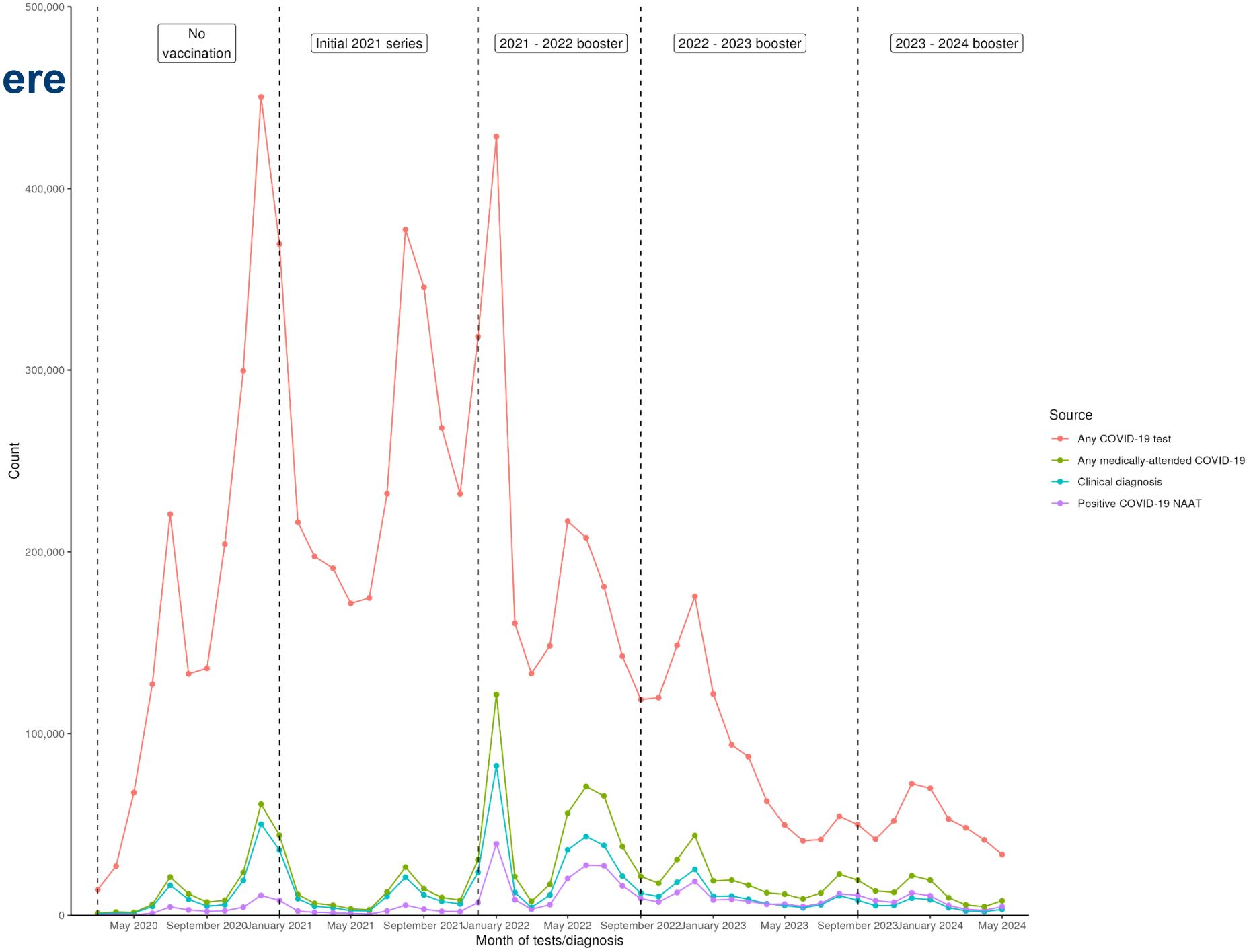
COVID-19 vaccine booster uptake and effectiveness among adults with cancer in the United States

Jacek Skarbinski, Larry Kushi and the Serological Sciences Network (SeroNet) team

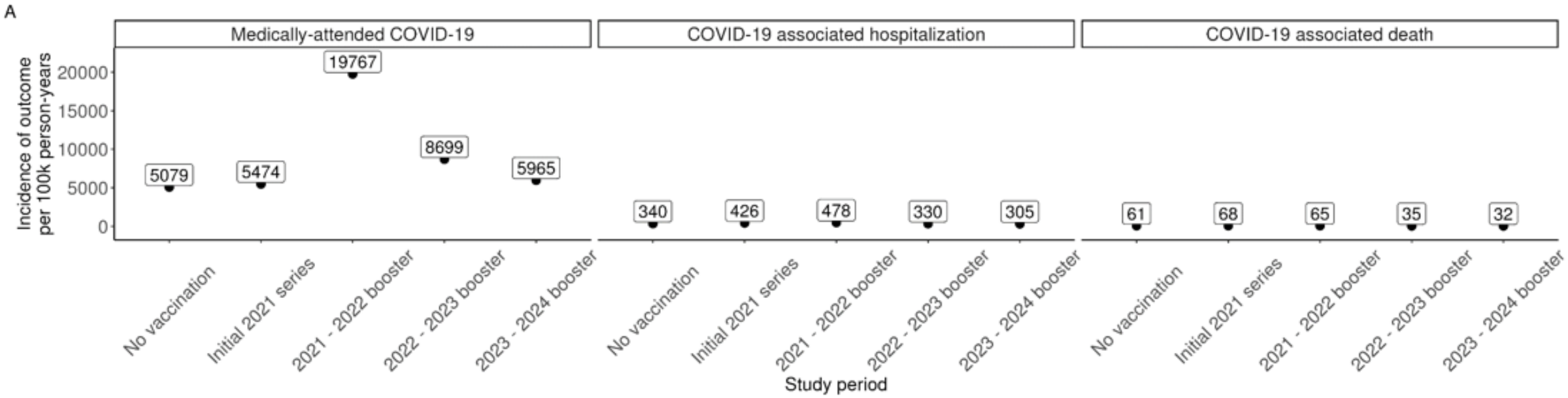
TPMG Cancer Research Symposium: November 7, 2025

PERMANENTE MEDICINE®
The Permanente Medical Group

COVID-19 is still here



COVID-19 associated hospitalizations and deaths remain



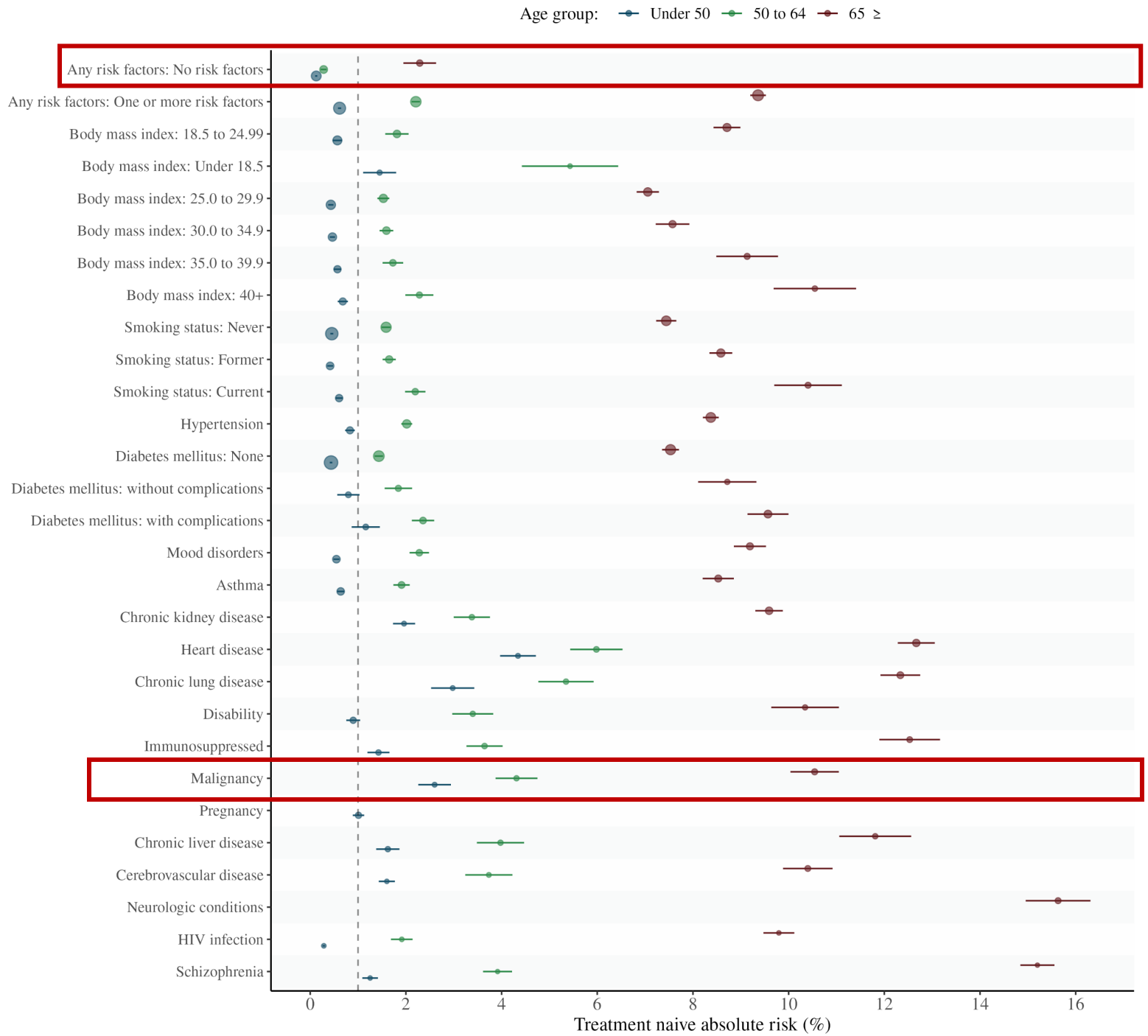
Adults with cancer at high risk for severe COVID-19

No CDC risk factors:

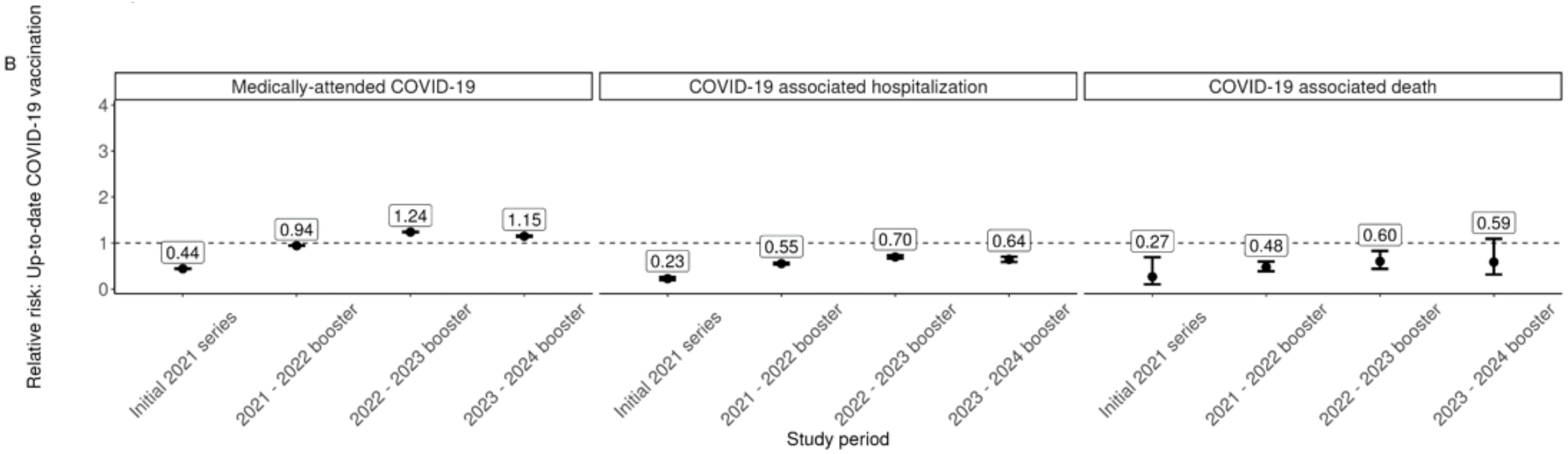
- 18-49yrs: 0.13%
- 50-64yrs: 0.28%
- 65+yrs: 2.29%

Adults with cancer

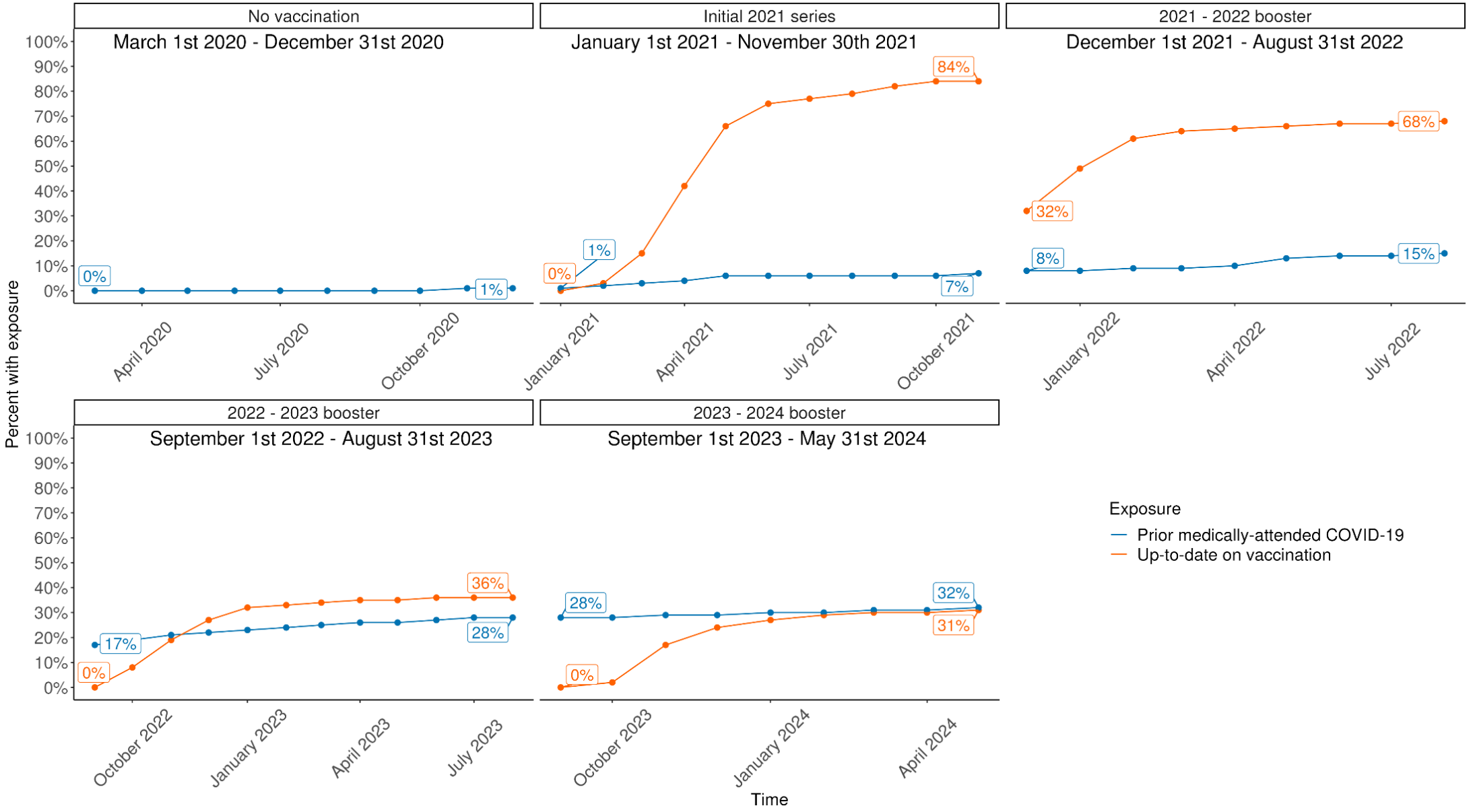
- 18-49yrs: 2.61%
- 50-64yrs: 4.32%
- 65+yrs: 10.54%



COVID-19 vaccination effective at preventing severe COVID-19



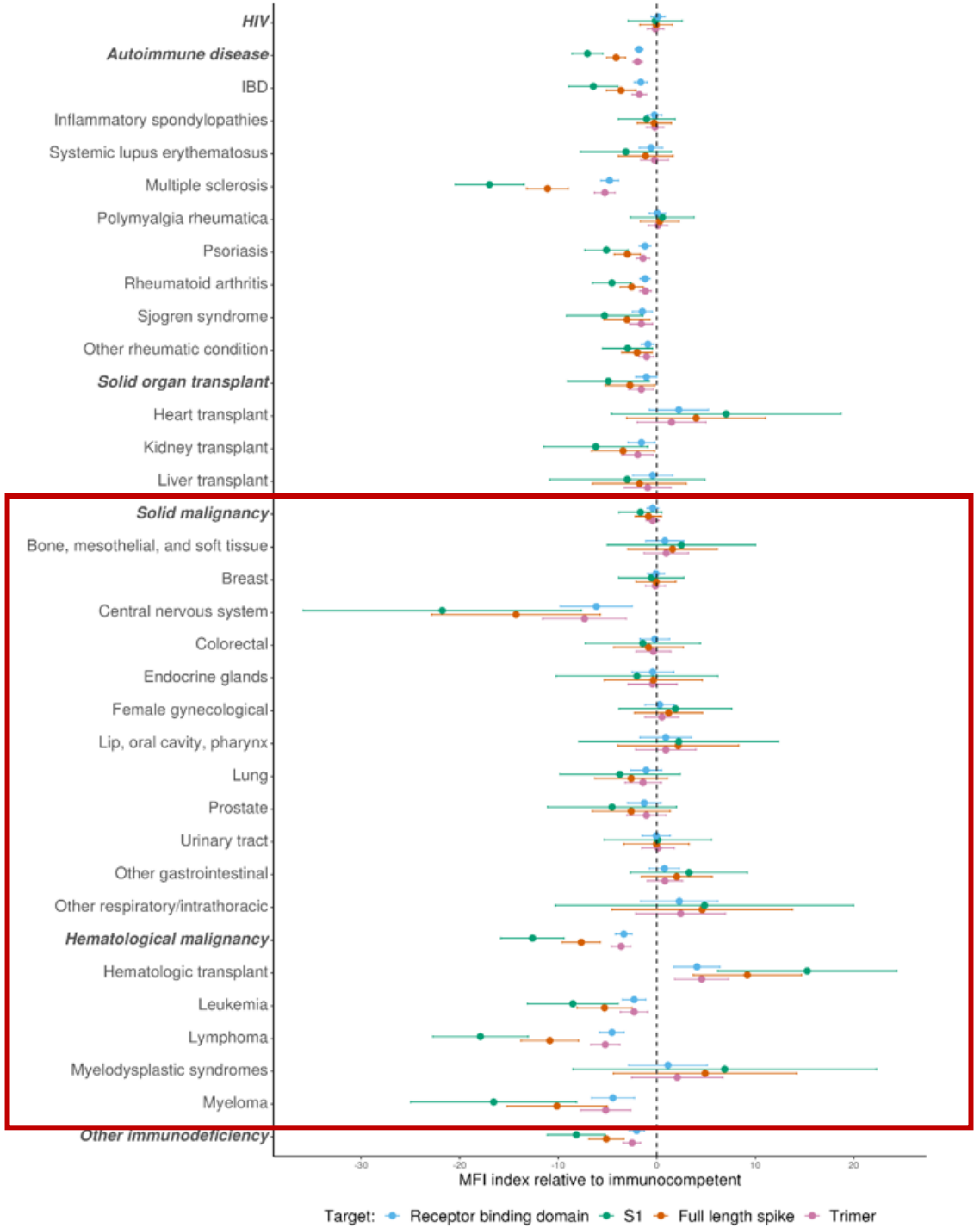
However, uptake is low



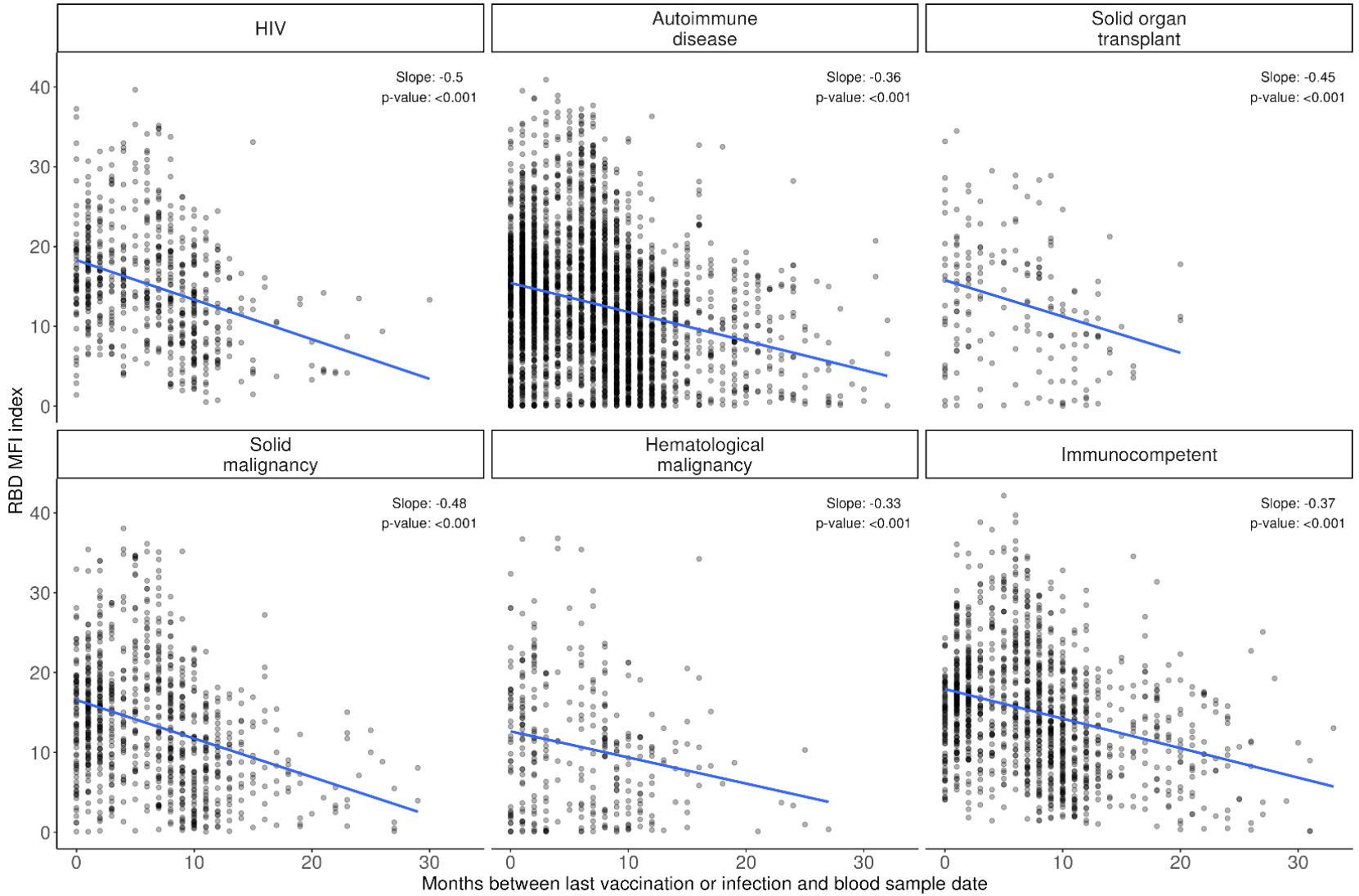
Adults with cancer have lower serological response to COVID-19 vaccination

6,369 vaccinated KP members enrolled

- Dried blood spot collected and spike antibody levels assessed
  - 1,327 non-immunosuppressed
  - 900 with solid malignancy
  - 334 with hematologic malignancy
  - 655 with HIV
  - 3,338 with autoimmune disease
  - 379 with other immunodeficiency



Spike antibody serological response heterogenous, but no significant differences in waning (decay over time); Vaccine effective for 4-6 months



Vaccine effectiveness in people with cancer

Few studies of vaccine effectiveness in people with cancer

- High-risk population often excluded from clinical trials

SeroNet Pooling Project

- Pooled data on adults with cancer from KPNC, Cedars Sinai, Northwell Health and the Veterans' Health Administration
  - 72,831 adults with cancer in the monovalent booster period January 1, 2022 to August 31, 2022
  - 88,417 adults with cancer in the bivalent booster period September 1, 2022 to August 31, 2023

- Assessed vaccine uptake, vaccine effectiveness to prevent COVID-19 hospitalization, number needed to vaccinate to prevent one COVID-19 hospitalization

Skarbinski J, Elkin EP, Ziemba YC, et al. COVID-19 Vaccine Booster Uptake and Effectiveness Among US Adults With Cancer. *JAMA Oncol.* Published online July 17, 2025. doi:10.1001/jamaoncol.2025.2020

Table 1. Characteristics of Monovalent COVID-19 Vaccine Booster Period (January 1, 2022-August 31, 2022) Cohort Combined From 4 Health Care Systems

Characteristic	All cancer[a]			Solid malignant neoplasms[a]			Hematologic malignant neoplasms[a]			Nonimmunocompromised[a]		
	Primary series, No. (%)[b]		Percentage with 1 additional dose	Primary series, No. (%)		Percentage with 1 additional dose	Primary series, No. (%)		Percentage with 1 additional dose	Primary series, No. (%)		Percentage with 1 additional dose
	Primary series only	One additional dose		Primary series only	One additional dose		Primary series only	One additional dose		Primary series only	One additional dose	
Total No.	22 566	50 265	69	19 131	42 910	69	6403	15 046	70	2 483 954	2 386 184	49
Age, y												
18-49	2237 (10)	2539 (5)	53	1750 (9)	2012 (5)	53	665 (10)	673 (4)	50	1 172 300 (47)	703 233 (29)	37
50-64	5656 (25)	9624 (19)	63	4776 (25)	8039 (19)	63	1491 (23)	2658 (18)	64	649 840 (26)	642 713 (27)	50
65-74	8269 (37)	20 804 (41)	72	7160 (37)	18 009 (42)	72	2254 (35)	6077 (40)	73	397 033 (16)	617 417 (26)	61
75-89	6404 (28)	17 298 (34)	73	5445 (28)	14 850 (35)	73	1993 (31)	5638 (37)	74	264 781 (11)	422 821 (18)	61
Female												
Yes	5680 (25)	12 242 (24)	68	4823 (25)	10 399 (24)	68	1208 (19)	2650 (18)	69	787 189 (32)	836 209 (35)	52
No	16 886 (75)	38 023 (76)	69	14 308 (75)	32 511 (76)	69	5195 (81)	12 396 (82)	70	1 696 765 (68)	1 549 975 (65)	48
Race and ethnicity												
Hispanic	2093 (9)	4028 (8)	66	1717 (9)	3350 (8)	66	577 (9)	1124 (7)	66	406 313 (16)	271 736 (11)	40
Asian or Pacific Islander	1291 (6)	3373 (7)	72	1047 (5)	2764 (6)	73	312 (5)	831 (6)	73	257 452 (10)	383 324 (16)	60
Black	3607 (16)	7578 (15)	68	3103 (16)	6666 (16)	68	1082 (17)	2354 (16)	69	331 942 (13)	260 452 (11)	44
White	14 272 (63)	33 007 (66)	70	12 166 (64)	28 164 (66)	70	4050 (63)	10 059 (67)	71	1 256 888 (51)	1 298 106 (54)	51
Other or unknown[c]	1303 (6)	2279 (5)	64	1098 (6)	1966 (5)	64	382 (6)	678 (5)	64	231 359 (9)	172 566 (7)	43
Charlson Comorbidity Index score ≥3[d]												
Yes	16 547 (73)	39 080 (78)	70	14 366 (75)	34 133 (80)	70	4444 (69)	11 188 (74)	72	182 621 (7)	266 810 (11)	59
No	6019 (27)	11 185 (22)	65	4765 (25)	8777 (20)	65	1959 (31)	3858 (26)	66	2 301 333 (93)	2 119 374 (89)	48

[a] See eTables 4 and 5 in Supplement 1 for definitions.

[b] As of index date January 1, 2022. Primary series was 1 dose of Ad26.COV2.s (Janssen) or 2 doses of BNT162b2 (Pfizer/BioNTech; at least 14 days apart) or mRNA-1273 (Moderna/National Institutes of Health; at least 21 days apart). Additional vaccination must have been at least 28 days after prior vaccination.

[c] Included American Indian, multiracial, and other race (not specified).

[d] Scores range from 0-29, with higher scores indicating greater comorbidity.

Table 3. Characteristics of Bivalent COVID-19 Vaccine Period (September 1, 2022-August 31, 2023) Cohort Combined From 4 Health Care Systems

Characteristic	All cancer[a]			Solid malignant neoplasms[a]			Hematologic malignant neoplasms[a]			Nonimmunocompromised[a]		
	Bivalent vaccine, No. (%)		Percentage with bivalent vaccine	Bivalent vaccine, No. (%)		Percentage with bivalent vaccine	Bivalent vaccine, No. (%)		Percentage with bivalent vaccine	Bivalent vaccine, No. (%)		Percentage with bi-valent vaccine
	No	Received		No	Received		No	Received		No	Received	
Total No.	54 711	33 706	38	46 544	28 645	38	15 237	9920	39	4 838 493	1 569 552	24
Age, y												
18-49	5398 (10)	1447 (4)	21	4219 (9)	1147 (4)	21	1533 (10)	392 (4)	20	2 223 616 (46)	429 666 (27)	16
50-64	12 936 (24)	6001 (18)	32	10 928 (23)	4926 (17)	31	3251 (21)	1694 (17)	34	1 258 958 (26)	414 465 (26)	25
65-74	18 770 (34)	13 143 (39)	41	16 267 (35)	11 249 (39)	41	5022 (33)	3757 (38)	43	766 466 (16)	409 937 (26)	35
75-89	17 607 (32)	13 115 (39)	43	15 130 (33)	11 323 (40)	43	5431 (36)	4077 (41)	43	589 453 (12)	315 484 (20)	35
Female												
Yes	15 244 (28)	9345 (28)	38	13 035 (28)	7888 (28)	38	3130 (21)	2135 (22)	41	1 653 878 (34)	572 941 (37)	26
No	39 467 (72)	24 361 (72)	38	33 509 (72)	20 757 (72)	38	12 107 (79)	7785 (78)	39	3 184 615 (66)	996 611 (63)	24
Race and ethnicity												
Hispanic	5043 (9)	2642 (8)	34	4171 (9)	2193 (8)	34	1336 (9)	765 (8)	36	738 079 (15)	170 275 (11)	19
Asian or Pacific Islander	3073 (6)	2604 (8)	46	2558 (5)	2128 (7)	45	694 (5)	649 (7)	48	459 488 (9)	264 656 (17)	37
Black	8044 (15)	5149 (15)	39	6902 (15)	4487 (16)	39	2354 (15)	1615 (16)	41	603 354 (12)	170 477 (11)	22
White	35 185 (64)	21 763 (65)	38	30 070 (65)	18 493 (65)	38	9897 (65)	6424 (65)	39	2 550 168 (53)	858 300 (55)	25
Other or unknown[b]	3366 (6)	1548 (5)	32	2843 (6)	1344 (5)	32	956 (6)	467 (5)	33	487 404 (10)	105 844 (7)	18
Charlson Comorbidity Index score ≥3[c]												
Yes	39 199 (72)	25 723 (76)	40	34 338 (74)	22 239 (78)	39	10 307 (68)	7405 (75)	42	333 227 (7)	186 721 (12)	36
No	15 512 (28)	7983 (24)	34	12 206 (26)	6406 (22)	34	4930 (32)	2515 (25)	34	4 505 266 (93)	1 382 831 (88)	23
Vaccination status[d]												
None/incomplete	11 861 (22)	245 (1)	2	10 040 (22)	207 (1)	2	3160 (21)	64 (1)	2	1 509 962 (31)	25 602 (2)	2
Primary series only	13 001 (24)	1099 (3)	8	10 943 (24)	922 (3)	8	3633 (24)	326 (3)	8	1 461 926 (30)	105 972 (7)	7
Primary series and 1 additional dose	20 794 (38)	10 207 (30)	33	17 803 (38)	8784 (31)	33	5768 (38)	2968 (30)	34	1 579 784 (33)	755 403 (48)	32
Primary series and 2 or 3 additional doses	9055 (17)	22 155 (66)	71	7758 (17)	18 732 (65)	71	2676 (18)	6562 (66)	71	286 821 (6)	682 575 (43)	70

[a] See eTables 4 and 5 in Supplement 1 for definitions.

[b] Included American Indian, multiracial, and other race (not specified).

[c] Scores range from 0-29, with higher scores indicating greater comorbidity.

[d] As of index date September 1, 2022. Incomplete status meant 1 dose of BNT162b2 (Pfizer/BioNTech) or mRNA-1273 (Moderna/National Institutes of Health) only. Primary series was 1 dose of Ad26.COV2.s (Janssen) or 2 doses of BNT162b2 (Pfizer/BioNTech; at least 14 days apart) or mRNA-1273 (Moderna/National Institutes of Health; at least 21 days apart). Additional vaccinations must have been at least 28 days after prior vaccination.

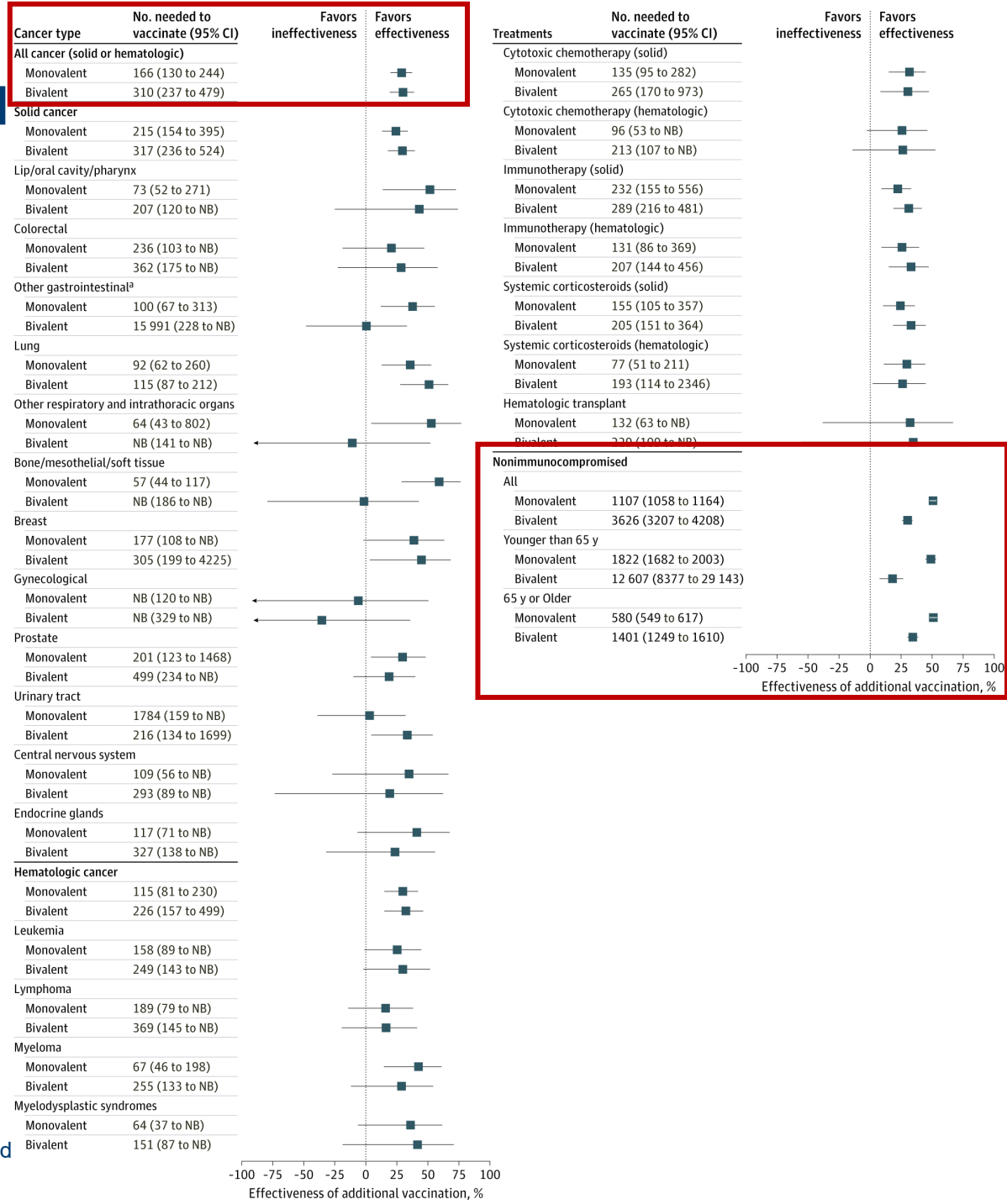
Vaccine effectiveness and number needed to vaccinate (NNV) to prevent hospitalization

Vaccine effectiveness among adults with cancer:

- Monovalent booster: 29.2%, NNV 166
- Bivalent booster: 29.9%, NNV 310

Vaccine effectiveness among non-immunosuppressed adults:

- Monovalent booster
  - All: 50.8%, NNV 1,107
  - 18-64yrs: 49.1%, NNV 1,822
  - 65+yrs: 51.0%, NNV 580
- Bivalent booster
  - All: 30.1%, NNV 3,626
  - 18-64yrs: 17.9%, NNV 12,607
  - 65+yrs: 34.6%, NNV 1,401



Skarbinski J, Elkin EP, Ziemba YC, et al. COVID-19 Vaccine Booster Uptake and Effectiveness Among US Ad
2025. doi:10.1001/jamaoncol.2025.2020

Food and Drug Administration (FDA) Recommendations

Recommends monovalent (single-strain) vaccines targeting the JN.1-lineage-based LP.8.1 strain in May 22, 2025 in guidance to manufacturers

- Pfizer, Moderna and Novovax have an FDA-approved vaccine for 2025-2026
  - Individuals 65 years of age and older
  - ≤64 years of age with at least one underlying condition that puts them at high risk for severe outcomes from COVID-19

Centers for Disease Control and Prevention (CDC) recommendations

Completed the initial series before 2025–2026 vaccine: • Administer 2 doses of 2025–2026 vaccine spaced 6 months apart		
3 or more doses Moderna or 3 or more doses Pfizer-BioNTech	2	**2025–2026 Dose 1** (Moderna [Spikevax], Novavax, or Pfizer-BioNTech): At least 8 weeks after last dose; (Moderna [mNexspike]): At least 3 months after last dose[§] **2025–2026 Dose 2** (Moderna [Spikevax], Novavax, or Pfizer-BioNTech): 6 months (minimum interval 2 months) after 2025–2026 Dose 1; (Moderna [mNexspike]): 6 months (minimum interval 3 months)[§] after 2025–2026 Dose 1
2 or more doses Novavax	2	**2025–2026 Dose 1** (Moderna [Spikevax], Novavax, or Pfizer-BioNTech): At least 8 weeks after last dose; (Moderna [mNexspike]): At least 3 months after last dose[§] **2025–2026 Dose 2** (Moderna [Spikevax], Novavax, or Pfizer-BioNTech): 6 months (minimum interval 2 months) after 2025–2026 Dose 1; (Moderna [mNexspike]): 6 months (minimum interval 3 months)[§] after 2025–2026 Dose 1

American Society of Clinical Oncology (ASCO) Guideline

TABLE 2. Recommended Immunizations for Adults With Cancer

Vaccine	Recommended Age	Schedule
Influenza[a]	All ages	Annually
RSV	60 years and older	Once
COVID-19	All ages	As per the latest CDC schedule for immunocompromised[17]
Tdap or Td[b]	19 years and older	One dose of Tdap, followed by Td or Tdap booster every 10 years
Hepatitis B	19-59 years: eligible 60 years and older: immunize those with other risk factors[c]	For adults 20 years and older, use high antigen (40 μg) and administer as a three-dose Recombivax HB series (0, 1, 6 months) or four-dose Engerix-B series (0, 1, 2, 6 months)[18]
Recombinant zoster vaccine	19 years and older	Two doses at least 4 weeks apart
Pneumococcal vaccine	19 years and older	One dose PCV15 followed by PPSV23 8 weeks later OR One dose PCV20[d]
HPV	19-26 years: eligible 27-45 years: *shared decision making*	Three doses, 0, 1–2, 6-months

NOTE. Adapted from CDC Adult Immunization Schedule By Medical Condition and Other Indication.[15] Information linking to US trade names for each vaccine is available and routinely updated at the CDC's website on vaccines.[16] Coadministration of two or more of the recommended nonlive vaccines is acceptable per CDC guidelines. When given on separate days, there is no recommended waiting period. Note, PCV-15 and PPSV-23 should be separated by at least 8 weeks as noted in the table.

Abbreviations: CDC, Centers for Disease Control and Prevention; HPV, human papillomavirus; PCV, pneumococcal conjugate vaccine; PPSV-23, 23 valent Pneumococcal polysaccharide vaccine; RSV, respiratory syncytial virus; Td, tetanus and diphtheria; Tdap, tetanus, diphtheria and pertussis.

[a]Live attenuated influenza vaccine, which is administered as a nasal spray, cannot be given to patients with cancer.

[b]Tdap has lower amounts of diphtheria and pertussis toxoid and is only used for those 7 years and older. DTaP, the pediatric vaccine for prevention of tetanus, diphtheria, and pertussis, is only for children younger than 7 years.

[c]HIV, chronic liver diseases, intravenous drug use, sexual risk factors, incarcerated individuals.

[d]Patients who have previously received PCV13 only can receive one dose of PCV 20 after an interval of 1 year.

Mini Kamboj et al. Vaccination of Adults With Cancer: ASCO Guideline. *JCO* **42**, 1699-1721(2024).DOI:10.1200/JCO.24.00032

Summary

COVID-19 still here

People with cancer at increased risk

COVID-19 vaccination effective with favorable number needed to vaccinate

Uptake among persons with cancer low (~35%)

Supported by CDC, FDA, ASCO guidance

Thank you!!!

This work was supported by

- National Cancer Institute of the National Institutes of Health under Award Number U01CA260584 as part of the Serological Sciences Network (SeroNet) (JS, LHK)
- Physician Researcher Program of The Permanente Medical Group Delivery Science and Applied Research Program (JS)