COVID-19 VACCINE EFFECTIVENESS IN IMMUNOCOMPROMISED PATIENT POPULATIONS

Rachel La Costa, MPAS, PA-C

UC San Diego Health

POINT 1902 LOMA
NAZARENE UNIVERSITY

aapa2022

DISCLOSURES

Non-Declaration Statement: I have no relevant relationships with ineligible companies to disclose within the past 24 months.

EDUCATIONAL OBJECTIVES

At the conclusion of this sessions, participants should be able to:

- Identify immunocompromised patient populations
- Discuss immunocompromised patients' serological response to COVID-19 vaccination
- Identify recommendations for ensuring protection from COVID-19 infection in immunocompromised patients

NOTE: DATA IS CURRENT AS OF FEBRUARY 28, 2022 (DUE TO AAPA CONFERENCE SUBMISSION REQUIREMENTS)

COVID-19 VACCINES

mRNA Vaccines

PHASE 3

APPROVED IN U.S., ELSEWHERE | EMERGENCY USE IN MANY COUNTRIES

Pfizer BIONTECH

VACCINE NAME: Comirnaty (also known as tozinameran or BNT162b2)
EFFICACY: 91%
DOSE: 2 doses, 3 weeks apart
TYPE: Muscle injection

PHASE 3

APPROVED IN U.S., ELSEWHERE | EMERGENCY USE IN MANY COUNTRIES

moderna NIH National Institutes of Health *Turning Discovery Into Health*

VACCINE NAME: mRNA-1273 or Spikevax
EFFICACY: Preventing Covid-19 illness: 93.2%. Preventing severe disease: 98.2%.
DOSE: 2 doses, 4 weeks apart
TYPE: Muscle injection

Adenoviral Vector Vaccine

PHASE 3

APPROVED IN CANADA | EMERGENCY USE IN U.S., OTHER COUNTRIES

Johnson & Johnson Beth Israel Lahey Health Beth Israel Deaconess Medical Center janssen

VACCINE NAME: Ad26.COV2.S
EFFICACY: 72% in United States, 68% in Brazil and 64% in South Africa
DOSE: 1 dose
TYPE: Muscle injection

CDC DEFINITION OF IMMUNOCOMPROMISED PATIENTS

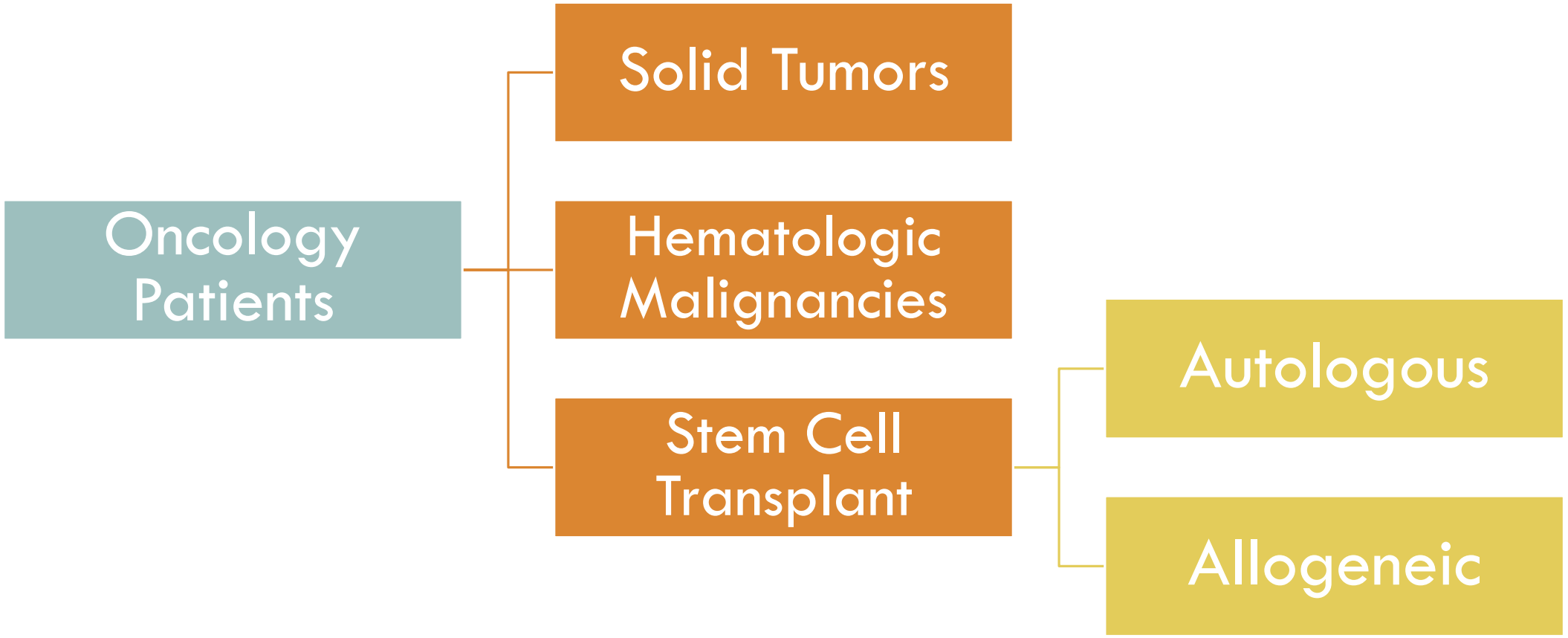
Who Is Moderately or Severely Immunocompromised?

Many conditions and treatments can cause a person to be immunocompromised, also known as having a weakened immune system. People are considered to be moderately or severely immunocompromised if they have:

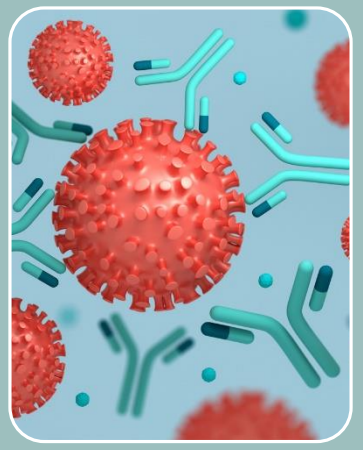
* Been receiving active cancer treatment for tumors or cancers of the blood
* Received an organ transplant and are taking medicine to suppress the immune system
* Received a stem cell transplant within the last 2 years or are taking medicine to suppress the immune system
- Moderate or severe primary immunodeficiency (such as DiGeorge syndrome, Wiskott-Aldrich syndrome)
- Advanced or untreated HIV infection
- Active treatment with high-dose corticosteroids or other drugs that may suppress their immune response

People should talk to their healthcare provider about COVID-19 vaccination given their medical condition.

RESPONSE TO COVID-19 VACCINATION IN IMMUNOCOMPROMISED ONCOLOGY PATIENTS



Seroconversion Rates



Antibody Titers

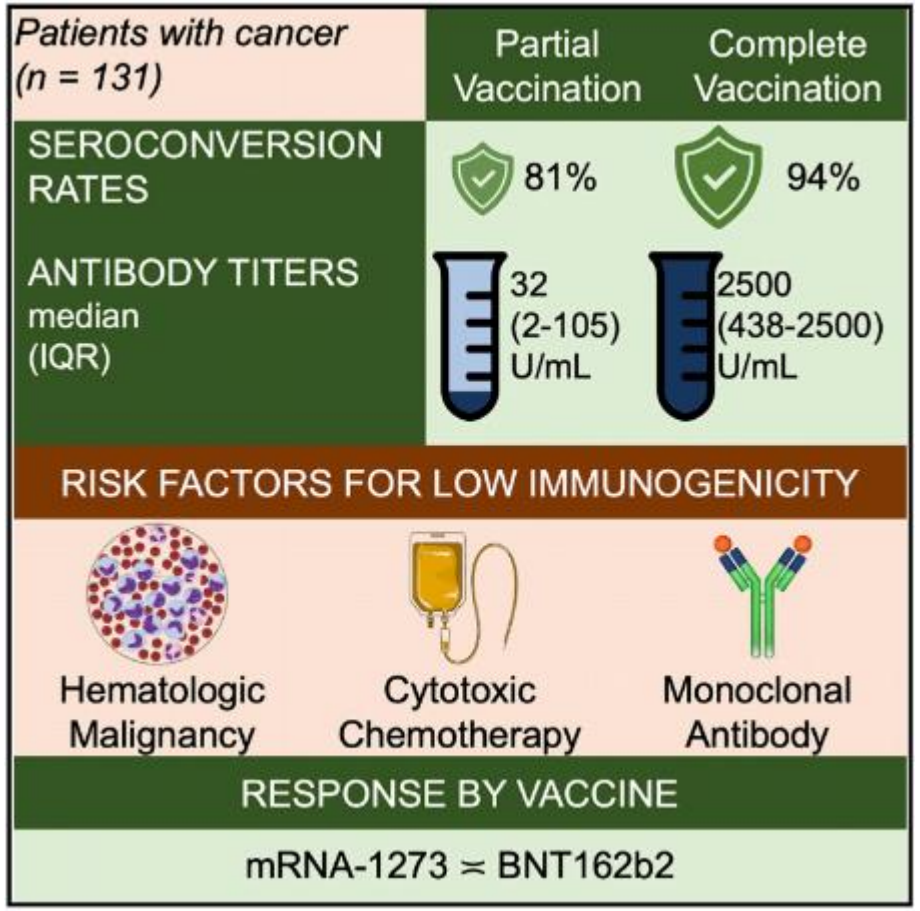
Cancer Cell

CellPress

Article

Immunogenicity of SARS-CoV-2 messenger RNA vaccines in patients with cancer

Alfredo Addeo,[1,5,*] Pankil K. Shah,[2,5] Natacha Bordry,[1] Robert D. Hudson,[2] Brenna Albracht,[2] Mariagrazia Di Marco,[1] Virginia Kaklamani,[2] Pierre-Yves Dietrich,[1] Barbara S. Taylor,[3] Pierre-Francois Simand,[1] Darpan Patel,[2] Jing Wang,[2] Intidhar Labidi-Galy,[1,4] Sara Fertani,[1] Robin J. Leach,[2] Jose Sandoval,[1] Ruben Mesa,[2] Kate Lathrop,[2,6] Nicolas Mach,[1,6] and Dimpy P. Shah[2,6,7,*]



Addeo et al., 2021, *Cancer Cell*

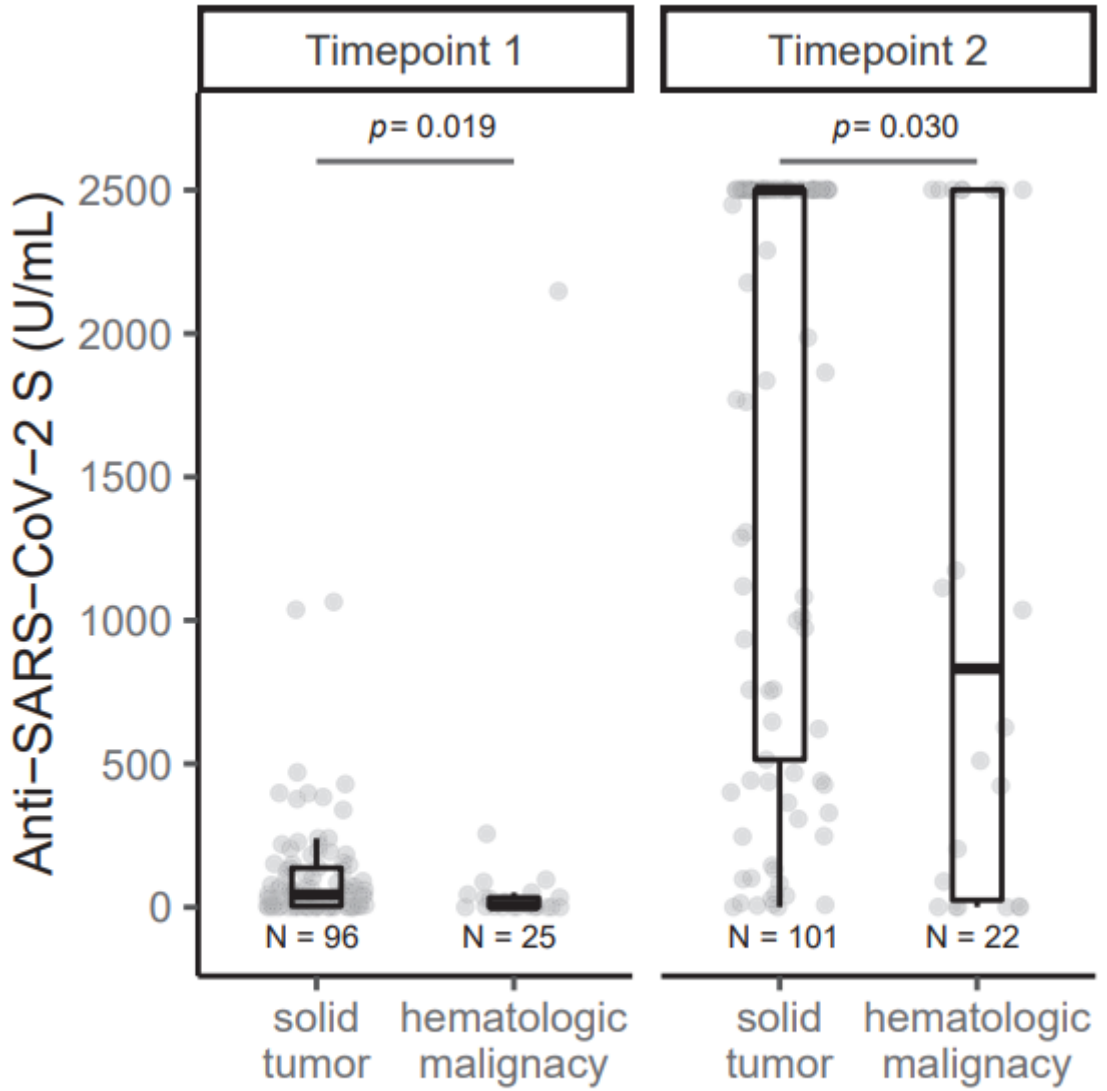


Figure 2. Differences in anti-SARS-CoV-2 S (anti-S) IgG titers following partial and complete vaccination, stratified by type of cancer

Addeo et al., 2021, *Cancer Cell*

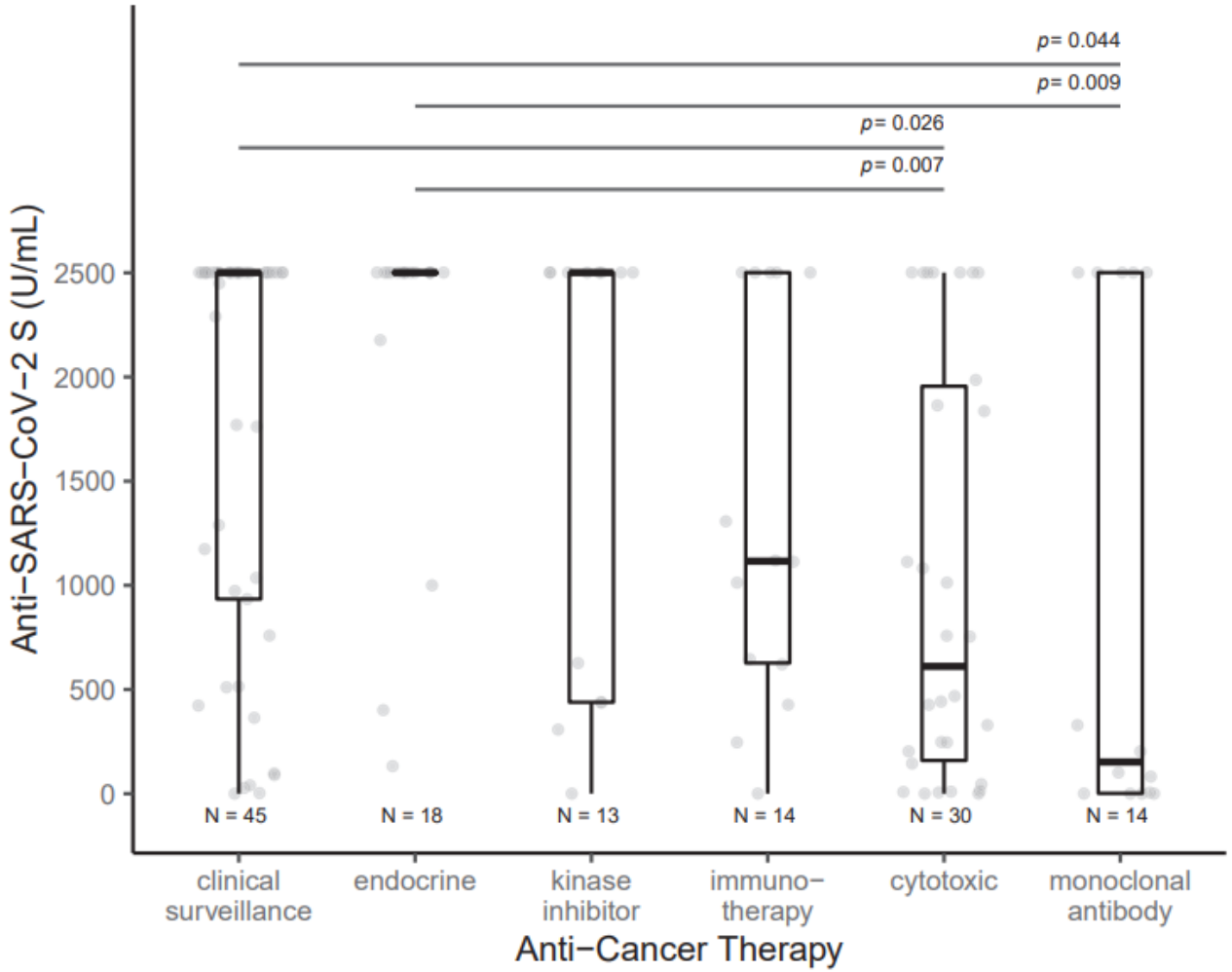


Figure 3. Differences in anti-SARS-CoV-2 S (anti-S) IgG titers following complete vaccination, stratified by anti-cancer treatment modality

Addeo et al., 2021, *Cancer Cell*

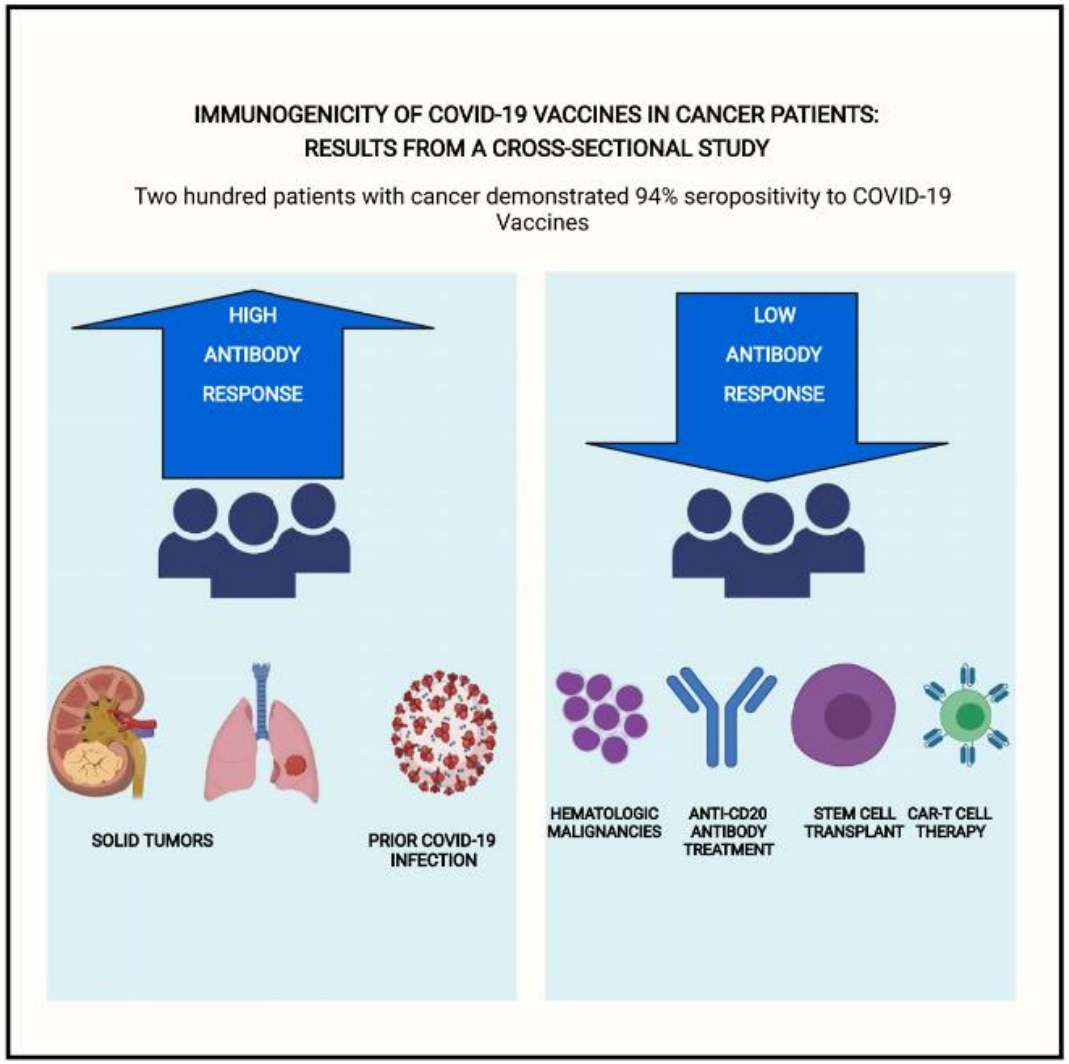
Cancer Cell

CellPress

Article

Seroconversion rates following COVID-19 vaccination among patients with cancer

Astha Thakkar,[1] Jesus D. Gonzalez-Lugo,[1] Niyati Goradia,[1] Radhika Gali,[1] Lauren C. Shapiro,[1] Kith Pradhan,[1] Shafia Rahman,[1] So Yeon Kim,[1] Brian Ko,[1] R. Alejandro Sica,[1] Noah Kornblum,[1] Lizamarie Bachier-Rodriguez,[1] Margaret McCort,[2] Sanjay Goel,[1] Roman Perez-Soler,[1] Stuart Packer,[1] Joseph Sparano,[1] Benjamin Gartrell,[1] Della Makower,[1] Yitz D. Goldstein,[3] Lucia Wolgast,[3] Amit Verma,[1,*] and Balazs Halmos[1,4,*]



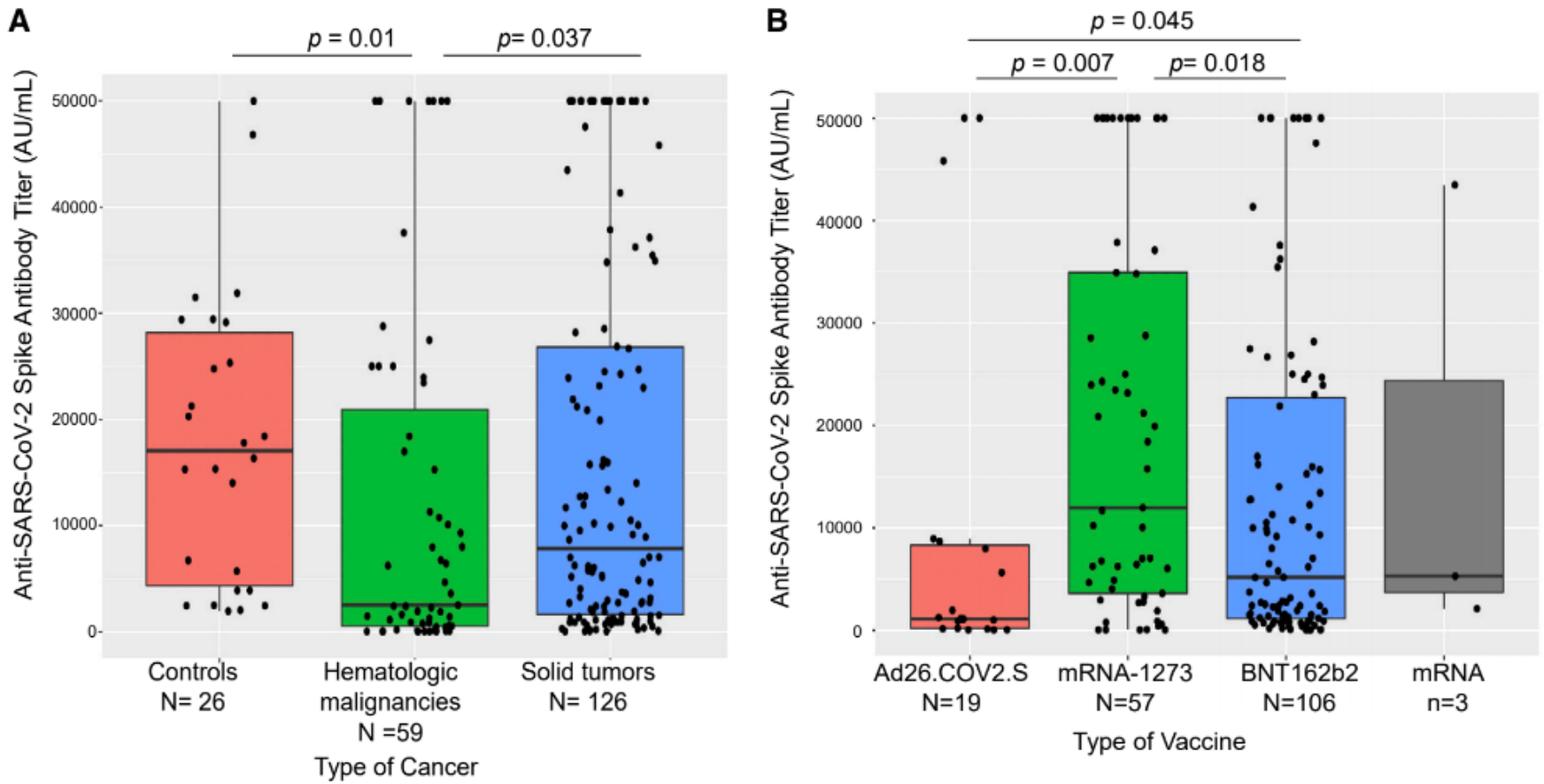


Figure 2. Association of anti-SARS-CoV-2 spike IgG with vaccine types and cancer types

(A) Patients with hematologic malignancies had lowest titers when compared with those with solid tumors and non-cancer patient controls. No difference was seen between patients with solid tumors and controls.

(B) Anti-spike protein IgG antibody titers (AU/mL) were significantly higher in patients who received mRNA vaccines than in those who received adenoviral vaccine.

Box plots here and in subsequent figures show median (horizontal bar), the 75th and 25th quartiles, and error bars depicting the largest and smallest values (up to 1.5 times the interquartile range). Differences assessed by Kruskal-Wallis test.

Thakkar et al., 2021, *Cancer Cell*

THE LANCET
Haematology

Immunogenicity of the BNT162b2 COVID-19 mRNA vaccine and early clinical outcomes in patients with haematological malignancies in Lithuania: a national prospective cohort study

Kazimieras Maneikis, Karolis Šablauskas*, Ugnė Ringelevičiūtė, Vilmantė Vaitekėnaitė, Rita Čekauskienė, Lina Kryžauskaitė, Daniel Naumovas, Valdas Banys, Valdas Pečeliūnas, Tumas Beinortas†, Laimonas Griškevičius†*

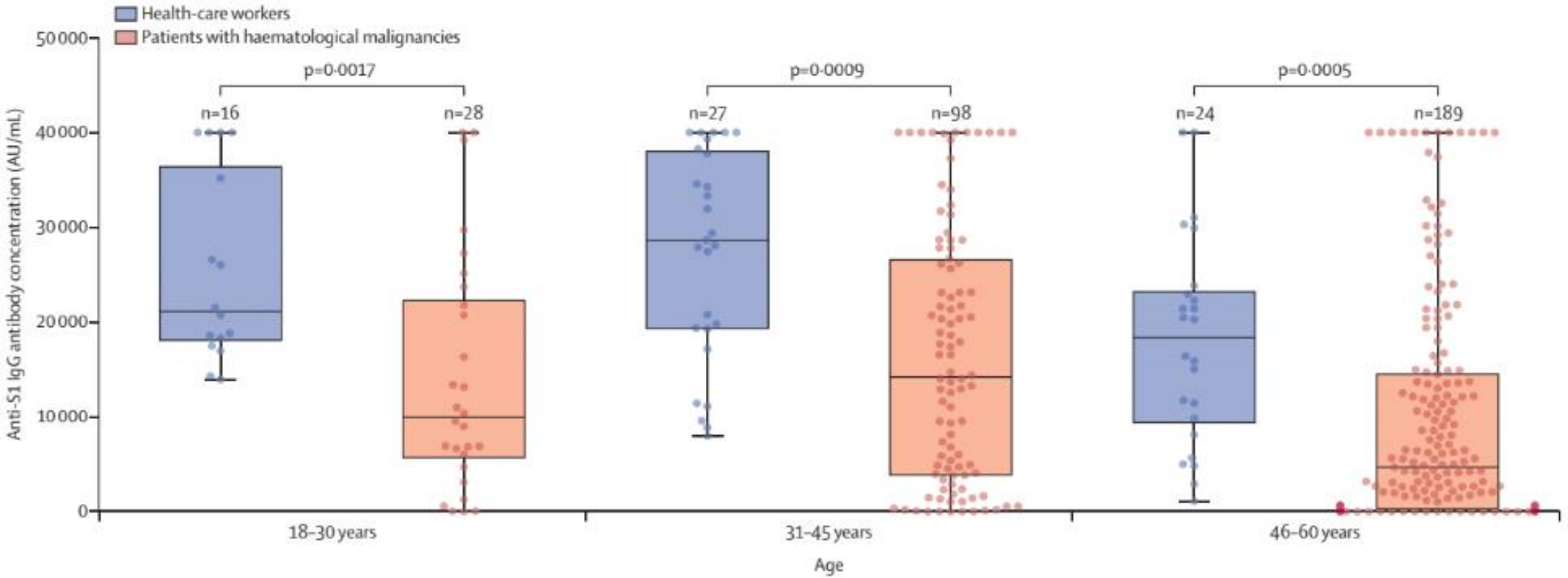


Figure 2: **Serological response to two doses of BNT162b2 mRNA vaccine**

The boxes show IQR, centre line shows the median, and whiskers show maximum and minimum values; the dots show individual participants. (A) Serological response to two doses of BNT162b2 in healthy individuals and in individuals with haematological malignancies grouped by age. (B) Serological response to two doses of BNT162b2 in treated patients compared with untreated patients with haematological malignancies; p values are for the comparison between the median anti-S1 IgG antibody concentration of each treatment group and the untreated group; the treatment regimens of each group are shown in the table. BTKIs=Bruton tyrosine kinase inhibitors. HSCT=haematopoietic stem-cell transplantation. IMiDs=immunomodulatory imide drugs. TKIs=tyrosine kinase inhibitors.

Maneikis et al., 2021, *Lancet Haematology*

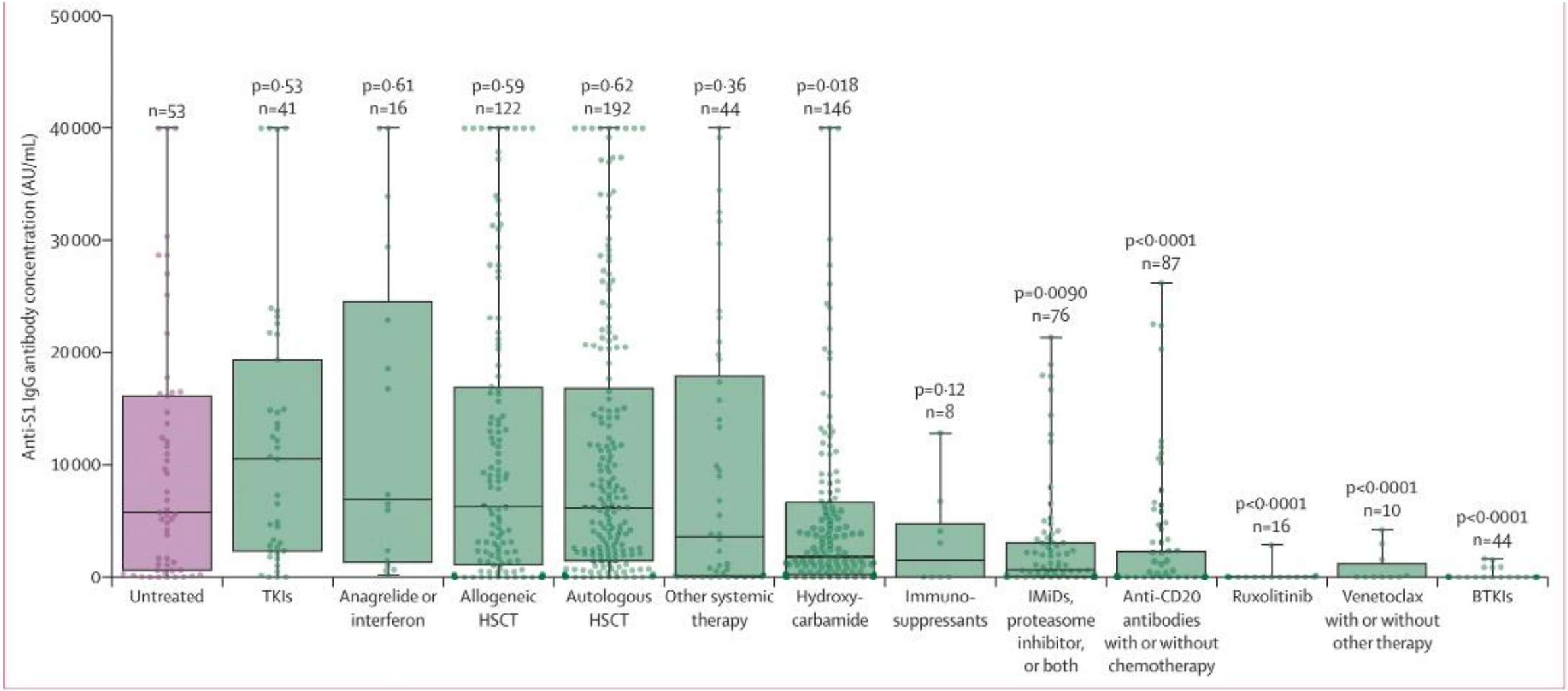


Figure 2: **Serological response to two doses of BNT162b2 mRNA vaccine**

The boxes show IQR, centre line shows the median, and whiskers show maximum and minimum values; the dots show individual participants. (A) Serological response to two doses of BNT162b2 in healthy individuals and in individuals with haematological malignancies grouped by age. (B) Serological response to two doses of BNT162b2 in treated patients compared with untreated patients with haematological malignancies; p values are for the comparison between the median anti-S1 IgG antibody concentration of each treatment group and the untreated group; the treatment regimens of each group are shown in the table. BTKIs=Bruton tyrosine kinase inhibitors. HSCT=haematopoietic stem-cell transplantation. IMiDs=immunomodulatory imide drugs. TKIs=tyrosine kinase inhibitors.

Maneikis et al., 2021, *Lancet Haematology*

blood®

CLINICAL TRIALS AND OBSERVATIONS

CME Article

Efficacy of the BNT162b2 mRNA COVID-19 vaccine in patients with chronic lymphocytic leukemia

Yair Herishanu,[1,2,*] Irit Avivi,[1,2,*] Anat Aharon,[1,2] Gabi Shefer,[3] Shai Levi,[2] Yotam Bronstein,[1,2] Miguel Morales,[3] Tomer Ziv,[1] Yamit Shorer Arbel,[1] Lydia Scarfò,[4,5] Erel Joffe,[6] Chava Perry,[1,2] and Paolo Ghia[4,5]

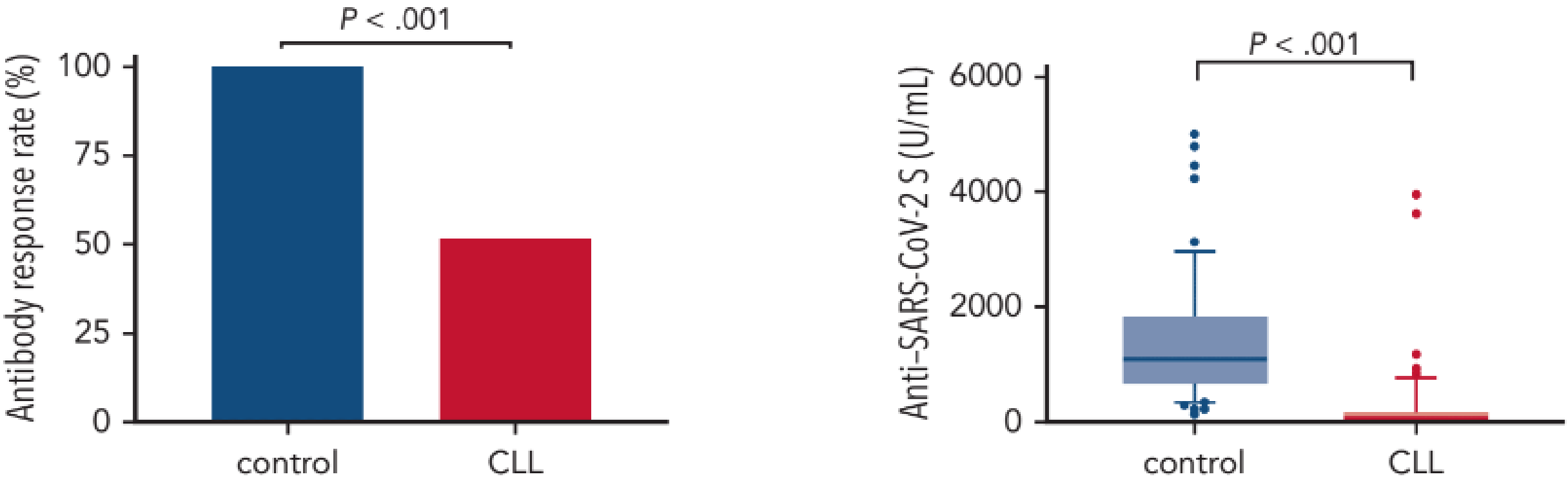


Figure 1. Anti–SARS-CoV-2 antibody response in patients with CLL and healthy control subjects. (A-B) Distribution of individual responses in patients with CLL (n = 52) and sex- and age-matched control subjects (n = 52). Each column represents the level of antibodies in individual patients (red bars indicate treatment naive, green bar indicates on-therapy, blue bars indicate off-therapy in remission, and purple bars indicate off-therapy in relapse) in panel A and in individual healthy control subjects (red bars) in panel B. (C) Response rate in patients with CLL (n = 52) and sex- and age-matched control subjects (n = 52). (D) Anti–SARS-CoV-2 antibody levels in patients with CLL (n = 52) and sex- and age-matched control subjects (n = 52).

Herishanu et al., 2021, *Blood*

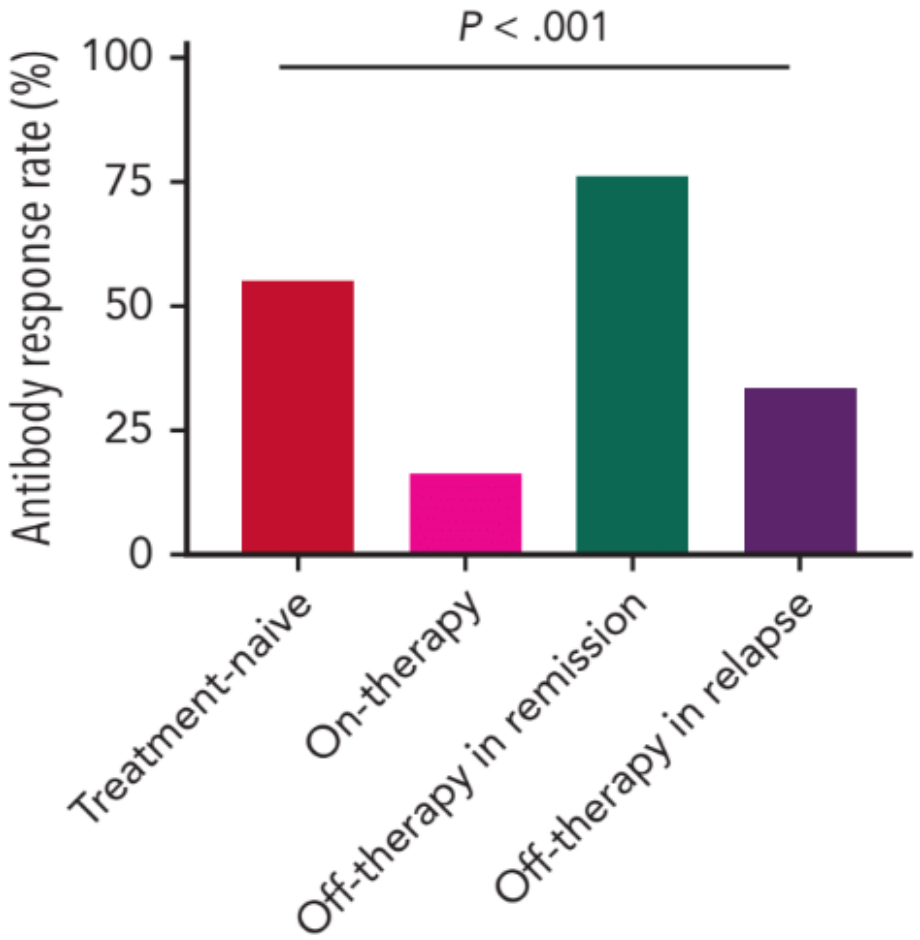


Figure 2. Anti–SARS-CoV-2 antibody responses in patients with CLL according to disease status and treatment. (A-B) Response rate and anti–SARS-CoV-2 antibody levels in patients with CLL according to disease status: Treatment naive (n = 58), on-therapy (n = 75), off-therapy in remission (n = 24), and off-therapy in relapse (n = 10). (C) Response rate in patients with CLL treated with BTKi (n = 50) and venetoclax (Ven) ± anti-CD20 antibody (n = 22). NS, not significant.

Herishanu et al., 2021, *Blood*

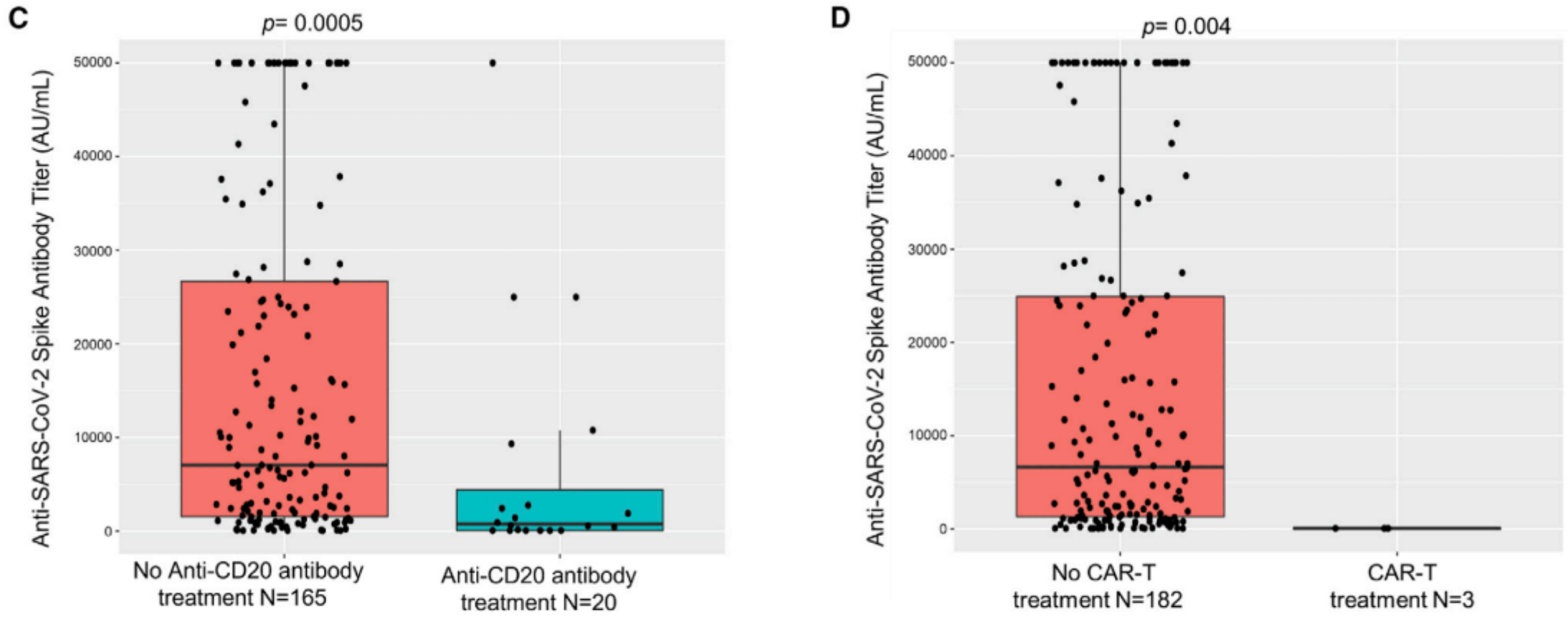


Figure 4. Association of anti-SARS-CoV-2 spike IgG with immunosuppressive therapies

(A and B) Anti-spike protein IgG antibody titers (AU/mL) after full vaccination did not significantly differ in patients having received stem cell transplantation (SCT) (A) or anti-CD38 antibody therapy (B) when compared with respective counterparts.

(C and D) Patients receiving anti-CD20 antibody treatments (C) or CAR-T cell therapy (D) had a significantly lower titer after vaccination when compared with respective counterparts.

Box plots are shown with differences assessed by Kruskal-Wallis test.

Thakkar et al., 2021, *Cancer Cell*

RECOMMENDATIONS

Pre-teens, Teens and Adults Who Are Moderately or Severely Immunocompromised

People ages 12 years and older who are moderately or severely immunocompromised **should receive a total of 4 doses** of COVID-19 vaccine. The 4 doses are made up of a primary series of 3 doses of an mRNA COVID-19 vaccine, plus 1 booster of an mRNA COVID-19 vaccine (4th dose).

Primary Series COVID-19 Vaccine	Age Group	Number of Doses to Complete Primary Series and Timing	Booster and Timing
Pfizer-BioNTech	12+ years	3 doses 2nd dose given 3 weeks (21 days) after 1st dose 3rd dose given at least 4 weeks (28 days) after 2nd dose	1 booster Given at least 3 months after 3rd dose
Moderna	18+ years	3 doses 2nd dose given 4 weeks (28 days) after 1st dose 3rd dose given at least 4 weeks (28 days) after 2nd dose	1 booster Given at least 3 months after 3rd dose

People Who Are Moderately or Severely Immunocompromised and Have Received a J&J/Janssen Vaccine

People ages 18 years and older who are moderately or severely immunocompromised and received the 1 dose Johnson & Johnson's Janssen COVID-19 vaccine should get a second dose of either Pfizer-BioNTech or Moderna COVID-19 vaccine (mRNA COVID-19 vaccines). They should also receive a booster—for **a total of 3 doses**.

Primary Series COVID-19 Vaccine	Age Group	Number of Doses to Complete Primary Series and Timing	Booster and Timing
J&J/Janssen	18+ years	2 doses 1st dose J&J/Janssen 2nd dose Pfizer-BioNTech or Moderna (mRNA COVID-19 vaccines) given at least 4 weeks (28 days) after 1st dose	1 booster Either Pfizer-BioNTech or Moderna (mRNA COVID-19 vaccines) in most situations given at least 2 months after 2nd dose

ADDITIONAL RECOMMENDATIONS

- Consider awaiting neutrophil and platelet recovery prior to vaccination
- Consider delaying anti-CD20 or BTK inhibitor therapy
- Ensure that vaccination is not a contraindication to enrollment on a clinical trial
- "Cocoon" strategy
- Non-pharmacological interventions
- *Patient education*

REFERENCES

1. The New York Times. Coronavirus Vaccine Tracker. https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html. Updated February 28, 2022. Accessed February 28, 2022.
2. Addeo A, Shah PK, Bordry N, et al. Immunogenicity of SARS-CoV-2 messenger RNA vaccines in patients with cancer. *Cancer Cell*. 2021;39(8):1091-1098.e2. doi:10.1016/j.ccell.2021.06.009
3. Thakkar A, Gonzalez-Lugo JD, Goradia N, et al. Seroconversion rates following COVID-19 vaccination among patients with cancer. *Cancer Cell*. 2021;39(8):1081-1090.e2. doi:10.1016/j.ccell.2021.06.002
4. Maneikis K, Šablauskas K, Ringelevičiūtė U, et al. Immunogenicity of the BNT162b2 COVID-19 mRNA vaccine and early clinical outcomes in patients with haematological malignancies in Lithuania: a national prospective cohort study. *Lancet Haematol*. 2021;8(8):e583-e592. doi:10.1016/S2352-3026(21)00169-1
5. Herishanu Y, Avivi I, Aharon A, et al. Efficacy of the BNT162b2 mRNA COVID-19 vaccine in patients with chronic lymphocytic leukemia. *Blood*. 2021;137(23):3165-3173. doi:10.1182/blood.2021011568

QUESTIONS?

Please feel free to reach out!

Email: rachelmlacosta@gmail.com