Cluster Analysis identifies distinct patterns of T-cell and Humoral immune responses: Evolution following a third dose of SARS-CoV-2 vaccine in people living with HIV

Breach Symposium

November 2023

Majdouline El Moussaoui

Department of Infectious Diseases and General Internal Medicine, University Hospital of Liège, Belgium

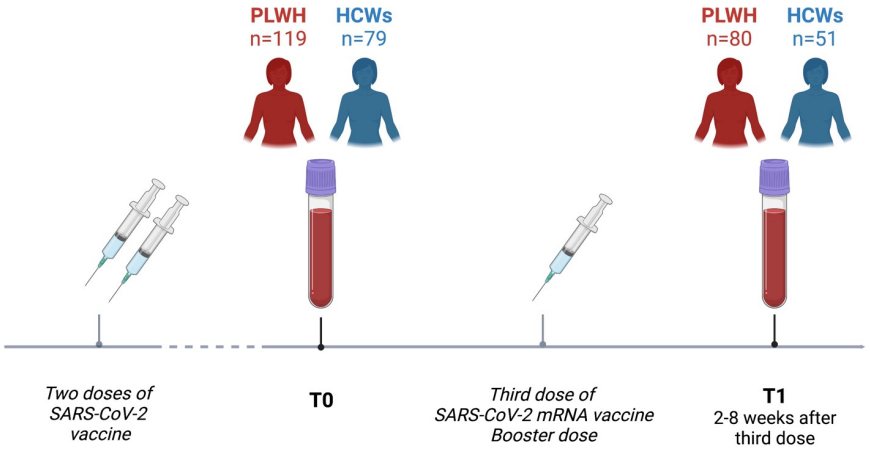
GIGA I3, University of Liège, Belgium

Previous study

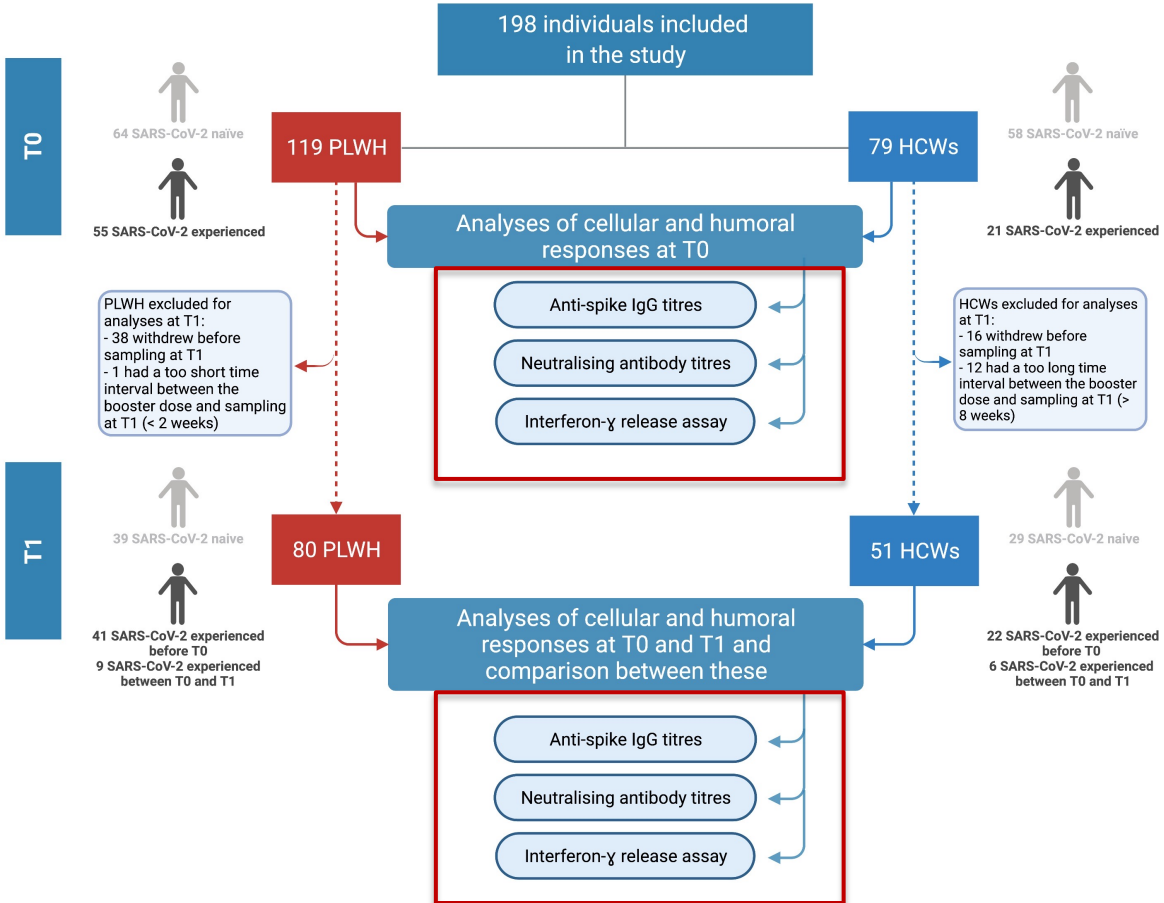
Reduced T-cell response following a third dose of SARS-CoV-2 vaccine in infection-naïve people living with HIV

Majdouline El Moussaoui [1] • Salomé Desmecht [1] • Aleksandr Tashkeev • Nicolas Lambert • Nathalie Maes • Joachim Braghini • Nicole Marechal • Céline Quintana • Karine Briquet • Stéphanie Gofflot • Françoise Toussaint • Marie-Pierre Hayette • Pieter Vermeersch • Laurence Lutteri • Céline Grégoire • Yves Beguin • Souad Rahmouni • Michel Moutschen • Daniel Desmecht [1] • Gilles Darcis [1] • Show less • Show footnotes

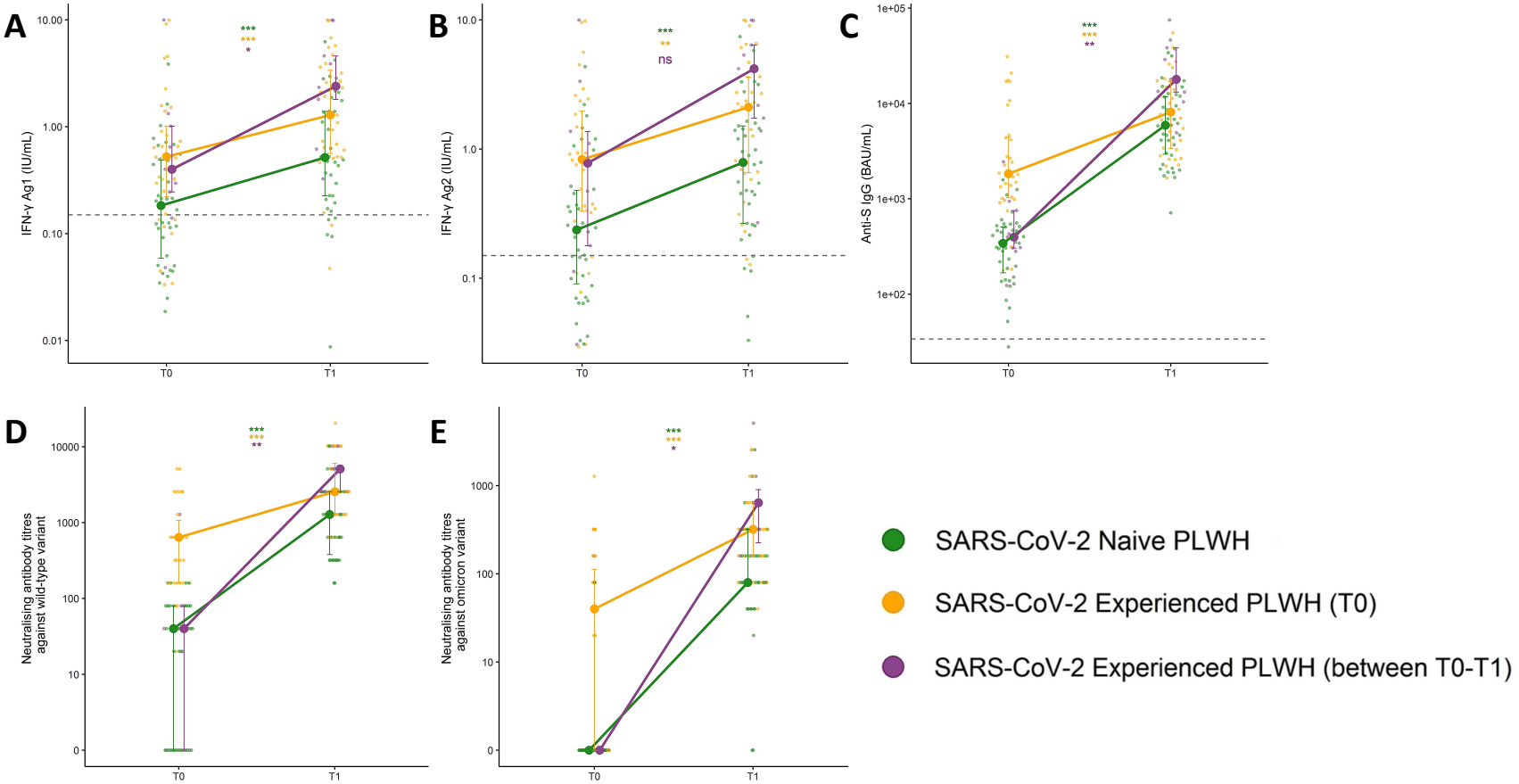
Published: September 08, 2022 • DOI: https://doi.org/10.1016/j.jinf.2022.09.006 • JOURNAL OF INFECTION



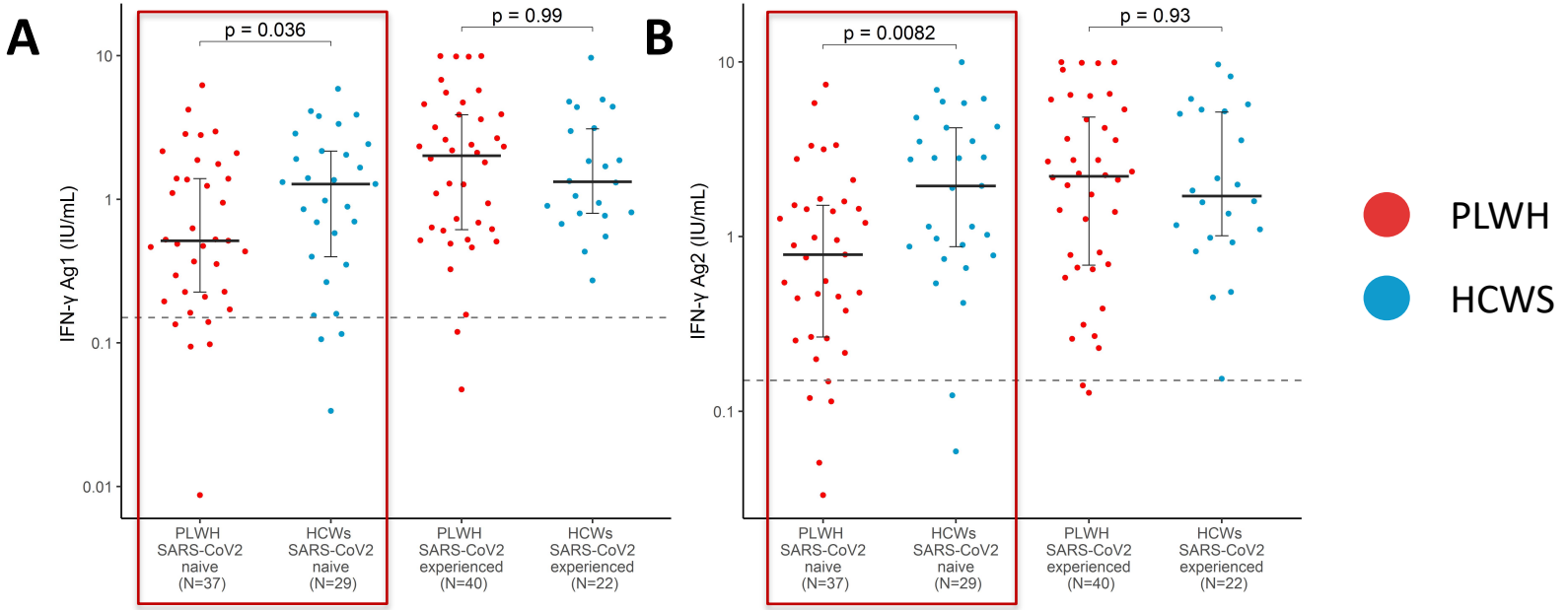
Study Design



Results: Evolution T0-T1 Among PLWH

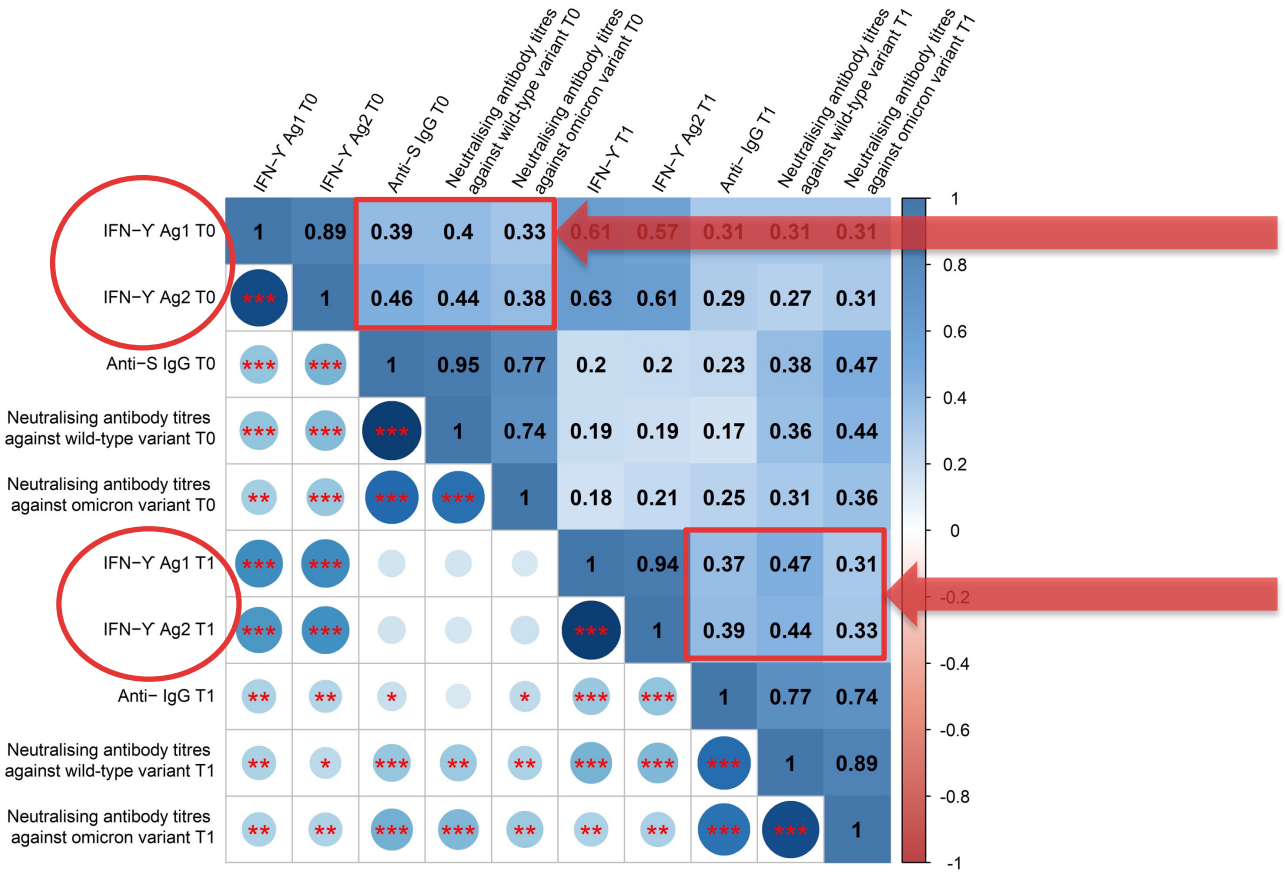


Results: After The Third Dose (T1)

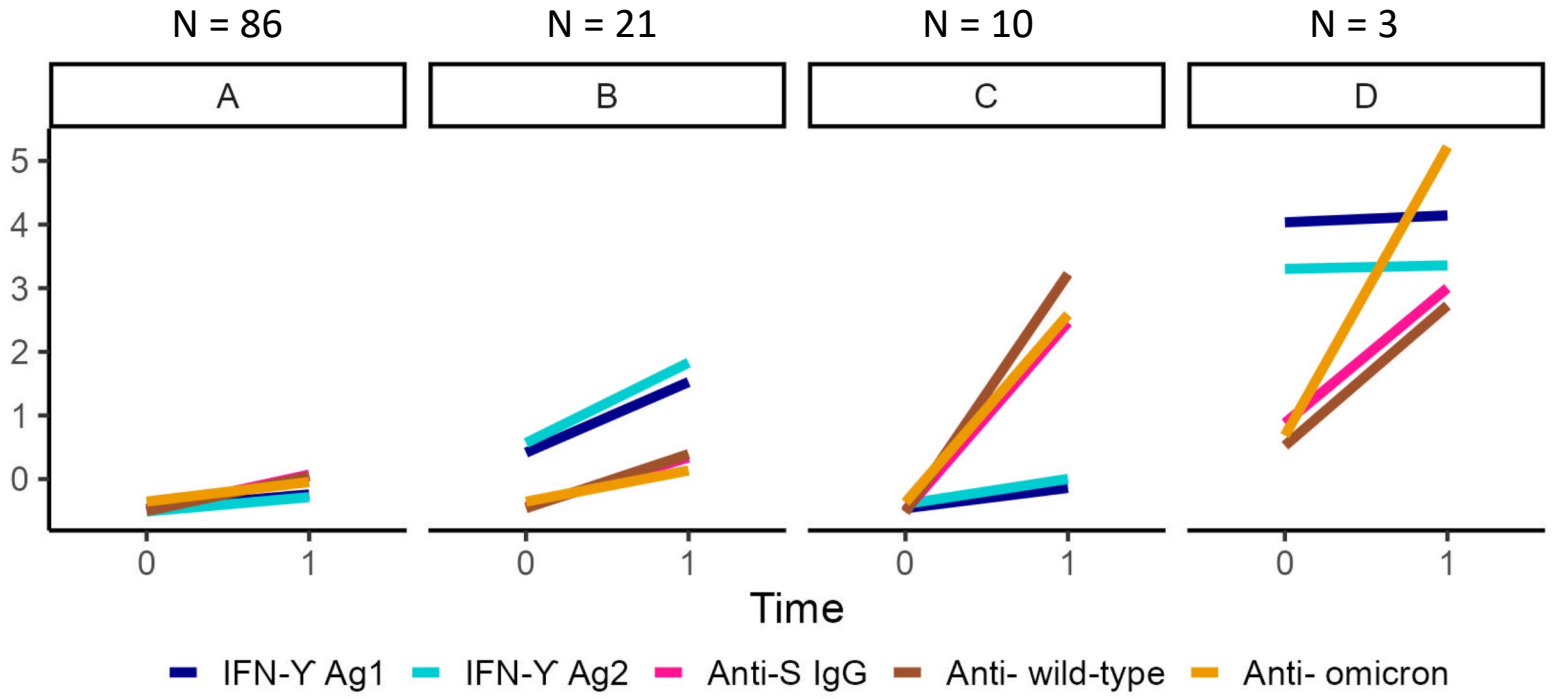


→ IFN-ɣ production after third dose was significantly lower precisely among those **<u>SARS-CoV-2 naïve PLWH</u>** when compared with HCWs, raising concerns about the vaccine's ability to induce protective T-cell immune response among PLWH who had not been previously infected

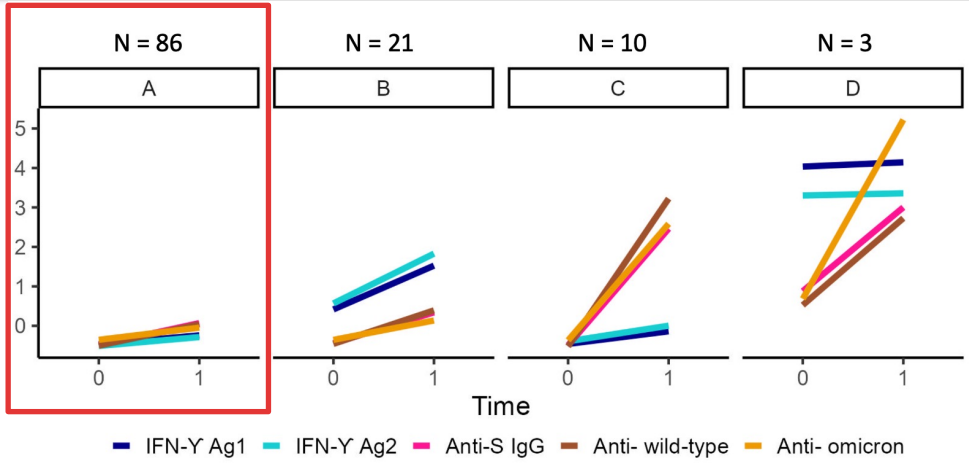
Immune response correlations in PLWH

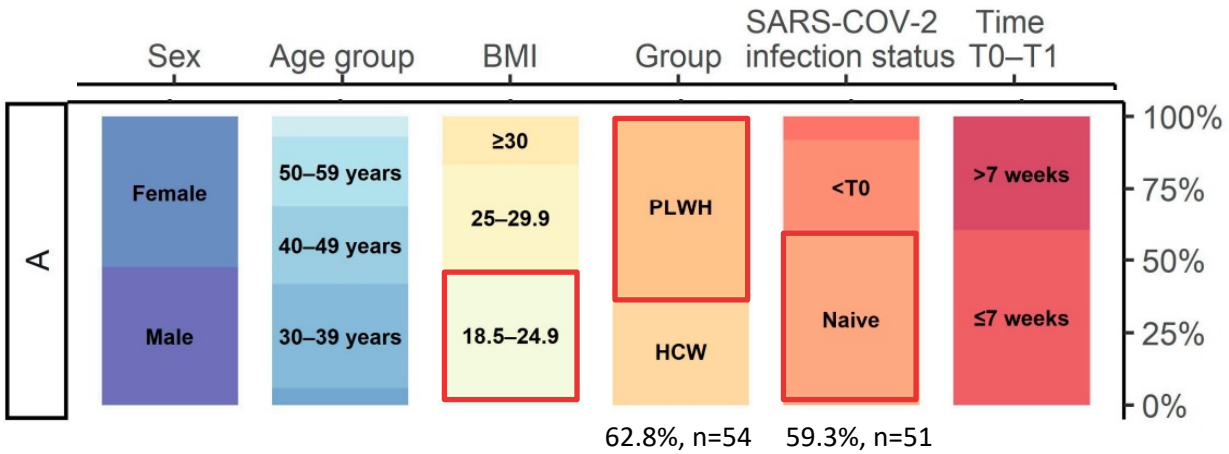


4 distinct patterns of immune response evolution

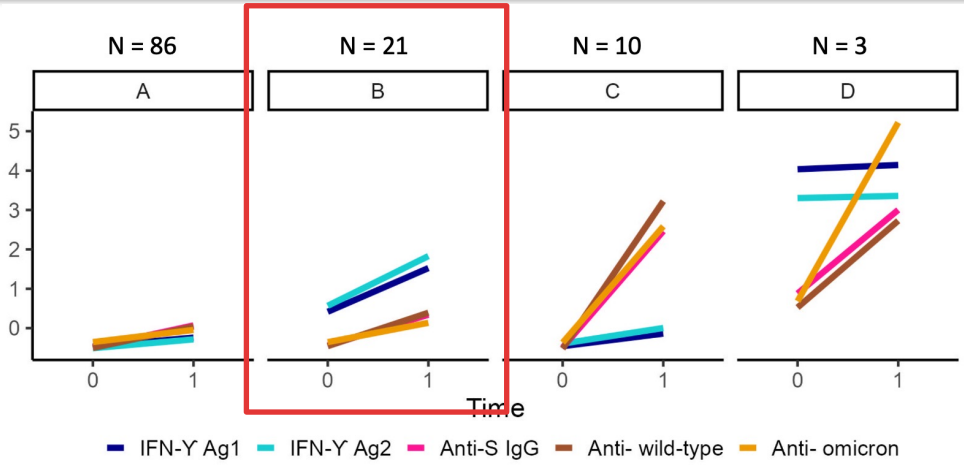


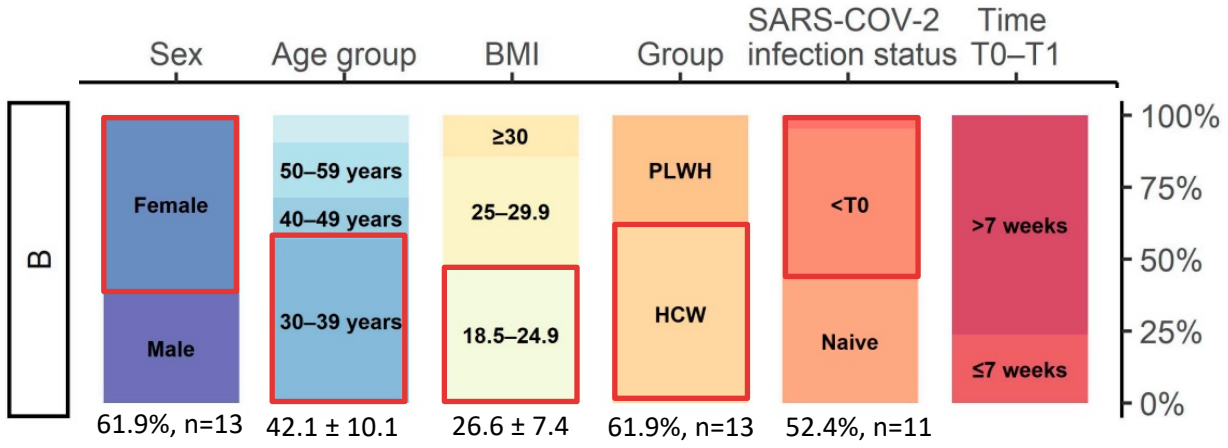
Characteristics of individuals in each of the 4 clusters (A)



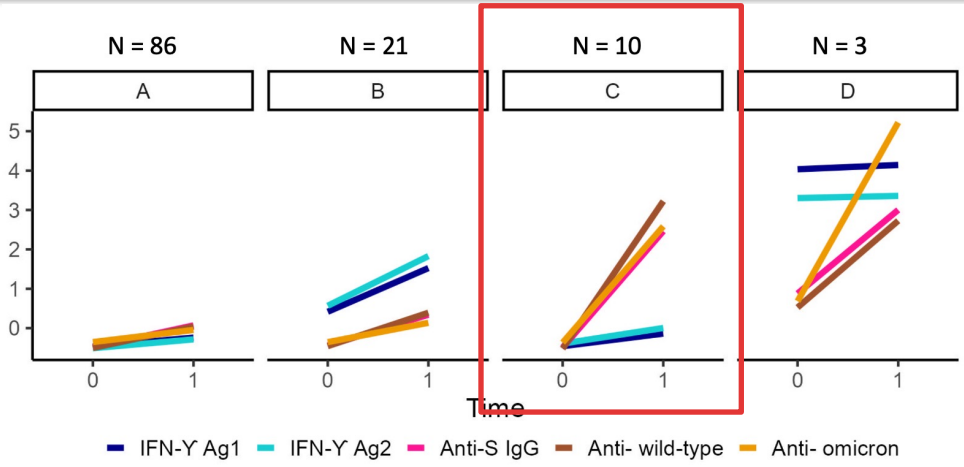


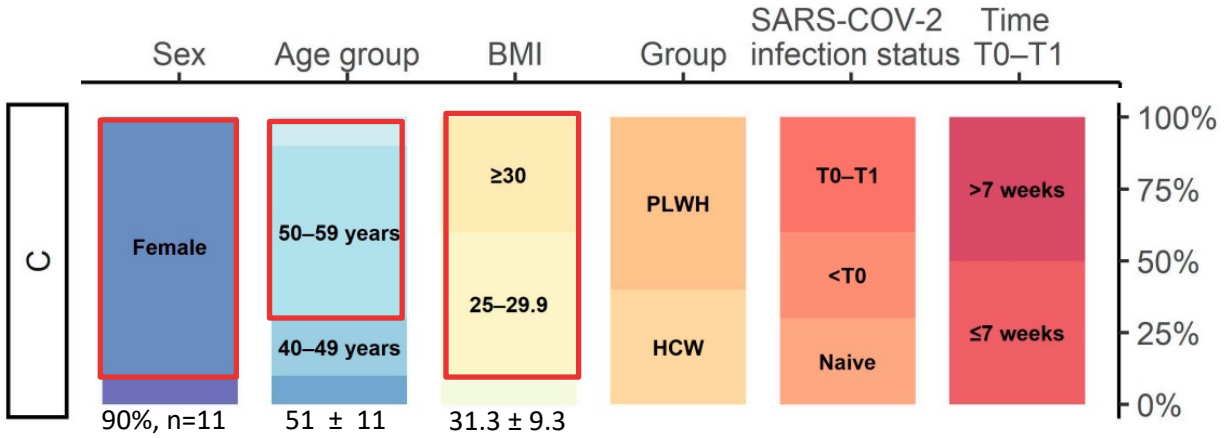
Characteristics of individuals in each of the 4 clusters (B)





Characteristics of individuals in each of the 4 clusters (C)





Conclusion

- Heterogeneity in immune responses among SARS-CoV-2 vaccinated PLWH
- Prior or breakthrough natural infection enhances the activity of vaccines and must be taken into account for informing global vaccine strategies among PLWH, even those with a viro-immunologically controlled infection
- Discordance in T-cell and humoral responses correlation highlights the complex interactions of the immune system suggesting that there are several mechanisms by which protection against SARS-CoV-2 can be achieved

Acknowledgements

Infectious Diseases Department (University Hospital of Liège)
Gilles Darcis
Michel Moutschen
Nicole Marechal
Karine Briquet
Nathalie Maes
Joachim Braghini
Céline Quintana

Clinical Microbiology Department (University Hospital of Liège)
Françoise Toussaint
Marie-Pierre Hayette

Laboratory of Animal Genomics (GIGA-institute Liège)
Salomé Desmecht
Souad Rahmouni

Laboratory Medicine Department (University Hospital of Leuven)
Pieter Vermeersch

Haematology Department & BHUL (University Hospital of Liège)
Stéphanie Gofflot
Céline Grégoire
Yves Beguin

Clinical Chemistry Department (University Hospital of Liège)
Laurence Lutteri

Animal Pathology Department (University of Liège)
Daniel Desmecht

LIÈGE université
GIGA

Thank you for your attention!

melmoussaoui@chuliege.be

Acknowledgments

viruses

MDPI

Article

Cluster Analysis Identifies Distinct Patterns of T-Cell and Humoral Immune Responses Evolution Following a Third Dose of SARS-CoV-2 Vaccine in People Living with HIV

Majdouline El Moussaoui [1,*,†], Salomé Desmecht [2,†], Nicolas Lambert [3], Nathalie Maes [4], Joachim Braghini [1], Nicole Marechal [1], Céline Quintana [1], Karine Briquet [1], Stéphanie Gofflot [5], Françoise Toussaint [6], Marie-Pierre Hayette [6], Pieter Vermeersch [7], Laurence Lutteri [8], Céline Grégoire [9], Yves Beguin [5,9], Souad Rahmouni [2], Michel Moutschen [1], Daniel Desmecht [10,‡] and Gilles Darcis [1,‡]

Background

- Clinical trials and real-world data have shown vaccination against SARS-CoV-2 to be highly effective against COVID-19 infection and severe outcomes
- Immunity waning and emergence of variants escaping vaccine-induced immune response, most notably the B.1.1.529 (Omicron) variant, justified the implementation of a third dose of mRNA vaccine, sometimes referred to as «booster»
- A booster dose vaccine has been recommended in Belgium for > years
- Real-world evidence on the effectiveness of booster dose vaccine in people living with HIV (PLWH) remains limited

Polack, et al., 2020, NEJM; Andrews, et al. 2022, Nature Medicine

Background characteristics of PLWH at T0 and T1

Variable	PLWH at T0 (n=119)	PLWH at T1 (n=80)
HIV infection		
HIV-1	118 (99.2)	79 (98.8)
HIV-2	1 (0.8)	1 (1.2)
Prior AIDS diagnosis	45 (37.8)	27 (33.8)
Time at T0 since HIV diagnosis (years)	11 (6-18)	11 (6.5-18)
<1	1 (0.8)	1 (1.2)
1-5	27 (22.7)	17 (21.3)
6-10	26 (21.9)	17 (21.3)
>10	65 (54.6)	45 (56.2)
Nadir CD4+T cell count per µL	259 (163-462)	292 (166-502)
<200	39 (32.8)	25 (31.2)
≥200	80 (67.2)	55 (68.8)
Last CD4+T cell count per µL (2021 or 2022)	680 (546-898)	743 (592-940)
<350	8 (6.7)	3 (3.7)
350-499	17 (14.3)	11 (13.8)
≥500	c94 (79.0)	66 (82.5)
CD4/CD8 ratio, n=117	1.03 ± 0.57	1.1 ± 0.57
<0.6	25 (21.4)	16 (20.0)
0.6-1	40 (34.2)	26 (32.5)
>1	52 (44.4)	38 (47.5)
Last plasma viral load copies/mL	<20 (<20-<20)	<20 (<20-<20)
<50	112 (94.1)	75 (93.8)
Time on ART (years)	10.7 ± 6.6	10.7 ± 6.9

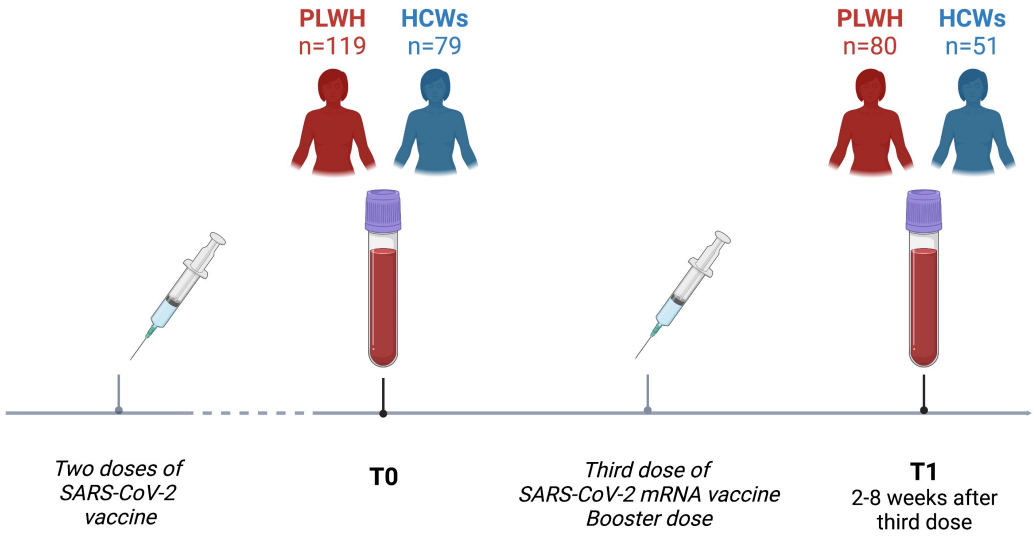
Background characteristics of PLWH and HCWs at T0 and T1

Variable	PLWH at T0 (n=119)	HCWs at T0 (n=79)	p-value	PLWH at T1 (n=80)	HCWs at T1 (n=51)	p-value
Male sex	59 (49.6)	13 (16.5)	<0.0001	43 (53.8)	11 (21.6)	0.0003
Age (Years)	45.2 ± 10.6	43.7 ± 11.5	0.36	45.6 ± 10.7	43.0 ± 10.0	0.18
18-29	6 (5.0)	7 (8.9)		4 (5.0)	2 (3.9)	
30-39	36 (30.2)	27 (34.2)		24 (30.0)	22 (43.1)	
40-49	36 (30.2)	19 (24.0)		21 (26.2)	13 (25.5)	
50-59	29 (24.4)	17 (21.5)		22 (27.5)	10 (19.6)	
≥60	12 (10.1)	9 (11.4)		9 (11.3)	4 (7.8)	
BMI (kg/m²)	28.0 ± 5.1	25.1 ± 6.2, n=76	0.0006	27.5 ± 5.6	25.9 ± 6.9, n=50	0.13
Underweight (<18.5)	0 (0.0)	2 (2.6)		0 (0.0)	2 (4.0)	
Normal range (18.5-24.9)	34 (28.6)	38 (50.0)		29 (36.2)	22 (44.0)	
Overweight (25-29.9)	50 (42.0)	24 (31.6)		34 (42.5)	17 (34.0)	
Obese (≥30)	35 (29.4)	12 (15.8)		17 (21.3)	9 (18.0)	
Ethnicity			-			-
Caucasian	45 (37.8)	-		34 (42.5)	-	
African	69 (58.0)	-		41 (51.3)	-	
Other	5 (4.2)	-		5 (6.2)	-	
Medical history						
Diabetes mellitus	8 (6.7)	3 (3.8)	0.53	5 (6.2)	1 (2.0)	0.40
Hypertension	32 (26.9)	14 (17.7)	0.13	18 (22.5)	7 (13.7)	0.21
Heart failure coronary artery disease	2 (1.7)	1 (1.3)	-	2 (2.5)	0 (0.0)	-
Stroke	2 (1.7)	0 (0.0)	-	1 (1.2)	0 (0.0)	-
Liver disease	1 (0.8)	0 (0.0)	-	1 (1.2)	0 (0.0)	-
Kidney disease	0 (0.0)	0 (0.0)	-	0 (0.0)	0 (0.0)	-
Chronic lung disease	1 (0.8)	0 (0.0)	-	1 (1.2)	0 (0.0)	-
Asthma	0 (0.0)	6 (7.6)	0.0036	0 (0.0)	3 (5.9)	0.0028
Autoimmune disease	1 (0.8)	4 (5.1)	0.083	0 (0.0)	2 (3.9)	-
Hematological cancer	0 (0.0)	4 (5.1)	-	0 (0.0)	1 (2.0)	-
Non hematological cancer	9 (7.6)	4 (5.1)	0.74	7 (8.8)	4 (7.8)	1.0
Solid-organ/cell transplantation	0 (0.0)	0 (0.0)	-	0 (0.0)	0 (0.0)	-
Immunosuppressive drugs			-			-
Corticosteroids	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Other	1 (0.8)	1 (1.3)		0 (0.0)	0 (0.0)	

Background characteristics of PLWH and HCWs at T0 and T1

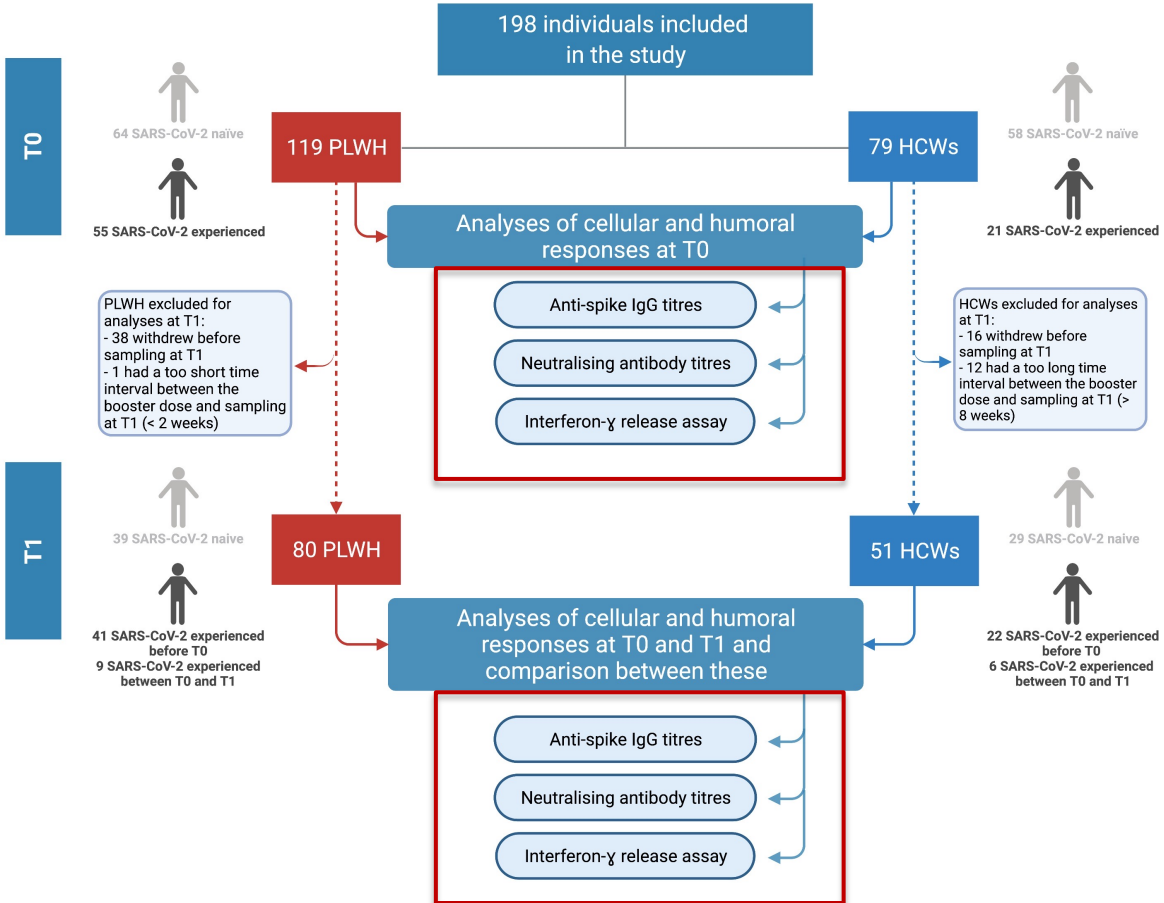
Variable	PLWH at T0 (n=119)	HCWs at T0 (n=79)	p-value	PLWH at T1 (n=80)	HCWs at T1 (n=51)	p-value
Previous SARS-CoV-2 infection (before T1)	-	-	-			
Questionnaire	-	-	-	15 (18.8)	18 (35.3)	0.033
Positive anti-N antibody	-	-	-	40 (50.0)	17 (34.0), n=50	0.074
SARS-CoV-2 experienced*	-	-	-	41 (51.2)	22 (43.1)	0.37
Experienced (between T0 and T1)	-	-	-	9 (11.2)	6 (11.7)	-
First vaccine dose			-			-
BNT162b2 mRNA (Pfizer)	101 (84.9)	79 (100.0)		69 (86.2)	51 (100.0)	
mRNA-1273 (Moderna)	8 (6.7)	0 (0.0)		4 (5.0)	0 (0.0)	
ChAdOx1-S (Astra Zeneca)	10 (8.4)	0 (0.0)		7 (8.8)	0 (0.0)	
Second vaccine dose			-			-
BNT162b2 mRNA (Pfizer)	100 (84.0)	79 (100.0)		69 (86.2)	51 (100.0)	
mRNA-1273 (Moderna)	9 (7.6)	0 (0.0)		4 (5.0)	0 (0.0)	
ChAdOx1-S (Astra Zeneca)	10 (8.4)	0 (0.0)		7 (8.8)	0 (0.0)	
Third vaccine dose			-			-
BNT162b2 mRNA (Pfizer)	-	-		42 (52.5)	51 (100.0)	
mRNA-1273 (Moderna)	-	-		38 (47.5)	0 (0.0)	
Time between first and second vaccine dose (weeks)	5.0 (4.0-5.0)	3.0 (3.0-3.1)	<0.0001	5.0 (4.4-5.0)	3.0 (3.0-3.1)	<0.0001
Time between second vaccine dose and sample at T0 (weeks)	25 (23-28)	24 (24-24)	0.025	25 (23-27)	24 (24-24)	0.014
Time between second and third vaccine dose (weeks)	-	-	-	27 (25-31)	38 (35-39)	<0.0001
Time between third vaccine dose and sample at T1 (weeks)	-	-	-	2.4 (3.1-3.9)	4.7 (4.0-8.0)	<0.0001
Time between T0 and T1 (weeks)	-	-	-	5 (4-6)	19 (18-19)	<0.0001

Methods: Populations



- The third dose, either BNT162b2 or mRNA-1273, was administered through Belgium's vaccination campaign
- Peripheral blood was sampled before the third dose (T0) and two to eight weeks after the third dose of vaccine (T1)

Study Design



Results: Evolution T0-T1 among HCWs