



Investigating Short-term Effects of COVID-19 mRNA Vaccination on Plasma Viremia and Intact HIV Reservoir Size in Individuals Receiving Antiretroviral Therapy (ART)

Maggie Duncan

Simon Fraser University

Brumme Lab

December 15th, 2022



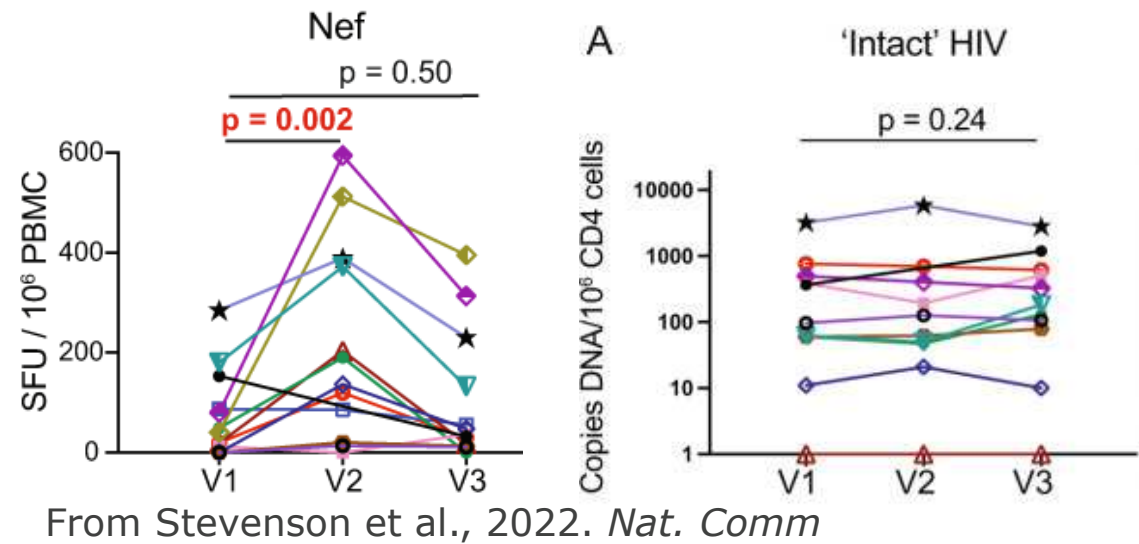
BRITISH COLUMBIA
CENTRE *for* EXCELLENCE
in HIV/AIDS

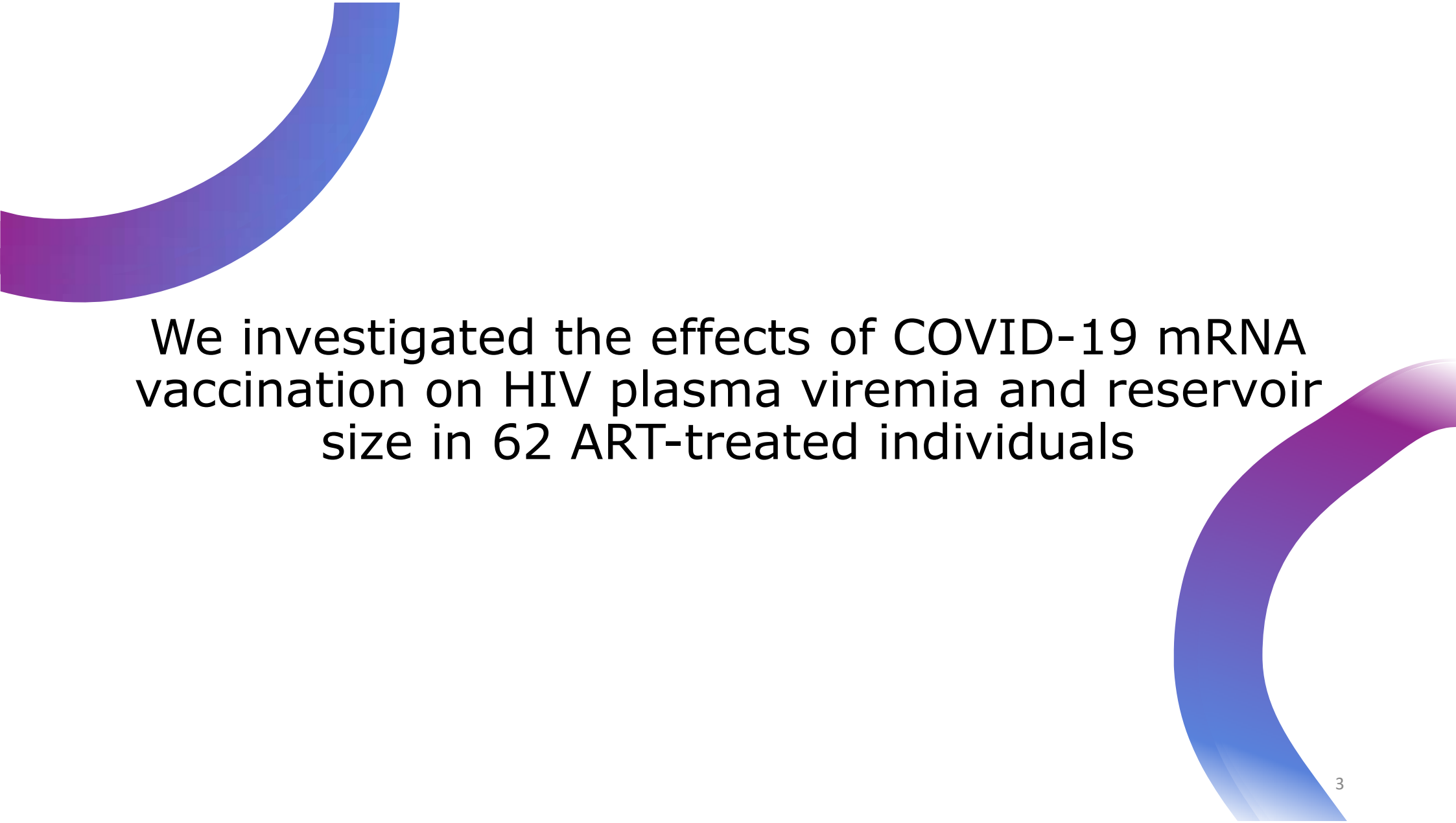


No conflicts of interest to declare

Background

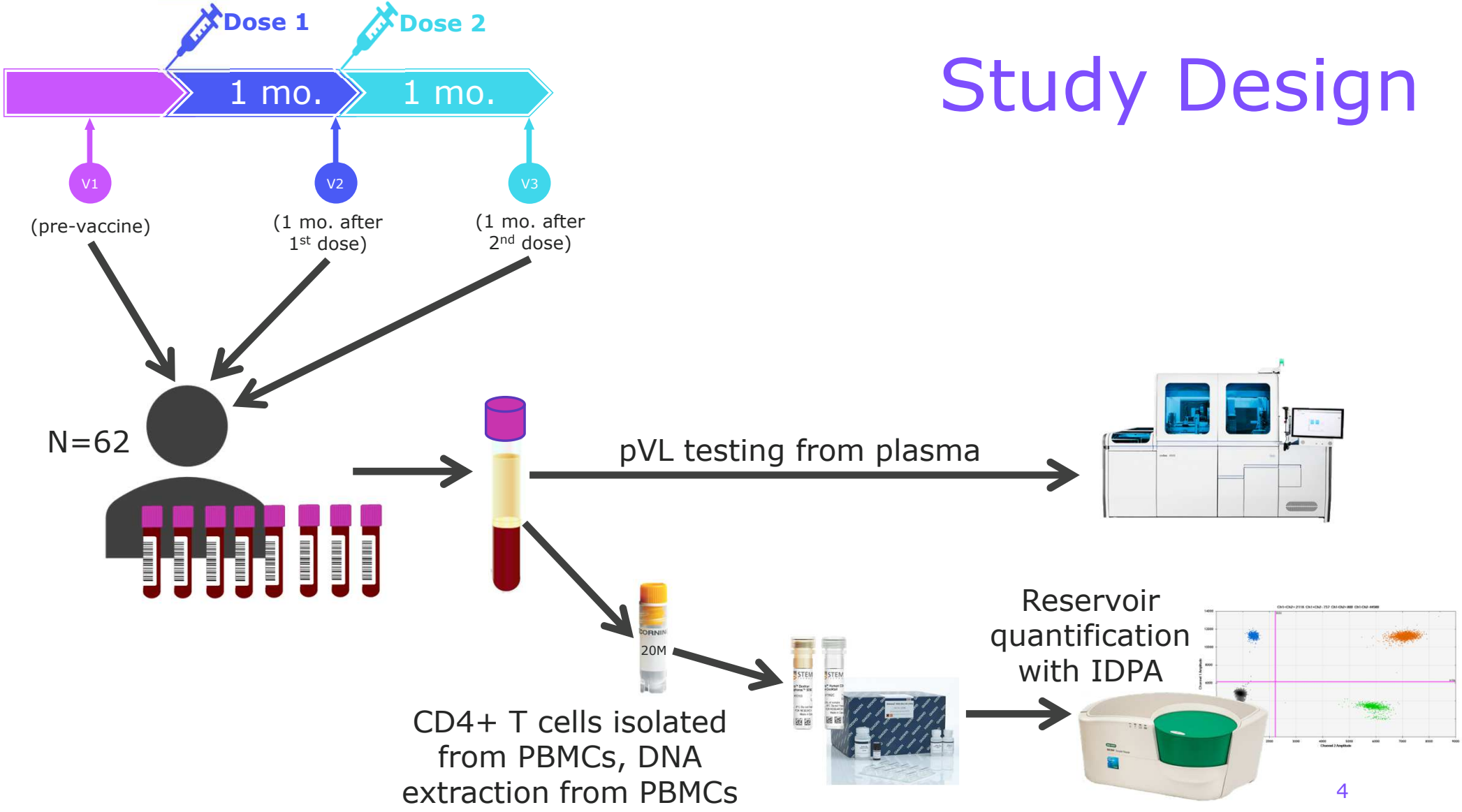
- Transient HIV viremia in ART-suppressed PLWH reported anecdotally following COVID-19 mRNA vaccination (Bozzi et al., 2021)
- Nef-specific CD8+ T cells increased and acquired granzyme B effector functions following COVID-19 mRNA vaccination (Stevenson et al., 2022)
 - No significant change in HIV reservoir size





We investigated the effects of COVID-19 mRNA vaccination on HIV plasma viremia and reservoir size in 62 ART-treated individuals

Study Design



Study Design



N=62

Cohort Characteristics

N = 62

Sociodemographic

Age in years, median (IQR)	43 (35, 56)
Sex assigned at birth, n(%)	
Male	55 (89%)
Female	7 (11%)

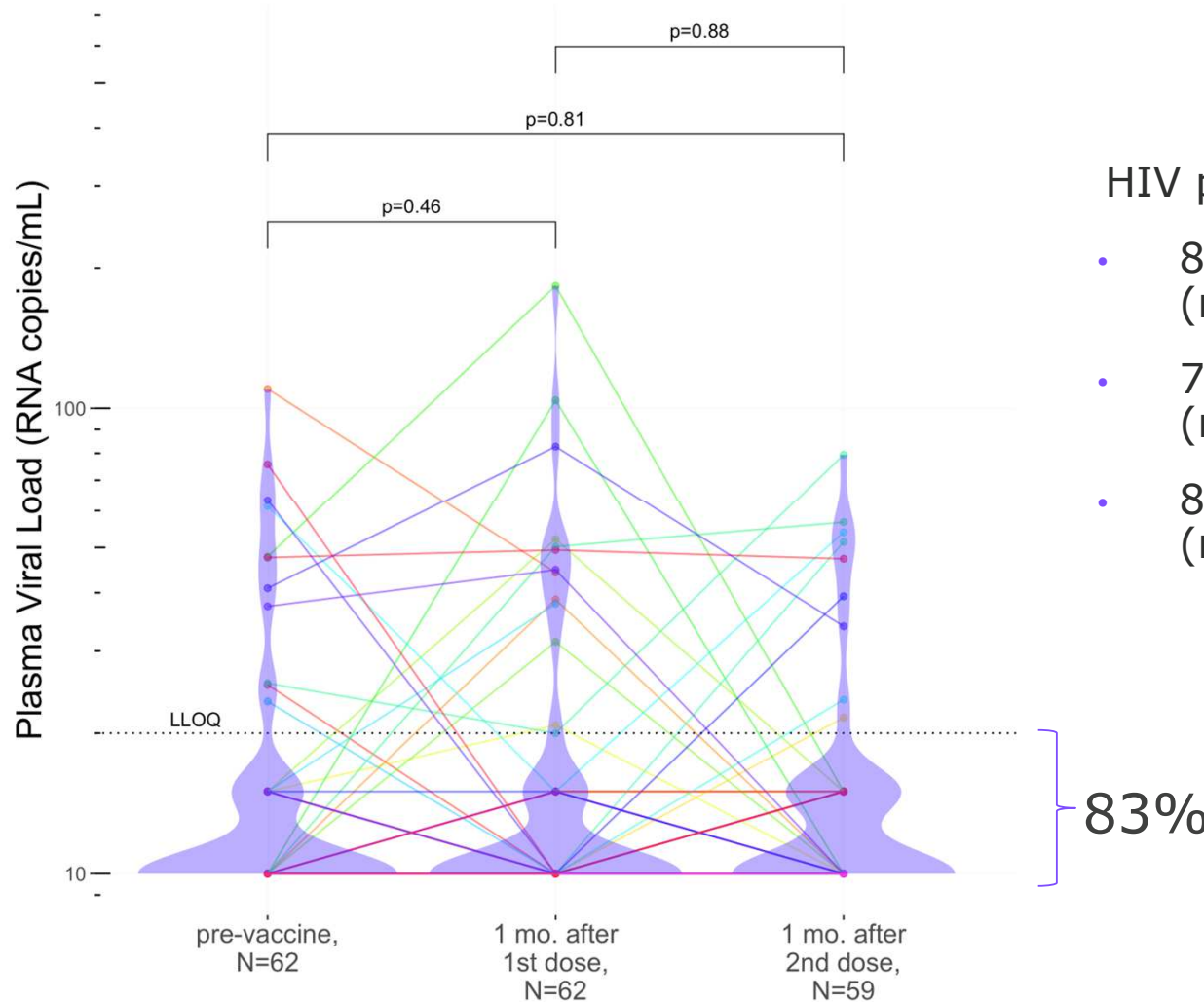
HIV-Related

Nadir CD4+ T-cell count (cells/mm³), median (IQR)	305 (160, 498)
Baseline CD4+ T-cell count (cells/mm³), median (IQR)	725 (475, 915)
Baseline CD4+/CD8+ T-cell ratio, median (IQR)	0.88 (0.63, 1.25)
Years on ART, median (IQR)	6 (3, 14)
Baseline pVL (copies HIV RNA/mL), median (IQR)	<20 (<20, <20)
ART regimen type, n(%)	
INSTI	46 (74%)
NNRTI	6 (9.7%)
PI	5 (8.1%)
Intensive/Other	5 (8.1%)

COVID-19-Related

COVID-19 vaccine regimen, n(%)	
Pfizer/BioNTech+Pfizer/BioNTech	43 (69%)
Moderna+Moderna	16 (26%)
Pfizer/BioNTech+Moderna	3 (4.8%)
COVID-19 Exposure, n(%)	
COVID-19 naive	57 (92%)
COVID-19 pre-vaccine	4 (6.5%)
COVID-19 between 1 st and 2 nd vaccine doses	1 (1.6%)

Results: HIV Plasma Viral Load

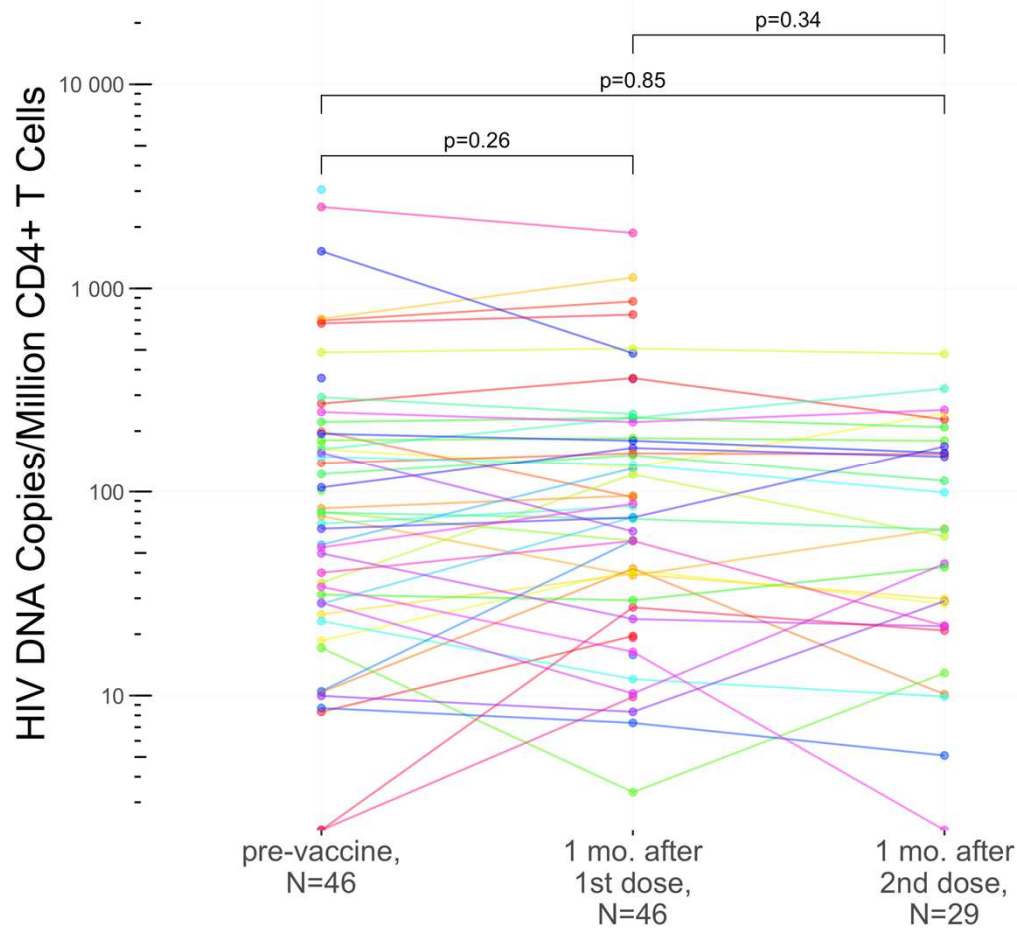
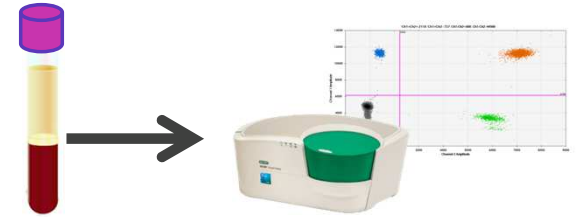


HIV pVL was <20 copies/mL in:

- 82% of participants pre-vaccination (range <20-110 copies/mL)
- 79% one month post-first-dose (range <20-183 copies/mL)
- 85% one month post-second-dose (range <20-79.4 copies/mL)

No significant changes in HIV plasma viral load were observed after vaccination (all $p > 0.4$)

Results: HIV Reservoir Size (Intact Proviruses)

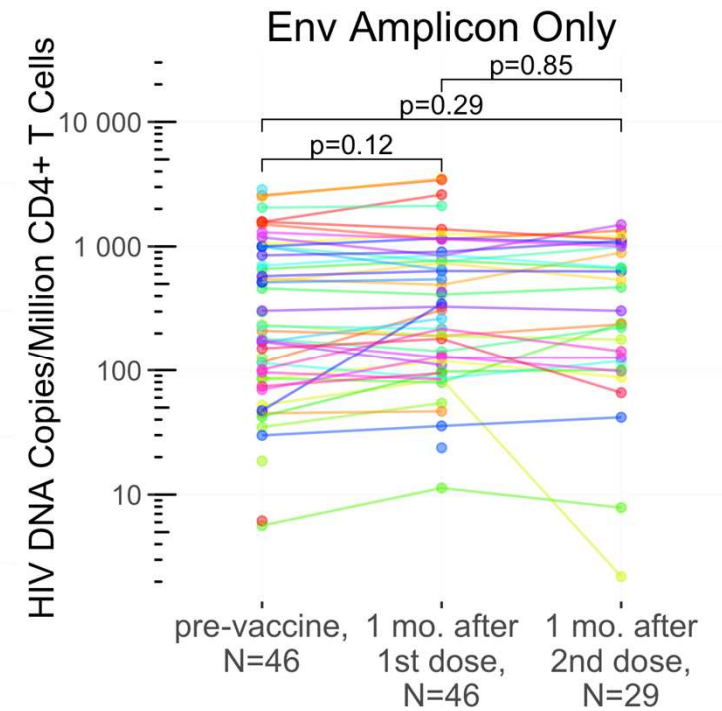
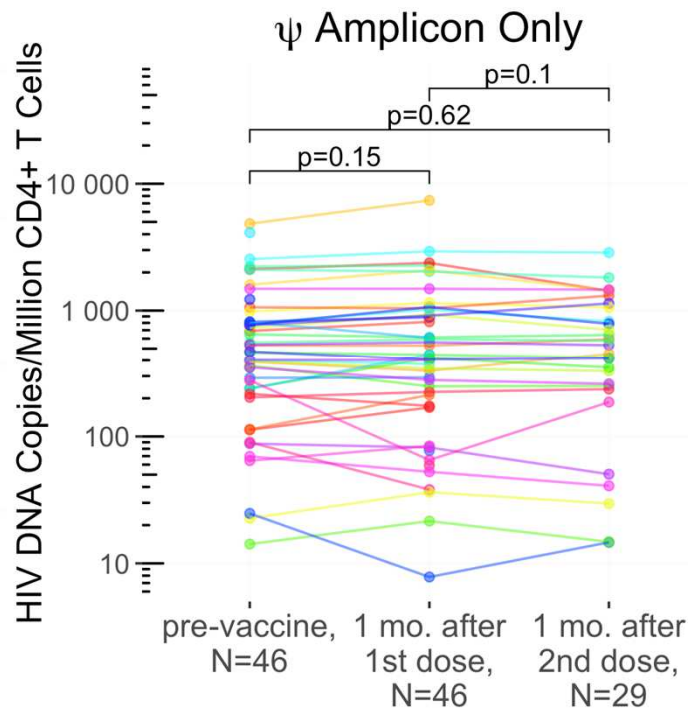
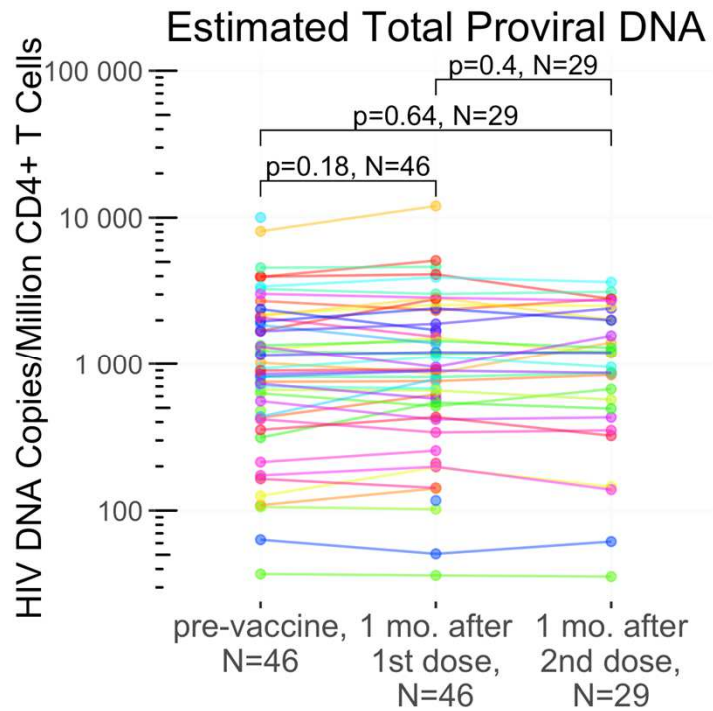


Median intact reservoir size was:

- 80 (IQR:28-197) HIV copies/million CD4+ T-cells pre-vaccine
- 85 (IQR:29-184) HIV copies/million CD4+ T-cells after the first dose
- 65 (IQR:22-168) HIV copies/million CD4+ T-cells after the second dose

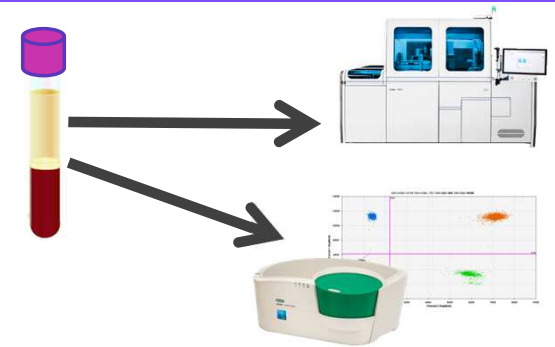
No significant changes in intact reservoir size were observed after vaccination (all $p > 0.2$)

Results: Total and Defective Proviral DNA



- No significant changes in estimated total, ψ + only and env+ only HIV DNA loads were observed after vaccination (all $p \geq 0.1$)

Results: Exploratory Analysis



Result Type	Stratification Variable	Stratification Variable Value	Comparison Visit A	Comparison Visit B	Number of Pairs	p Values	q Values	Significant?
IntactHIVCopiesPerMillionCD4			2	1	46	0.26	0.9	No
IntactHIVCopiesPerMillionCD4			3	1	29	0.85	1	No
IntactHIVCopiesPerMillionCD4			3	2	29	0.34	0.9	No
EnvCopiesPerMillionCD4			2	1	46	0.24	0.9	No
EnvCopiesPerMillionCD4			3	1	29	0.35	0.9	No
EnvCopiesPerMillionCD4			3	2	29	0.95	1	No
GagCopiesPerMillionCD4			2	1	46	0.15	0.9	No
GagCopiesPerMillionCD4			3	1	29	0.62	1	No
GagCopiesPerMillionCD4			3	2	29	0.1	0.9	No
EstTotalReservoirSize			2	1	46	0.18	0.9	No
EstTotalReservoirSize			3	1	29	0.64	1	No
EstTotalReservoirSize			3	2	29	0.4	0.91	No
IntactHIVCopiesPerMillionCD4	Sex_at_birth	Female	2	1	5	0.81	1	No
IntactHIVCopiesPerMillionCD4	Sex_at_birth	Female	3	1	4	0.25	0.9	No
IntactHIVCopiesPerMillionCD4	Sex_at_birth	Female	3	2	4	0.88	1	No
EnvCopiesPerMillionCD4	Sex_at_birth	Female	2	1	5	0.06	0.9	No
EnvCopiesPerMillionCD4	Sex_at_birth	Female	3	1	4	0.38	0.9	No
EnvCopiesPerMillionCD4	Sex_at_birth	Female	3	2	4	0.88	1	No
GagCopiesPerMillionCD4	Sex_at_birth	Female	2	1	5	0.12	0.9	No
GagCopiesPerMillionCD4	Sex_at_birth	Female	3	1	4	0.12	0.9	No
GagCopiesPerMillionCD4	Sex_at_birth	Female	3	2	4	0.88	1	No
EstTotalReservoirSize	Sex_at_birth	Female	2	1	5	0.06	0.9	No
EstTotalReservoirSize	Sex_at_birth	Female	3	1	4	0.25	0.9	No
EstTotalReservoirSize	Sex_at_birth	Female	3	2	4	0.62	1	No
IntactHIVCopiesPerMillionCD4	Sex_at_birth	Male	2	1	41	0.23	0.9	No
IntactHIVCopiesPerMillionCD4	Sex_at_birth	Male	3	1	25	0.69	1	No
IntactHIVCopiesPerMillionCD4	Sex_at_birth	Male	3	2	25	0.22	0.9	No
EnvCopiesPerMillionCD4	Sex_at_birth	Male	2	1	41	0.5	1	No
EnvCopiesPerMillionCD4	Sex_at_birth	Male	3	1	25	0.54	1	No
EnvCopiesPerMillionCD4	Sex_at_birth	Male	3	2	25	0.96	1	No
GagCopiesPerMillionCD4	Sex_at_birth	Male	2	1	41	0.37	0.9	No
GagCopiesPerMillionCD4	Sex_at_birth	Male	3	1	25	0.13	0.9	No
GagCopiesPerMillionCD4	Sex_at_birth	Male	3	2	25	0.07	0.9	No
EstTotalReservoirSize	Sex_at_birth	Male	2	1	41	0.41	0.91	No
EstTotalReservoirSize	Sex_at_birth	Male	3	1	25	0.87	1	No
EstTotalReservoirSize	Sex_at_birth	Male	3	2	25	0.54	1	No

↓ for 76 more rows...

Stratification by:

- Sex assigned at birth
- COVID-19 vaccine regimen
- ART Regimen

No significant differences in pVL or HIV DNA measures following vaccination

- **Key question:** Does mRNA vaccination for COVID-19 induce increased plasma viral loads or impact HIV reservoir size in PLWH taking ART?
- **Key findings:** While COVID-19 mRNA vaccines may stimulate HIV-specific immune responses in ART-treated individuals, our results suggest that they do not reproducibly induce measurable changes in intact reservoir size nor lasting plasma HIV viremia

Acknowledgements

SFU SIMON FRASER UNIVERSITY

Zabrina Brumme
Harrison Omondi
Natalie Kinloch
Yurou Sang
Mark Brockman

 BRITISH COLUMBIA CENTRE for EXCELLENCE in HIV/AIDS

Hope Lapointe
Sarah Speckmaier
Nadia Moran-Garcia
Marianne Harris
Hanwei Sudderuddin
Kieran Atkinson

 ST. PAUL'S HOSPITAL PROVIDENCE HEALTH CARE

Christopher Lowe
Marc Romney
Tanya Lawson



Research Enterprise to Advance a Cure for HIV

 Canadian Institutes of Health Research
Institut de recherche en santé du Canada

We thank the clinics that helped advertise our study

Above all, we thank the **study participants**, without whom research would not be possible

Learn more at Poster #1.37

Investigating short-term effects of COVID-19 mRNA Vaccination on Plasma Viremia and Intact HIV Reservoir Size in Individuals Receiving Antiretroviral Therapy (ART)

Maggie C Duncan^{1,2}, F Harrison Omondi^{1,2}, Natalie N Kinloch^{1,2}, Hope R Lapointe¹, Sarah Speckmaier¹, Nadia Moran-Garcia¹, Christopher F Lowe^{1,4}, Marc G Romney^{1,4}, Tanya Lawson^{1,4}, Marianne Harris^{1,2,5}, Mark A Brockman^{1,4}, Zabrina L Brumme^{1,2}

¹Faculty of Health Sciences, Simon Fraser University, Burnaby, Canada; ²BC Centre for Excellence in HIV/AIDS, Vancouver, Canada; ³Division of Medical Microbiology and Virology, St. Paul's Hospital, Vancouver, Canada; ⁴Department of Pathology and Laboratory Medicine, University of British Columbia, Vancouver, Canada; ⁵Faculty of Medicine, University of British Columbia, Vancouver, Canada; ⁶Department of Molecular Biology and Biochemistry, Faculty of Science, Simon Fraser University, Burnaby, Canada

Background

Anecdotal reports of transient HIV viremia in ART-suppressed individuals following COVID-19 mRNA vaccination suggest a possible stimulatory effect on the HIV reservoir¹. This was further supported by a recent study demonstrating that Nef-specific CD4+ T cells increased and acquired granzyme-B effector function following BNT162b2 vaccination, and that this correlated with markers of immune-mediated suppression of HIV-transcribing cells². That study, however, did not investigate plasma HIV viremia nor demonstrate significant alterations in reservoir size in the subset of 13 participants assessed³.

Objective

We investigated the effects of COVID-19 mRNA vaccination on HIV plasma viremia and reservoir size in 62 ART-treated individuals.

Methods

Dose 1 (1 mo. after 1st dose) **Dose 2** (1 mo. after 2nd dose)

(pre-vaccine) V1 V2 V3

PK testing from plasma

CD4+ T cells isolated from PBMC, using interferon- γ induction, IFN γ

Results

Cohort Characteristics

Sociodemographic	n = 62
Age in years, median (IQR)	41 (35, 50)
Sex assigned at birth, n (%)	55 (89%)
Male	7 (11%)
HIV-Related	
Nef-CD4 T-cell count (cells/mm ³), median (IQR)	305 (162, 489)
Baseline CD4+ T-cell count (cells/mm ³), median (IQR)	723 (476, 933)
Baseline CD4+ T-cell ratio, median (IQR)	0.88 (0.63, 1.20)
Years on ART, median (IQR)	6 (3, 14)
Baseline pVL Log ₁₀ HIV RNA/mL, median (IQR)	<31 (<10, <10)
ART regimen type, n (%)	
ART	46 (74%)
ART	6 (10%)
Other	5 (8%)
COVID-19-related	
COVID-19 vaccine regimen, n (%)	
Pfizer/BioNTech/BioNTech	43 (69%)
Moderna/Medtrix	16 (26%)
Pfizer/BioNTech/Moderna	3 (5%)
COVID-19 exposure, n (%)	
COVID-19	17 (28%)
COVID-19 pre-vaccine	4 (6%)
COVID-19 between 1 st and 2 nd vaccine doses	1 (2%)

HIV Plasma Viral Load

HIV pVL was <20 copies/mL in:

- 82% of participants pre-vaccination (range <20-110 copies/mL)
- 79% one month post-first dose (range <20-183 copies/mL)
- 85% one month post-second-dose (range <20-79.4 copies/mL)

No significant changes in pVL were observed after vaccination (all p>0.4).

HIV Reservoir Size

To date, IPDA is complete for 74% of participants at the first two study visits and 47% at the third.

Median intact reservoir size was:

- 80 (IQR: 28-197) HIV copies/million CD4+ T cells pre-vaccine
- 85 (IQR: 29-184) HIV copies/million CD4+ T cells after the first dose
- 65 (IQR: 22-168) HIV copies/million CD4+ T cells after the second dose

No significant changes in intact reservoir size were observed after vaccination (all p>0.2).

Summary

- We observed no significant changes in HIV plasma viral load one month after receiving the first and second COVID-19 mRNA vaccine doses
- We observed no significant changes in intact HIV reservoir size nor overall HIV proviral DNA load one month after receiving the first and second COVID-19 mRNA vaccine doses
- Key Message:** While COVID-19 mRNA vaccines may stimulate HIV-specific immune responses in ART-treated individuals³, our results suggest that they do not reproducibly induce measurable changes in intact reservoir size nor lasting plasma HIV viremia

Acknowledgements

We thank the clinics that helped advertise our study and the participants, without whom research would not be possible.

References

1. Bhat G, Lambert A, Lapointe H, Morrison A, Hegerberg L, Johnson D, Sun A, and Sanders A (2021). HIV-1 Viremia in HIV-1 RNA after COVID-19 vaccination with mRNA. *PLoS One* 16(12): e0242020. doi:10.1371/journal.pone.0242020

2. Harrison Omondi F, Kinloch N, Lapointe H, Speckmaier S, Moran-Garcia N, Harris M, et al. (2022). COVID-19 mRNA Vaccination Induces HIV-1 Transcription and CD4+ T Cell Activation. *PLoS Pathog* 18(1): e1009811. doi:10.1371/journal.ppat.1009811

3. Duncan MC, Omondi FH, Kinloch NN, Lapointe HR, Speckmaier S, Moran-Garcia N, et al. (2022). COVID-19 mRNA Vaccination Induces HIV-1 Transcription and CD4+ T Cell Activation. *PLoS Pathog* 18(1): e1009811. doi:10.1371/journal.ppat.1009811