Using HIV Antibody Avidity to Monitor Long-Term Antiretroviral Therapy: A Proof-of-Concept Study

962

Shiying You[1], Hae-Young Kim[1], David Kaftan[1], Frey B. Assefa[1], Nao Yamamoto[1], Joseph B. Sempa[2], Alex Welte[2,3], Shelley Facente[4,5], Oliver Laeyendecker[6], Anna Bershteyn[1]

[1]New York University, Population Health, New York, NY, USA, [2]University of the Free State, Bloemfontein, South Africa, [3]Stellenbosch University, Stellenbosch, South Africa, [4]University of California, Berkeley, Berkeley, CA, USA, [5]Facente Consulting, Richmond, CA, USA, [6]National Institutes of Health, Baltimore, MD, USA

NYU Langone Health

BACKGROUND

- HIV viral load (VL) testing is the gold standard for antiretroviral therapy (ART) monitoring, but is resource-intensive, motivating interest in complementary monitoring tools.
- HIV recency assays, developed for incidence surveillance, often misclassify individuals on ART for a long-term as recently infected.
- This misclassification reflects treatment-associated alterations in HIV antibody maturation under prolonged viral suppression, resembling early infection immune profile.
- This may provide an opportunity to repurpose recency assays for ART monitoring.
- **Objective**: evaluate the longitudinal association between ART duration and recency assay readouts.

METHODS

Data Source

Consortium for the Evaluation and Performance of HIV Incidence Assays (CEPHIA), a biobank established in 2011 for the evaluation of HIV recency assays.

- 75% male, over 80% aged 20–49.
- Samples from U.S. (≈ 42%) and African countries (≈ 55%).
- HIV subtypes predominantly B and C.

Study Population

We selected CEPHIA plasma specimens from individuals with:

- Known Estimated Date of Detectable Infection (EDDI).
- Known ART initiation date.
- Viral load suppression (VLS<1,000 copies/mL) at all study visits.

Statistical Analysis

- Linear mixed-effects (LME) models with random intercepts.
  - Accounted for correlation among repeated measurements within individuals and between-individual heterogeneity in baseline levels.
- Predictor (X axis): Years since ART initiation (duration of ART-induced VLS.)
- Outcome (Y axis): HIV recency assay readout score.
- Subgroup analysis:
  Participants initiating ART ≥ 1 year after EDDI.

RESULTS

Figure 1. Flowchart of Study Population Selection

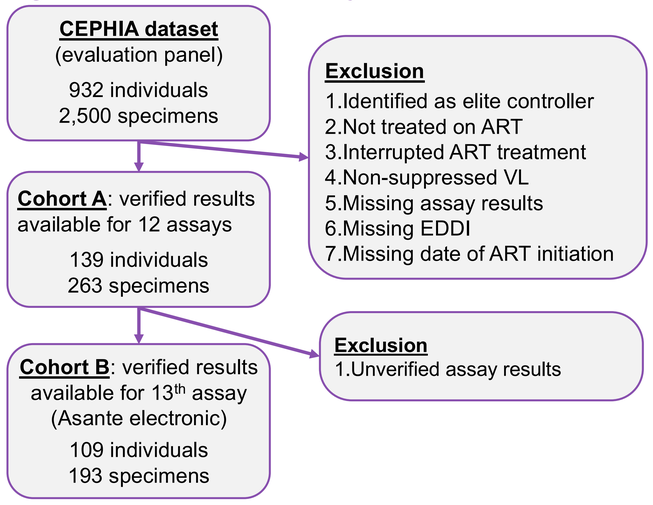
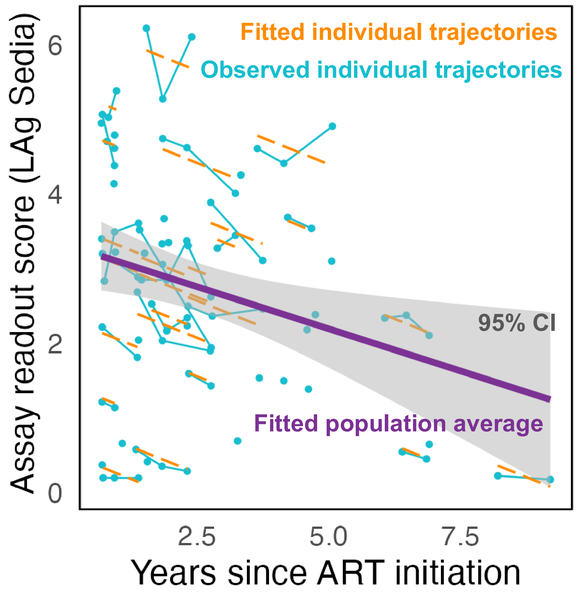


Figure 2. Example LME Model
LAg-Sedia Scores Decline with Longer ART Duration



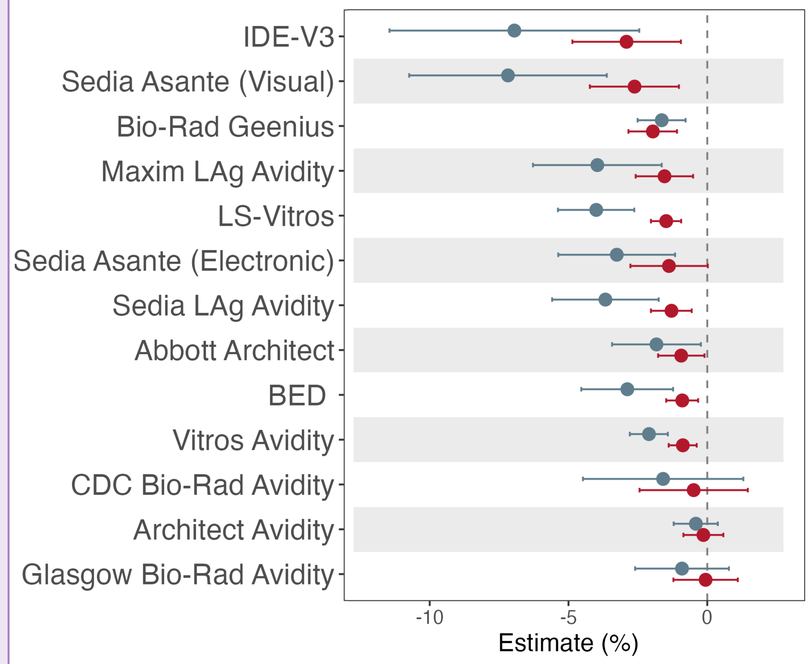
This research was supported by the Gates Foundation [INV-092141] and the NIH NHLBI [R01AI174932].

Author contact information: shiying.you@nyulangone.org

9 out of 13 HIV recency assays correlated with time on ART, suggesting they could be repurposed for HIV treatment monitoring

RESULTS

Figure 3. Annual Change in Recency Assay Readouts with Increasing Time on ART



Takeaway:

- 9 of 13 recency assays showed statistically significant declines with longer ART duration in both primary and subgroup analyses.
- Declines were steeper among delayed ART initiators.
- IDE-V3 and Sedia Asante (Visual) exhibited the strongest effects.

Dots represent estimated annual percent change in assay readouts; horizontal bars indicate 95% confidence intervals. Assay scores were standardized to a percentage between minimum and maximum reader outputs.

CONCLUSIONS

- Most recency assay readouts declined with increasing ART duration.
- The steepest declines were observed among delayed ART (≥1 year) initiators.
- The assays appear suitable for personalized longitudinal assessment but are unlikely to perform well as cross-sectional measures.