# Adherence by DBS, Self-Report, and Pill Count in Young Adults with Perinatal HIV

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## BACKGROUND

**Young adults with perinatal HIV-infection (YAPHIV) are at high risk for ART non-adherence and viremia**, jeopardizing individual and public health; however, detecting non-adherence is challenging.

Concentrations of tenfovir-diphosphate (TFV-DP) in dried blood spots (DBS), self-reported adherence, and unannounced telephone pill counts are all validated measures of adherence with benefits and tradeoffs.

## AIMS

1. **Characterize adherence levels for all 3 measures** associated with viral suppression for: a) individual health (VL<20 copies/mL) vs. b) treatment as prevention (TaSP) in the context of U=U (Undetectable=Untransmittable, VL<200).
2. **Compare the ability of adherence measures** (TFV-DP, self-reported adherence, pill counts) to distinguish AYAPHIV with viral suppression.

## POPULATION

**CASAH (Child and Adolescent Self-Awareness and Health)** is a longitudinal study of 340 adolescent and young adults (AYA) living with perinatal HIV infection and HIV-exposure in New York City. AYA were recruited 2003-2008 when they were ages 9-16 and seen every 12-18 months. Analysis uses data from a subset of YAPHIV who were on a tenofovir-based ART regimens (n=34 on TDF/FTC, n=27 on TAF/FTC) and agreed to a one-time venous blood draw in young adulthood (ages 18-28, mean age 24, 69% female). Of the 61 YAPHIV who agreed to the blood draw, 42 completed all 3 adherence measures.

## MEASURES

**HIV viral load (VL):** Blood drawn in young adulthood.

**TFV-DP in DBS:** Blood drawn and spotted onto 903 Protein Saver Cards and quantified using LC-MS/MS.

**Self-Reported Adherence:** Assessed prior to blood draw using 3-item scale (Wilson, 2016) based on days missed, frequency of doses taken as prescribed, and rating of how well doses were taken as prescribed.

**Pill count:** Assessed at 4 unannounced telephone pill count calls (Kalichman, 2007) 30 days apart; analysis used adherence score closest to blood draw. Past month adherence was defined as the proportion of doses taken since prior call.

## ANALYSIS

Mean (95% CI) and median (IQR) TFV-DP levels (by regimen: tenofovir disoproxil fumarate/emtricitabine [TDF]/FTC and tenofovir alafenamide [TAF]/FTC), self-reported adherence, and pill counts were estimated. All were stratified by VL <20 and VL <200 copies/mL.

Diagnostic ability of each adherence measure to distinguish VL<200 copies/mL was compared using ROC analysis.

## RESULTS

### 1. Viral suppression among YAPHIV

Among 34 YAPHIV on TFD/FTC, only 41% had VL<20 copies/mL (n=14) and 59% had VL<200 copies/mL (n=20). Among 27 YAPHIV on TAF/FTC, only 52% had VL<20 copies/mL (n=14) and 63% had VL<200 copies/mL (n=17).

### 2. Diagnostic ability to distinguish VL<200 copies/mL

TFV-DP in TDF/FTC had the highest area under the curve (0.97 [95% CI: 0.89, 1.00; p=0.001]), but all adherence measures were associated with VL: TFV-DP from TDF/FTC (0.87 [95% CI: 0.68, 1.00; p=0.007]), pill count (0.72 [95% CI: 0.53, 0.90; p=0.03]), and self-report (0.69 [95% CI: 0.53, 0.86; p=0.05]).

### 3. Mean and median adherence levels among YAPHIV with VL<20 copies/mL vs. VL<200 copies/mL

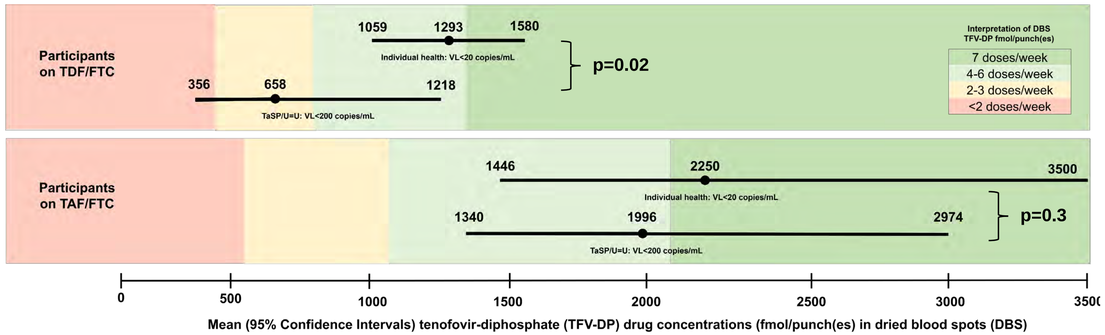
Mean TFV-DP and pill counts were significantly higher in YAPHIV with VL<20 copies/mL vs. VL≥20 copies/mL and VL<200 copies/mL vs. VL≥200 copies/mL but not self-reported adherence. Self-reported adherence and pill counts were less sensitive to differences for individual health vs. (TaSP/U=U).

| | Overall | VL <20 | VL ≥20 | p-value | VL <200 | VL ≥200 | p-value |
|---|---|---|---|---|---|---|---|
| Tenofovir-diphosphate (TFV-DP) (fmol/punch): Participants on TDF/FTC (n=34) | | | | | | | |
| Mean (95% CI)[A] | 321 (175, 587) | 1293 (1059, 1580) | 121 (56, 261) | <.0001 | 658 (356, 1218) | 115 (45, 195) | 0.004 |
| Median (IQR) | 847 (13, 3482) | 1135 (986, 1704) | 111 (24, 550) | | 992 (694, 1344) | 111 (13, 497) | |
| Tenofovir-diphosphate (TFV-DP) (fmol/punches): Participants on TAF/FTC (n=27) | | | | | | | |
| Mean (95% CI)[A] | 800 (443, 1443) | 2250 (1446, 3500) | 263 (124, 557) | <0.0001 | 1996 (1340, 2974) | 169 (78, 367) | <0.0001 |
| Median (IQR) | 1241 (324, 2416) | 2358 (1424, 3832) | 324 (135, 662) | | 2300 (1374, 3060) | 217 (104, 339) | |
| Unannounced telephone pill count (n=42) | | | | | | | |
| Mean (95% CI) | 77% (69%, 86%) | 89% (82%, 96%) | 60% (45%, 76%) | 0.002 | 85% (77%, 93%) | 60% (41%, 80%) | 0.02 |
| Median (IQR) | 88% (58%, 100%) | 97% (83%, 100%) | 49% (35%, 93%) | | 95% (76%, 100%) | 47% (34%, 97%) | |
| Self-reported adherence (n=42) | | | | | | | |
| Mean (95% CI) | 81% (74%, 87%) | 84% (77%, 92%) | 75% (63%, 87%) | 0.1 | 84% (78%, 91%) | 72% (58%, 87%) | 0.08 |
| Median (IQR) | 84% (75%, 95%) | 84% (77%, 100%) | 78% (64%, 92%) | | 91% (77%, 100%) | 77% (64%, 91%) | |

A Drug concentrations were log-transformed and back-transformed to estimate geometric means with 95% confidence intervals (CIs)

**KEY FINDING: TFV-DP drug concentrations may be different for maximizing viral suppression at the individual level vs. preventing transmission at the population level (TaSP, U=U)**

### 4. Differential TFV-DP drug concentrations among YAPHIV on TDF/FTC vs. TAF/FTC with VL<20 copies/mL vs. VL<200 copies/mL




Considerations: 1) Dosing based on studies among healthy HIV-negative adults. Drug concentrations may be higher among persons living with HIV (including YAPHIV). 2) Drug concentration and viral load are measured concomitantly, thus YAPHIV can be virally suppressed with low drug concentration because viremia is not an immediate event after non-adherence.

## CONCLUSIONS

Differences in mean TFV-DP concentrations for HIV VL<20 copies/mL versus <200 copies/mL suggest differential drug concentration targets for achieving individual patient-level health outcomes versus population-level health outcomes (TaSP, U=U).

Self-reported adherence and pill counts were less sensitive to different thresholds for individual health versus population health.

All adherence measures were associated with HIV VL<200 copies/mL, making the choice of a specific adherence monitoring method dependent on context, preference, and available resources.

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