508

Validity of point-of-care urine tenofovir testing to differentiate viremia versus suppression on TLD

Suzanne M. McCluskey[1,2,3], Katya Govender[4], Winnie Muyindike[5], Eliza Passell[1], Taing N. Aung[1], Gugulethu Shazi[4], Victoria Nanfuka[5], Lyra S. Johnson[1], Bethany Hedt-Gauthier[6], Vincent C. Marconi[7], Mahomed-Yunus Moosa[8], Ravindra K. Gupta[4,9], Matthew Spinelli[10], Monica Gandhi[10], Mark J. Siedner[1,2,3,4,5,8]

[1] Medical Practice Evaluation Center, Massachusetts General Hospital, Boston, MA, USA; [2] Division of Infectious Diseases, Massachusetts General Hospital, Boston, MA, USA; [3] Harvard Medical School, Boston, MA, USA; [4] Africa Health Research Institute, Durban, South Africa; [5] Mbarara University of Science and Technology, Mbarara, Uganda; [6] University of North Carolina-Chapel Hill, Chapel Hill, NC, USA; [7] Emory University School of Medicine and Rollins School of Public Health, Emory University, Atlanta, GA, USA; [8] University of KwaZulu-Natal, Durban, South Africa; [9] University of Cambridge, Cambridge, United Kingdom; [10] University of California San Francisco, San Francisco, CA, USA

Background

- Point of care tests to aid in assessing HIV treatment failure may improve clinical care
- We assessed the validity of a point-of-care, urine lateral flow assay that detects tenofovir (TFV) (Figure 1) to differentiate viremia from viral suppression among people taking tenofovir-lamivudine-dolutegravir (TLD).

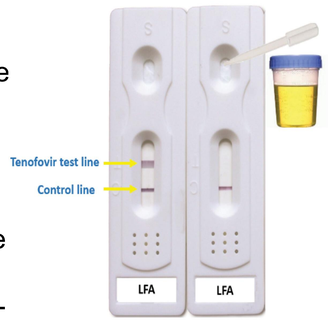


Figure 1. *Point of care urine TDF assay (Image courtesy of Spinelli & Gandhi 2024)*

Methods





- **Study Design**
  - Nested case-control study within DISCO Study (NCT04066036)
  - Data and specimens from adults with HIV on TLD as 1st line ART
- **Setting:** Uganda and South Africa
- **Cases:** Viral load ≥50 copies/mL after ≥24 weeks on TLD
- **Controls:** Never viremic on TLD
- **Matching**
  - 1:1 propensity score matching with models including age, sex, duration of ART, and prior ART regimen
  - Exact matching on country and ART-experienced vs ART-naïve status at TLD start
- **Statistical analysis**
  - Conditional logistic regression model with presence or absence of TFV in the urine as the predictor and viremia as the outcome of interest
  - Test performance characteristics of the urine TFV test to differentiate viremia vs viral suppression.
  - Estimated the positive and negative predictive values (PPV and NPV), assuming population prevalence of viremia ranging from 1 – 20%.

Results

We identified 123 total cases with viremia and 123 matched controls from a study population of 1,173 participants.

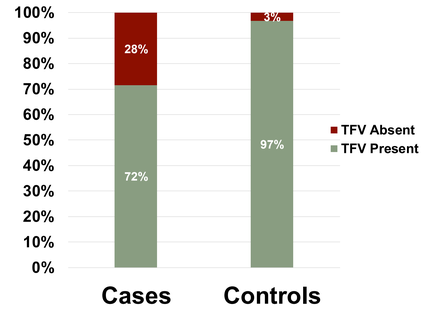
Table 1. Study population characteristics

Characteristics	Total (n=246)	Case (n=123)	Controls (n=123)
Age in years, median [IQR]	38 [31,46]	39 [31,46]	38 [32,48]
Female, *n* (%)	109 (44)	54 (44)	55 (45)
Duration of ART in years, median [IQR]	4.0 [0,7.6]	3.7 [0,7.4]	4.9 [0,9.1]
Country, *n* (%)			
Uganda	170 (69)	85 (69)	85 (69)
South Africa	76 (31)	38 (31)	38 (31)
ART prior to TLD, *n* (%)			
3(F)TC/TDF/EFV	132 (54)	67 (54)	65 (53)
3(F)TC/AZT/NVP	24 (10)	13 (11)	11 (9)
Other	14 (6)	5 (4)	9 (7)
Art naïve	76 (31)	38 (31)	38 (31)

Table 2. Conditional Regression Results

Predictor of viremia	Odds Ratio (95%CI)	*p*
Absence of TFV in urine	11.33 (3.48, 36.90)	<0.0001

Figure 2. Presence versus absence of tenofovir at study visits



Plain Language Summary

We now have a rapid urine test to indicate whether a person with HIV is taking their treatment. Having no tenofovir detected on the urine test is associated with having detectable virus in the blood.

The absence of tenofovir in urine on a point-of-care test was associated with >11x increased odds of viremia while on TLD

Table 3. Test Performance Characteristics

	Reference Standard Positive (VL≥50 c/mL)	Reference Standard Negative (VL<50 c/mL)
Test Positive (-TFV in urine)	35	4
Test Negative (+TFV in urine)	88	119
Test Sensitivity	28.5% (20.7 – 37.3%)	
Test Specificity	96.7% (91.9 – 99.1%)	
Positive Likelihood Ratio	8.75 (3.21 – 23.88)	
Negative Likelihood Ratio	0.74 (0.66 – 0.83)	

Table 4. NPV and PPV with varying prevalence of virologic failure on TLD

Estimated prevalence of viral failure on TLD		Negative predictive value	Positive predictive value
Lower prevalence	1%	99.3% (99.2 – 99.3%)	8.1% (3.1 – 19.4%)
	5%	96.3% (95.8 – 96.7%)	31.5% (14.4 – 55.7%)
	10%	92.4% (91.6 – 93.2%)	49.3% (26.3 – 72.6%)
Higher prevalence	20%	84.4% (82.8 – 85.9%)	68.6% (44.5 – 85.7%)

Conclusions

- Absence of TFV in urine was associated with >11 times increased odds of viremia while on TLD.
- For groups or populations with high pre-test probability of viremia, absence of TFV in urine is suggestive of viremia.
- However, for groups or populations with low pre-test probability of viremia, the presence of TFV in urine is highly suggestive (>95%) of suppression.

Contact
Suzanne McCluskey, MD
Massachusetts General Hospital
Harvard Medical School
smccluskey@mgh.harvard.edu

Acknowledgements
This work was supported by the NIH [K23 AI143470 to SMM; 2R01AI143340 to MG], ViiV [212215 to MJS], Wellcome Trust [to RKG].