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DRIED BLOOD SPOTS PROVIDE SIMPLIFIED ACCURATE MEASUREMENT OF HIV VIRAL LOAD

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BACKGROUND

HIV viral load (VL) is a robust measure of adherence and treatment efficacy when monitoring antiretroviral therapy (ART), facilitating timely switching to second line regimens. However, collection of plasma for VL requires phlebotomy, controlled transport conditions, and is costly, thereby limiting its use in community-based settings.

The use of dried blood spot (DBS) cards of finger-prick blood transported at ambient temperature to a central laboratory for VL testing would simplify monitoring, but requires validation against the gold standard method of plasma VL.



METHODS

In a randomized study of community-based delivery of ART in South Africa (the DO ART Study) 760 persons living with HIV provided concurrent EDTA plasma and DBS specimens from Oct 2017 through Nov 2019.



Specimens were collected in KwaZulu-Natal, in the DO ART Study.

Specimens were transported 100 - 250 km to Global Labs (Durban), which used the bioMérieux NucliSENS EasyQ HIV-1 v2.0 assay to measure plasma VL (lower limit of quantification [LoQ]: 20 copies/mL) and a modified version of the same assay for DBS whole blood specimens (LoQ: 100 copies/mL). Values below the LoQ are represented as 1 (0 when log transformed).

We compared 996 pairs of results using intra-class correlation (ICC), scatterplots, mean-difference plots, and two by two tables in R.

RESULTS

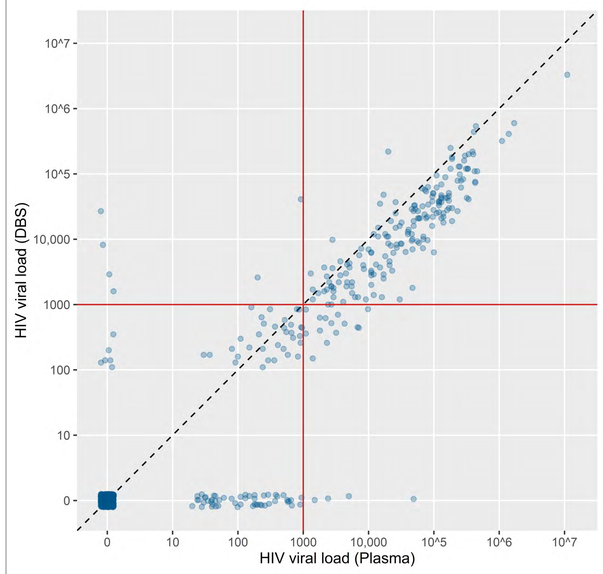
There was high correlation between log-transformed DBS and plasma VL results.

ICC: 0.94 (95% CI: 0.93 - 0.94)

86% were within 0.5 $\log_{10}$ copies/mL

DBS viral loads tended to be lower overall.

Mean difference:
-0.13 $\log_{10}$ copies/mL
(95% between -1.35 and 1.09)



**The red lines indicate the WHO viral suppression threshold of 1000 copies/mL. Jitter was applied when either result was not detectable to better visualize overlapping points. The cluster of results at (0, 0) contains 700 points.*

Figure: HIV viral load in dried blood spots vs plasma

Using the WHO threshold for viral suppression of 1000 copies/mL, in a population with 13% virological failure:

	Plasma < 1000	Plasma ≥ 1000
DBS ≥ 1000	6	181
DBS < 1000	791	18

Sensitivity: 91% (86 - 95)
Specificity: 99% (98 - 100)
PPV: 94% (90 - 98)
NPV: 99% (98 - 99)

In this population, for every 100 persons undergoing viral load monitoring via DBS, an estimated one treatment failure would be missed.

There were no clinically meaningful differences by sex or CD4 count.

CONCLUSIONS

DBS VL provides a highly accurate result compared to plasma and could be used in a simplified approach to population-based ART monitoring in resource-limited settings.

Self-collection of DBS cards should be evaluated as a means of further simplifying specimen collection and ART monitoring.

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