



Evaluation of the VIKIA[®] HIV 1/2 rapid test (BioMerieux)

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Background and description of the assay

The VIKIA[®] HIV1/2 (product number 31 112) is a visually read rapid test which is based on the immunochromatographic technique (ICT or lateral flow). The test is for the qualitative detection of antibodies to HIV-1 and HIV-2 using human serum, plasma, or whole blood specimens.

The kit consists of a synthetic filtration membrane positioned on top of an absorbent material within a plastic cartridge. One test dot is coated with HIV-1 and HIV-2 recombinant proteins which turns blue after testing if the sample contains antibodies to HIV-1/2. The assay also has a procedural control dot which turns red after testing to confirm the presence of IgG in the test sample.

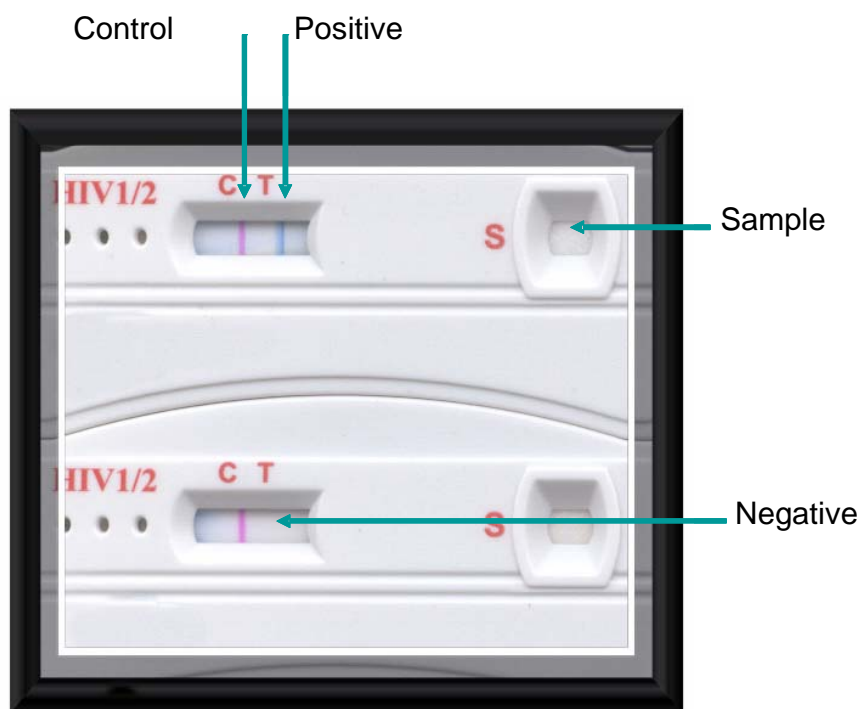


Figure 1: VIKIA[®] HIV 1/2 kit

The kit provided for the evaluation included 25 individually sealed pouches each containing a ready to use test device and desiccant. Also included in the kit was one

dropper bottle with coating buffer for use with whole blood samples, and the kit insert. Materials not provided in the kit included lancets, 75ul EDTA capillary tubes and 'bulbs' for whole blood.

The VIKIA[®] HIV 1/2 rapid test device carries a CE Mark and therefore has undergone testing described in the Common Technical Specification for Annex IIa related products and in accordance to the European Union *In Vitro* Diagnostic Medical Device Directive. This evaluation builds on the work already completed for CE marking by providing comparative performance information on a range of specimens with a particular focus on seroconversion timing. The panel is moderately sized.

This report specifically relates to the kit version and lot numbers supplied for this evaluation. We cannot guarantee that these will reflect the performance of other lot numbers or subsequent versions.

Table 1: Assay information

General	
Assay name	VIKIA [®] HIV1/2
Manufacturer / UK agent	BioMerieux
Sample types validated for testing	Finger stick whole blood, venous whole blood, serum, plasma
Product number	31 112
Kit insert version	2007-04
CE Marked	Yes
Number of tests per pack	25
Specimen volume	75µL
Presentation	
Assay type	Immunochromatographic
Controls	Coloured line in control region, confirming sample migration
Stages	
Dispense sample	75 µL
Dispense buffer for whole blood sample types only	40 µL
Read	Read test at 30 mins
Additional equipment required	
Timer	
Whole blood 'finger stick' assay	Lancets
	75 µL EDTA capillary tubes 'Bulbs' (For use with capillaries)

Evaluation panel and methods

The evaluation panel totalled 438 specimens (Table 2). Of these, 150 were anti-HIV negative specimens (including serum and whole blood samples from blood donors), 150 were anti-HIV1 positive and 20 were anti-HIV2 positive. A further 107 specimens were from 18 seroconversion panels and 11 quality control samples were tested. A more detailed breakdown is given in Table 2. A subset of 159 specimens was used to assess a second kit lot (Table 3).

The method outlined in the kit insert was strictly followed. All reactions were read visually by three independent readers and a scoring system was implemented as follows:

- 0 = negative
- 1 = ambiguous result
- 2 = very weak, but definite reaction
- 3 = medium reaction
- 4 = strongly reactive

Table 2: Evaluation panel (Lot 1, HIV7099002)

Specimen category	Number
1. HIV positive (n=170)	
a. HIV-1 positive (sera/plasma)	96
b. HIV-1 positive group O (sera/plasma)	2
c. HIV-2 positive (sera/plasma)	20
d. HIV-1 or 2 positive (whole blood)	50
2. HIV negative (n=150)	
a. HIV negative (sera/plasma : Blood donors specimens)	70
b. HIV negative (sera/plasma: antenatal)	30
c. HIV negative (whole blood)	50
3. HIV seroconversion panels (18 Panels, 107 specimens)	
BBi – PRB916	6
BBi – PRB917*	6
BBi – PRB919	3
BBi – PRB922*	4
BBi – PRB924	8
BBi – PRB925	6
BBi – PRB927*	5
BBi – PRB929	7
BBi – PRB930*	4
BBi – PRB932*	9
BBi – PRB937	6
BBi – PRB938	3
BBi – PRB940*	8
BBi – PRB943	7
BBi – PRB944	6
BBi – PRB945*	6
BBi – PRB946	4
BCP 6245*	9
4. Quality Control samples 11 (x3)	
HPA-HIV1-QC1	1 (3x)
HPA-HIV1-QC2	1 (3x)
HPA-HIV1-QC3	1 (3x)
HPA-HIV1-QC5	1 (3x)
HPA-HIV2-QC2	1 (3x)
HPA-HIV2-QC3	1 (3x)
HPA-p24 Ag-QC1	1 (3x)
HPA-p24 Ag-QC2	1 (3x)
NIBSC-HIV 1 British working standard	1 (3x)
NIBSC-HIV 1 British working standard, 1 in 5	1 (3x)
NIBSC-HIV 2 Monitor sample	1 (3x)
TOTAL number of specimens	438

BBi: Boston Biomedica Inc (Seracare); BCP: Zeptomatrix (formerly BioClinical Partners Inc);
 HPA: Health Protection Agency; NIBSC: National Institute for Biological Standards and Control
 Anti-HIV negative whole blood specimens were obtained from the North London Blood Centre and anti-HIV
 positive whole blood specimens from the HPA's Virus Reference Division

* For seroconversion panels specimens with an asterisk, previous Determine HIV results were used for comparison in this study

Table 3: Subset of main panel used to compare batches (Lot 2, HIV7099001)

Specimen category	Number
1. HIV positive (n=55)	
a. HIV-1 positive (sera/plasma)	40
b. HIV-2 positive (sera/plasma)	5
c. HIV-1 or 2 positive (whole blood)	10
2. HIV negative (n=50)	
a. HIV negative (sera/plasma)	40
b. HIV negative (whole blood)	10
3. HIV seroconversion panels (5 panels, 43 specimens)	
BBI – PRB916	6
BBI – PRB924	8
BBI – PRB932	9
BBI – PRB939	9
BCP 6245	11
4. Quality Control samples 11 (x3)	
HPA-HIV1-QC1	1 (3x)
HPA-HIV1-QC2	1 (3x)
HPA-HIV1-QC3	1 (3x)
HPA-HIV1-QC5	1 (3x)
HPA-HIV2-QC2	1 (3x)
HPA-HIV2-QC3	1 (3x)
HPA-p24 Ag-QC1	1 (3x)
HPA-p24 Ag-QC2	1 (3x)
NIBSC-HIV 1 British working standard	1 (3x)
NIBSC-HIV 1 British working standard, 1 in 5	1 (3x)
NIBSC-HIV 2 Monitor sample	1 (3x)
TOTAL number of specimens	159

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 positive whole blood specimens from the HPA's Virus Reference Division

Results

Specificity findings

Anti-HIV negative: whole blood

Of 50 anti-HIV negative whole bloods tested, 50 were unreactive to give a specificity of 100% (Table 4); 95% confidence intervals 92.9-100%. Blood donor specimens were assigned and confirmed as HIV-negative by the National Blood Service

Table 4: Anti-HIV negative whole blood specimens

	Consensus: initial result				
Number tested	Medium-strong reactive	Weak reactive	Negative	Indeterminate	Invalid
50	0	0	50	0	0

Anti-HIV negative: serum/plasma

Of 100 HIV negative serum blood donor specimens, 100 were unreactive to give a specificity of 100% (Table 5) 95% CI: 96.4-100%.

Table 5: Anti-HIV negative serum/plasma specimens

	Consensus: initial result				
Number tested	Medium-strong reactive	Weak reactive	Negative	Indeterminate	Invalid
100	0	0	100	0	0

Sensitivity findings

Anti-HIV positive: whole blood

Of 50 HIV positive whole bloods, 50 were reactive by the VIKIA[®] HIV1/2 rapid test to give a sensitivity of 100% (95% CI: 92.9 -100%). All the specimens were strongly positive with scores of 3 or 4 (Table 6).

Table 6: Anti-HIV1 positive whole blood specimens

	Consensus: initial result				
Number tested	Medium-strong reactive	Weak reactive	Negative	Indeterminate	Invalid
50	50	0	0	0	0

Anti-HIV1 positive: serum/plasma

Of 98 HIV1 positive serums, two gave invalid results. These two specimens had a viscous consistency which prevented them from running across the device membrane.

The sensitivity excluding the two invalid test results (i.e. based on a sample total of 96); was 100 % (95% CI: 96.2-100%)

Table 7: Anti-HIV1 positive serum/plasma specimens

	Consensus: initial result				
Number tested	Medium-strong reactive	Weak reactive	Negative	Indeterminate	Invalid
98	96	0	0	0	2

Note: The above included two HIV group O specimens, both of which gave strong positive results

Anti-HIV2 positive: serum/plasma

Of 19 anti-HIV2 positive sera, 12 were medium to strongly reactive (consensus scores 3 and 4) while seven were weakly reactive (consensus score of 2) to give 100% sensitivity (95% CI: 82.4-100%) (Table 8)

Anti-HIV2 positive serum specimens

	Consensus initial result				
Number tested	Medium-strong reactive	Weak reactive	Negative	Indeterminate	Invalid
19	12	7	0	0	0

Seroconversion sensitivity

The ability of the VIKIA[®] rapid test to detect early infection in eighteen seroconversion panels was compared with three other rapid tests, including Determine HIV (Inverness Medical) and two other rapid tests without CE marking and available outside Europe.

The seroconversion panels included 17 from SeraCare Boston Biomedica Inc (BBI) and one from Zeptometrix (formerly BioClinical Partners, Inc). VIKIA[®] gave a score of 38 out of 46 (Table 9 and 10) and was ranked second.

Table 10 shows the sum of positives found in each panel for each of the kits evaluated

Table 9: Seroconversion assay comparison (18 panels)

HIV Test kit	Product number	PRB916 n=6	PRB917 n=6	PRB919 n=3	PRB922 n=4	PRB924 n=8	PRB925 n=6	PRB927 n=5	PRB929 n=7	PRB930 n=4
Determine	7D23	2	2	2	4	3	4	3	2	2
VIKIA [®]	31 112	3	3	3	3	3	2	3	1	2
RTD3	NA	1	1	2	2	0	1	2	0	0
RTD4	NA	2	0	2	2	0	1	2	0	0
HIV Test kit	Product number	PRB932 n=9	PRB937 n=6	PRB938 n=3	PRB940 n=8	PRB943 n=7	PRB944 n=6	PRB945 n=6	PRB946 n=4	BCP4245 n=9
Determine	7D23	5	0	1	6	2	2	2	0	4
VIKIA [®]	31 112	3	0	1	5	1	2	1	0	2
RTD3	NA	0	0	0	5	0	1	1	0	2
RTD4	NA	0	0	5	1	0	1	0	0	1

NA Not available for this report

Table 10: Seroconversion ranked scoring (18 panels)

HIV Test kit	Product number	Cumulative score	Rank
Determine	7D23	46	1
VIKIA [®]	31 112	38	2
RTD3	NA	18	3
RTD4	NA	17	4

NA Not available for this report

Comparative timing of detection

Timing of detection was analysed by assigning the most sensitive assay for each seroconversion panel a value of 'time zero', and any less sensitive assay a positive value based on the number of days after the most sensitive assay detected infection. An overall mean and median delay was then calculated for the seroconversion panels tested (Table 11, Figure 2).

The mean delay can be influenced by outlying results from seroconversion panels for which the interval between the last negative and the first positive specimen is long; this can give rise to an artefact due to the timing of blood collection. The median delay is not affected in the same way.

Using mean values the VIKIA[®] HIV rapid test detected seroconversion 2.8 days later than Determine HIV. The median delay was 0 days, the same as the Determine HIV kit.

Table 11: Delay in detection of seroconversion

Assay	Product code	Delay in detecting seroconversion in each panel compared with the most sensitive assay		
		Range	Median	Mean
Determine	7D23	0-24	0.0	3.6
VIKIA [®]	31112	0-26	0.0	6.4
Kit 3	NA	2-163	7.0	16.0
Kit 4	NA	2-163	8.0	16.1

Notes: The upper limit of the range is, to some extent, influenced by the intervals between bleeds for any individual panel. The mean and median values provide a better general guide to each assay's ability to detect seroconversion. When an assay failed to detect seroconversion in a panel it was given an arbitrary extra 3 days delay for that panel.
Time 0 = earliest detection of HIV infection by any screening assay

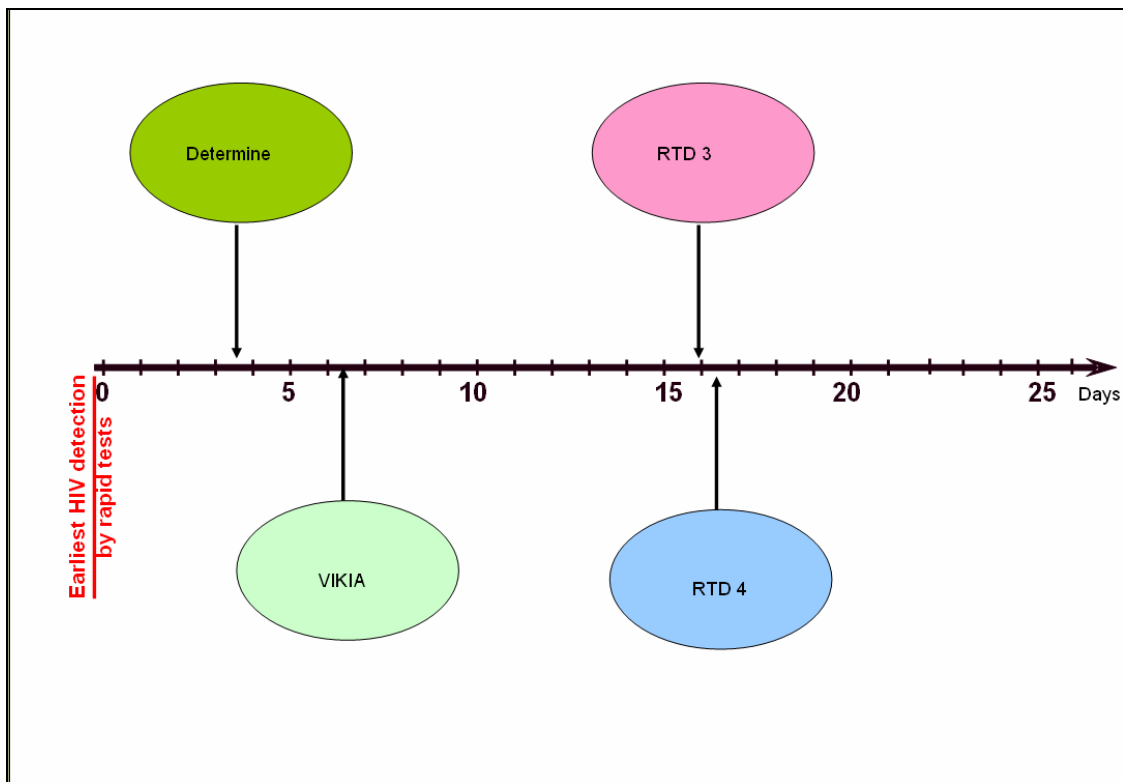


Figure 2: Mean comparative timing of detection of primary HIV following seroconversion based on employing HIV rapid tests

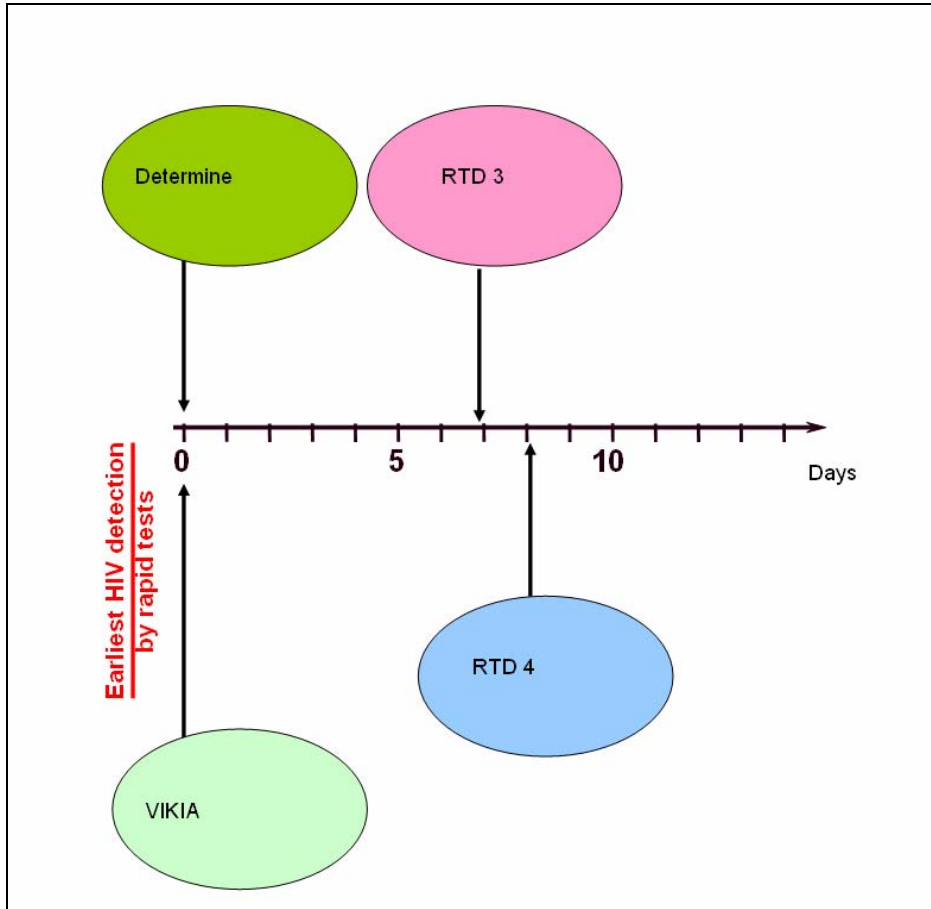


Figure 3: Median comparative timing of detection (on of primary HIV following seroconversion based on employing HIV rapid tests

Quality control reagents

Eleven quality control samples were tested in triplicate (Table 12).

For the HIV1 controls, HPA HIV1 QC5 gave medium to strongly reactive results and the NIBSC HIV1 British Working Standard (BWS) was weakly reactivity.

For the HIV2 controls, HPA HIV2QC2 and the NIBSC HIV2 Monitor sample gave medium to strongly reactive results. The HPA HIV2QC3 control was weakly reactive on two (of three) occasions and medium to strongly reactive on one occasion.

Table 12: Internal quality controls for HIV kit monitoring

Control name	Number tested	Medium-strong reactive	Weak reactive	Negative	Intermediate	Invalid control
HIV1 CONTROLS						
HIV1 QC2	3				3	
HIV1 QC3	3					3
HIV1 QC5	3	3				
NIBSC HIV1 BWS	3		3			
NIBSC HIV1 1/5	3			3		
HIV2 CONTROLS						
HIV2 QC2	3	3				
HIV2 QC3	3	1	2			
NIBSC HIV2 Monitor	3	3				
HIV P24 CONTROLS						
HPA P24QC1	3					3
HPA P24QC2	3					3

Lot comparison

A subset of the specimens used for the main part of the evaluation was tested using a different batch (lot number HIV7099001. Exp.31/01/2009). This panel comprised forty HIV-1 positives, four HIV-2 positives, fifty HIV negatives, five seroconversion panels (43 specimens) and eleven quality control samples.

There was some variation between the two lots as shown in Table 13.

Table 13: Comparison of two assay lots

Specimen Category	No of specimens	No of Initial Reactive Specimens	
		Lot number	
		lot 1: HIV7099002	Lot 2: HIV7099001
Quality Control Samples (n=11)			
HPA HIV1 QC1	1 (x3)	3	3
HPA HIV1 QC2	1 (x3)	0	1
HPA HIV1 QC3	1 (x3)	0	0
HPA HIV1 QC5	1 (x3)	3	3
HPA HIV2 QC2	1 (x3)	3	3
HPA HIV2 QC3	1 (x3)	3	3
HPA HIV1 p24 QC1	1 (x3)	0	0
HPA HIV1 p24 QC2	1 (x3)	0	0
NIBSC HIV1 1 in 5 BWS	1 (x3)	0	0
NIBSC HIV1 BWS	1 (x3)	2	3
NIBSC HIV2 Monitor sample	1 (x3)	3	3
Seroconversion Panels (n=5)			
PRB 916	6	3*	2
PRB 924	8	3	3
PRB 932	9	3*	4*
PRB 939	9	1 (1 invalid)	1 (1 invalid)
BCP 9245	11	2	2 (1 invalid)
HIV positives (n=44)			
HIV 1 Positive serum/plasma	40	40	38 (2 invalid)
HIV 2 positive serum/plasma	4	4	3
HIV Negatives (n=50)			
HIV negative serum/plasma (blood donors)	40	0	0 (with 2 indeterminate)
HIV negative whole bloods (blood donors)	10	0	0
* Note: The following panels were seen to display mid panel detection: Lot 1: Panel PRB916, Lot 1 & 2: Panel PRB932. Note: Panel RRB939-08 was found to be invalid in both lots 1 & lot 2			

Technical appraisal

The 'Instructions for Use' were easy to follow although they would benefit from a larger text font (version 2007-04)

Overall VIKIA[®] was quick and easy to use and required approximately one hour to test 40 devices.

Conclusion

The VIKIA[®] HIV1/2 kit is designed to detect antibodies to HIV 1 and HIV 2 in a rapid test device/point of care format.

The device demonstrated good specificity and sensitivity on serum/plasma and whole blood specimens, including anti-HIV1, HIV subtype O and HIV2 positive specimens. Two viscous samples gave invalid results. When compared against three other rapid tests VIKIA[®] was ranked second (after Determine) in terms of seroconversion sensitivity using the mean timing calculation. When using the median calculation the seroconversion sensitivity of VIKIA[®] was equal to Determine.

VIKIA[®] demonstrated slight variation in results between batches and use of quality control reagents for ongoing monitoring is recommended. As part of the assessment two HIV1 (one strong and one weak control), and three HIV2 quality controls were identified for use with the VIKIA[®].

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