Primer Design Ltd

R00112

Human Immunodeficiency Virus Type 1

Kit version: 3

Target region:

Gag gene

genesig® Standard Kit

150 tests

GENESIG

Kits by Primerdesign

For general laboratory and research use only

Introduction to Human Immunodeficiency Virus Type 1

Human immunodeficiency virus (commonly known as HIV, and formerly known as HTLV-III and lymphadenopathy-associated virus) is a retrovirus that is the cause of the disease known as AIDS (acquired immunodeficiency syndrome), a syndrome where the immune system begins to fail, leading to many life-threatening opportunistic infections.

HIV is transmitted through direct contact of a mucous membrane with a bodily fluid containing HIV, such as blood, semen, vaginal fluid, pre-seminal fluid or breast milk. This transmission can come in the form of penetrative (anal or vaginal) sex, oral sex, blood transfusion, contaminated needles and exchange between mother and infant during pregnancy, childbirth, or breastfeeding.

Since the start of the epidemic in 1981, AIDS has been responsible for the deaths of over 40 million people, making it one of the most devastating pandemics in recorded history. According to the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO), an estimated 1.3 million people were newly infected with HIV in 2022. Of the estimated 624,000 people who died of AIDS-related illnesses in 2022, approximately 16 per cent of them were under 20 years of age. An estimated 130,000 children aged 0-9 contracted HIV in 2022, bringing the total number of children in this age group living with HIV to 930,000. Almost 85% of these children reside in sub-Saharan Africa. Every week, 4,000 adolescent girls and young women aged 15–24 years became infected with HIV globally in 2022. Almost 80% of these infections occurred in sub-Saharan Africa. To reduce HIV-related mortality and morbidity among these highly vulnerable populations, early testing and treatment is essential.

Two species of HIV infect humans: HIV-1 and HIV-2. HIV-1 is hypothesized to have originated in southern Cameroon after jumping from wild chimpanzees (Pan troglodytes troglodytes) to humans during the twentieth century. HIV-2 is hypothesized to have originated from the Sooty Mangabey (Cercocebus atys), an Old World monkey of Guinea-Bissau, Gabon, and Cameroon. HIV-1 is more virulent, more easily transmitted and is the cause of the majority of HIV infections globally, while HIV-2 is less easily transmitted and is largely confined to West Africa.

Specificity

The genesig® Standard Kit for Human Immunodeficiency Virus Type 1 (HIV1) is designed for the in vitro quantification of Human Immunodeficiency Virus Type 1 genomes. The kit is designed to have a broad detection profile. Specifically, the primers will detect over 95% of sequences available on the Los Alamos National Laboratory database at the time of last review.

Due to the complexity of HIV1 subtype variation, this assay is designed to detect subtypes A1, A2, A3, A6, B, C and AE. When reviewing this HIV1 kit, sequences from a three-year period were analysed from the Los Alamos National Laboratory database. Due to the sequence evolution observed in the HIV1 genome over time, this is considered to be an adequate time period for analysis.

This kit is predicted to cross react with Simian-Human immunodeficiency virus and Simian immunodeficiency virus.

The dynamics of genetic variation mean that new sequence information may become available after the most recent review. If you require further information or have a specific question about the detection profile of this kit then please send an e-mail to techsupport@primerdesign.co.uk and our team will answer your question.

Kit contents

- **1x HIV1_v3.0 primer/probe mix (150 reactions, BROWN)**
  FAM labelled
- **1x HIV1_v3.0 positive control template (for Standard curve, RED)**
- **1x RNase/DNase-free water (WHITE)**
  for resuspension of primer/probe mixes
- **2x Template preparation buffer (YELLOW)**
  for resuspension of positive control template and standard curve preparation

Reagents and equipment to be supplied by the user

Real-time PCR Instrument

Extraction kit
This kit is recommended for use with genesig® Easy DNA/RNA extraction kit or exsig®Mag. However, it is designed to work well with all processes that yield high-quality nucleic acid with minimal PCR inhibitors.

oasig® lyophilised OneStep or PrecisionPLUS® OneStep 2X RT-qPCR Master Mix
This kit is intended for use with oasig® lyophilised OneStep or PrecisionPLUS® OneStep 2X RT-qPCR Master Mix

Pipettors and filter tips

Vortex and centrifuge

1.5 ml microtubes

qPCR plates or reaction tubes

Kit storage and stability

This kit is stable for shipping at ambient temperature but should be stored at -20°C upon arrival. Once the lyophilised components have been resuspended, they should not be exposed to temperatures above -20°C for longer than 30 minutes at a time and unnecessary repeated freeze/thawing should be avoided. The kit is stable for six months from the date of resuspension under these circumstances.

If a standard curve dilution series is prepared this can be stored frozen for an extended period. If you see any degradation in this serial dilution a fresh standard curve can be prepared from the positive control.

Primer Design Ltd does not recommend using the kit after the expiry date stated on the pack.

Suitable sample material

This kit can be used with all types of samples from various origins. Please ensure that the extracted nucleic acid samples are suitable in terms of purity, concentration, and RNA integrity.

Dynamic range of test

Under optimal PCR conditions the kit can achieve priming efficiencies between 90-110% and detect less than 100 copies of target template. If running a positive control standard curve for a quantitative result, and an efficiency of between 90% to 110% is not achieved, then the run should be repeated with a freshly prepared standard curve.

Principles of the test

Real-time PCR

A target specific primer/probe mix is provided, and this can be detected through the FAM channel.

The primer/probe mix provided exploits with the so-called TaqMan® principle. During PCR amplification, forward and reverse primers hybridize to the target RNA. A fluorogenic probe is included in the same reaction mixture which consists of a DNA probe labelled with a 5′-dye and a 3′-quencher. During PCR amplification, the probe is cleaved, and the reporter dye and quencher are separated. The resulting increase in fluorescence can be detected on a range of qPCR platforms.

Positive control

For copy number determination and as a positive control for the PCR set-up, the kit contains a positive control template. This can be used to generate a standard curve of the target copy number/Cq value. Alternatively, the positive control can be used at a single dilution where full quantitative analysis of the samples is not required. Each time the kit is used, at least one positive control reaction must be included in the run. A positive result indicates that the primers/probes for detecting the target gene worked properly in that particular experimental scenario. If a negative result is obtained the test results are invalid and must be repeated. Care should be taken to ensure that the positive control does not contaminate any other kit component which would lead to false-positive results. This can be achieved by handling this component in a Post PCR environment. Care should also be taken to avoid cross-contamination of other samples when adding the positive control to the run. This can be avoided by sealing all other samples and negative controls before pipetting the positive control into the positive control well.

Negative control

To validate any positive findings a negative control reaction should be included every time the kit is used. For this reaction, RNase/DNase-free water should be used instead of the template. A negative result indicates that the reagents have not become contaminated while setting up the run.

Resuspension Protocol

To minimize the risk of contamination with foreign RNA/DNA, we recommend that all pipetting is performed in a PCR clean environment. Ideally, this would be a designated PCR lab or PCR cabinet. Filter tips are recommended for all pipetting steps.

1. **Pulse-spin each tube in a centrifuge before opening.**
   This will ensure that the lyophilised primer/probe mix or template is in the base of the tube and is not lost upon opening the tube.

2. **Resuspend the kit components in the RNase/DNase-free water supplied, according to the table below.**
   To ensure complete resuspension, vortex each tube thoroughly.

Component - resuspend in water	Volume
Pre-PCR pack	
HIV1_v3.0 primer/probe mix (**BROWN**)	165 µl

3. **Resuspend the positive control template in the template preparation buffer supplied, according to the table below:**
   To ensure complete resuspension, vortex the tube thoroughly.

Component - resuspend in template preparation buffer	Volume
Post-PCR heat-sealed foil	
HIV1_v3.0 Positive Control Template (**RED**)	500 µl

* This component contains a high copy number template and is a VERY significant contamination risk. It must be opened and handled in a separate laboratory environment, away from the other components.

OneStep RT-qPCR detection protocol

For optimum performance and sensitivity.
All pipetting steps and experimental plate set up should be performed on ice. After the plate is prepared proceed immediately to the OneStep amplification protocol. Prolonged incubation of reaction mixes at room temperature can lead to PCR artifacts that reduce the sensitivity of detection.

1. **For each RNA sample prepare a reaction mix according to the table below:**
   Include sufficient reactions for positive and negative controls.

Component	Volume
oasig® lyophilised OneStep or PrecisionPLUS® OneStep 2X RT-qPCR Master Mix	10 µl
HIV1_v3.0 primer/probe mix (**BROWN**)	1 µl
RNase/DNase-free water (WHITE)	4 µl
Final Volume	**15 µl**

2. **Pipette 15 µl of this mix into each well according to your qPCR experimental plate set-up.**

3. **Pipette 5 µl of RNA template into each well, according to your experimental plate set up.**
   For negative control wells us 5 µl of RNase/DNase free water (WHITE). For positive control wells use 5 µl of the positive control template (**RED**). The final volume in each well is 20 µl.

4. (Optional) Standard curve preparation for quantitative analysis.

For quantitative analysis of the samples, a standard curve dilution series can be prepared using the positive control template (**RED**). This is not required for qualitative analysis.

4.1 Reaction mix preparation for the standard curve.

Include sufficient reactions for each dilution of the standard curve.

Component	Volume
oasig® lyophilised OneStep or PrecisionPLUS® OneStep 2X RT-qPCR Master Mix	10 µl
HIV1_v3.0 primer/probe mix (**BROWN**)	1 µl
RNase/DNase-free water (WHITE)	4 µl
Final Volume	**15 µl**

4.2 Preparation of a 10-fold standard curve dilution series.

a. pipette 90 µl of template preparation buffer (YELLOW) into 5 tubes and label them 2-6. The neat positive control tube (**RED**) is considered tube 1.

b. Pipette 10 µl of positive control template (**RED**) into tube 2.

c. Vortex thoroughly.

d. Change pipette tip and pipette 10 µl from tube 2 into tube 3.

e. Vortex thoroughly.

Repeat steps **d** and **e** across the tubes to complete the dilution series.

Standard Curve	Copy Number
Tube 1 Positive control (**RED**)	2×10^5 per µl
Tube 2	2×10^4 per µl
Tube 3	2×10^3 per µl
Tube 4	2×10^2 per µl
Tube 5	20 per µl
Tube 6	2 per µl

4.3 Pipette 15 µl of reaction mix and 5 µl of the respective standard into each well for the standard curve according to your plate set up.

The final volume in each well is 20 µl.

OneStep RT-qPCR Amplification Protocol

Amplification conditions using oasig® lyophilised OneStep or PrecisionPLUS® OneStep 2X RT-qPCR Master Mix.

	Step	Time	Temp
	Reverse Transcription	10 min	55 °C
	Enzyme activation	2 min	95 °C
Cycling x50	Denaturation	10 s	95 °C
	DATA COLLECTION *	60 s	60 °C

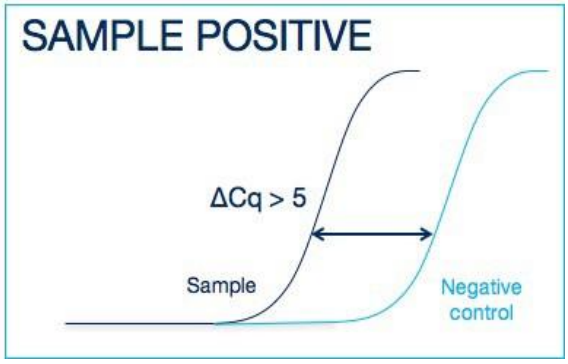
* Fluorogenic data should be collected during this step through the FAM channels

Interpretation of results

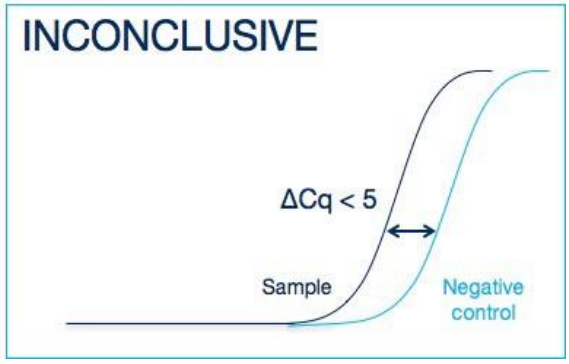
Target	Positive control	Negative control	Interpretation
+	+	-	**POSITIVE QUANTITATIVE RESULT** calculate copy number
-	+	-	**NEGATIVE RESULT**
+ / -	+	≤ 35	**EXPERIMENT FAILED** due to test contamination
+ / -	+	> 35	*
+ / -	-	+ / -	**EXPERIMENT FAILED**

A positive control template is expected to amplify between Cq 16 and 23. Failure to satisfy this quality control criterion is a strong indication that the experiment has been compromised.

*Where the test sample is positive and the negative control is positive with a Cq > 35, the sample must be reinterpreted based on the relative signal strength of the two results:



If the sample amplifies > 5 Cq earlier than the negative control, then the sample should be reinterpreted (via the table above) with the negative control verified as negative.



If the sample amplifies < 5 Cq earlier than the negative control, then the positive sample result is invalidated, and the result should be determined inconclusive due to test contamination. The test for this sample should be repeated.

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