ASSAYS TO SUPPORT
HIV Treatment
Decisions
Human Immunodeficiency Virus (HIV)

HIV and AIDS remain a persistent problem for the United States and countries around the world. Efforts to identify HIV-positive individuals have improved, yet many remain undiagnosed. Of those diagnosed, fewer still are engaged in treatment, and of those prescribed antiretroviral therapy (ART), only 30% are virally suppressed.

Of the 1.2 million Americans living with HIV, only 30% are virally suppressed

<table>
<thead>
<tr>
<th>Diagnosed</th>
<th>Engaged in Care</th>
<th>Prescribed ART</th>
<th>Virally Suppressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>86%</td>
<td>40%</td>
<td>37%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Newly diagnosed, as well as chronic HIV infected patients, now have the advantage of multiple treatment options and advanced laboratory technologies to help control their disease. LabCorp, with Monogram Biosciences, offer a comprehensive menu to help manage all types of patients affected by HIV.
Resistance Assays Most Commonly Used in HIV-1 Management

GenoSure Archive®
GenoSure Archive provides valuable information when considering regimen switches in virologically suppressed patients. Increasingly common today is the need for “fine tuning” regimens while maintaining a patient’s viral suppression. Reasons for this include:
• Side effects
• Adverse events
• Regimen simplification
• Drug-drug interactions
• Concern for long-term toxicities
• Regimen intolerance

GenoSure PRIme® provides a complete picture of resistance to PIs, NRTIs, NNRTIs, and INIs to aid in selecting the optimal therapy for each patient.

For Treatment-naive Patients
Department of Health and Human Services (DHHS) guidelines recommend HIV drug-resistance testing for persons with HIV at entry into care to guide selection of the initial antiretroviral therapy (ART) regimen. When transmitted integrase inhibitor (INSTI) resistance is a concern, ensure resistance testing includes INSTI genotype testing.2

For Treatment-experienced Patients
The DHHS guidelines recommend genotypic testing as the preferred resistance test for patients experiencing suboptimal virologic response or virologic failure while on first- or second-line antiretroviral therapy.2

PhenoSense GT® Plus Integrase and PhenoSense GT®:
Combined Phenotypic and Genotypic Testing
The DHHS Guidelines note the following: “Addition of phenotypic to genotypic testing is generally preferred for persons with known or suspected complex drug-resistance mutation patterns”.2 Together, complementary information from phenotypic and genotypic data provides a more comprehensive picture of your patient’s ARV options compared to either technology alone.3
• Phenotyping is a direct, quantitative measure of drug susceptibility based on differences in ARV drug concentration required to inhibit viral replication. It can also provide drug resensitization and hypersusceptibility information.4
• Genotyping identifies a comprehensive list of mutations, including key resistance-associated mutations, and can identify mixtures of wild-type and drug-resistant viruses.

Other Tests Related to HIV Management

<table>
<thead>
<tr>
<th>Test No</th>
<th>Test Name</th>
<th>Use/Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>006926</td>
<td>HLA B*57:01, Abacavir Hypersensitivity HLA Association</td>
<td>The presence of the HLA-B*57:01 allele increases the susceptibility to abacavir hypersensitivity in several populations studied.</td>
</tr>
<tr>
<td>322744</td>
<td>Hepatitis Panel, Acute</td>
<td>Hepatitis A antibody, IgM; hepatitis B core antibody, IgM; hepatitis B surface antigen; hepatitis C virus antibody.</td>
</tr>
<tr>
<td>037215</td>
<td>Hepatitis B Virus (HBV) Evaluation Profile</td>
<td>Determine HBV infection status.</td>
</tr>
<tr>
<td>144050</td>
<td>Hepatitis C Virus (HCV) Antibody With Reflex to Quantitative Real-time PCR</td>
<td>Diagnosis of active hepatitis C virus infection.</td>
</tr>
<tr>
<td>182873</td>
<td>QuantiFERON®-TB Gold</td>
<td>The QuantiFERON®-TB Gold test is an in vitro assay to aid in the diagnosis of both latent and active infection with Mycobacterium tuberculosis.</td>
</tr>
<tr>
<td>505271</td>
<td>CD4:CD8 Ratio Profile</td>
<td>In HIV-1 seropositive patients, enumeration of CD4 T cells may be used for prognostic purposes and to monitor disease progression and antiretroviral therapy.</td>
</tr>
<tr>
<td>550420</td>
<td>Human Immunodeficiency Virus 1 (HIV-1), Quantitative, Real-time PCR (Graphical)</td>
<td>Detect and quantitate HIV-1 in plasma.</td>
</tr>
<tr>
<td>Test Name</td>
<td>Clinical Utility</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Newly Diagnosed Treatment Naive 1st and 2nd failures</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| GenoSure PRLme<sup>a</sup> | - Genotypic assay to detect resistance in HIV-1 to four classes of commonly prescribed antiretroviral drugs: NRTIs, NNRTIs, PIs, INIs.  
- The DHHS guidelines recommend genotypic testing as the preferred resistance testing to guide therapy in antiretroviral-naïve patients.  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance.  
- Includes both a genotypic and phenotypic assay for NRTIs, NNRTIs, PIs, INIs.  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance.  
- Provides susceptibility assessments for NRTIs, NNRTIs, PIs, INIs in cell-associated viral DNA. |
| GenoSure MG | - Genotypic assay to detect resistance in HIV-1 to three classes of commonly prescribed antiretroviral drugs: NRTIs, NNRTIs, PIs.  
- The DHHS guidelines recommend genotypic testing as the preferred resistance testing to guide therapy in antiretroviral-naïve patients, and specifically recommends genotyping for all pregnant women prior to initiating treatment.  
- The guidelines also recommend resistance testing when changing regimens in patients experiencing virologic failure.  
- The guidelines also recommend resistance testing when changing regimens in patients experiencing virologic failure.  
- The DHHS guidelines recommend genotypic testing as the preferred resistance testing to guide therapy in antiretroviral-naïve patients, as well as when changing regimens in patients experiencing virologic failure.  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance.  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance. |
| **Complex Known or Suspected Drug Resistance** |
| PhenoSense<sup>b</sup> | - Determines phenotypic resistance to NRTIs, NNRTIs, PIs. Viral replication capacity is also included.  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance.  
- Includes both a genotypic and phenotypic assay for NRTIs, NNRTIs, PIs, INIs.  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance. |
| PhenoSense GT<sup>c</sup> | - Includes both a genotypic and phenotypic assay for nucleoside reverse transcriptase inhibitors (NRTIs), nonnucleoside reverse transcriptase inhibitors (NNRTIs), and protease inhibitors (PIs).  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance. |
| PhenoSense GT<sup>d</sup> Plus Integrase | - Includes both a genotypic and phenotypic assay for NRTIs, NNRTIs, PIs, and integrase inhibitors (INIs).  
- The DHHS guidelines note that the addition of phenotypic to genotypic testing is generally preferred for those with known or suspected drug resistance. |
| **Virologically Suppressed Undetectable Viral Load** |
| GenoSure Archive<sup>e</sup> | - Designed to provide HIV-1 antiretroviral (ARV) drug resistance data when a patient’s viral load is suppressed or too low for standard resistance testing.  
- Provides susceptibility assessments for PIs, NRTIs, NNRTIs, and INIs in cell-associated viral DNA. |
| Trofile<sup>f</sup> DNA | - Detects HIV-1 coreceptor tropism in patients with undetectable viral load; used to determine eligibility for CCR5 antagonist therapy such as maraviroc.  
- DHHS guidelines note that “coreceptor usage can be determined from proviral DNA” in patients with undetectable viral load.  
- The guidelines also note that “a coreceptor tropism assay should be performed whenever the use of a CCR5 antagonist is being considered.”  
- The guidelines also note that “a coreceptor tropism assay should be performed whenever the use of a CCR5 antagonist is being considered.”  
- The guidelines recommend phenotyping as generally preferred for coreceptor tropism screening. |
| GenoSure Integrate<sup>g</sup> | - Genotypic assay to detect resistance of HIV-1 to integrase inhibitors  
- DHHS guidelines note that in ART-naive patients in whom transmitted integrase inhibitor (INSTI) resistance is supplement standard genotypic resistance (NRTIs, NNRTIs, PIs) testing.  
- The guidelines also note that in patients failing INSTI regimens, genotyping can help determine whether to include INIs. |
| PhenoSense Integrate<sup>h</sup> | - A phenotypic resistance test used to determine the susceptibility of a patient’s HIV to integrase inhibitors. Integrase inhibitors block HIV replication by preventing the virus from integrating into the host cell’s DNA. |
| Trofile<sup>i</sup> | - Detects HIV-1 coreceptor tropism; used to determine eligibility for CCR5 antagonist therapy such as maraviroc.  
- DHHS guidelines note that “a coreceptor tropism assay should be performed whenever the use of a CCR5 antagonist is being considered.”  
- The guidelines also note that “a coreceptor tropism assay should be performed whenever the use of a CCR5 antagonist is being considered.”  
- The guidelines recommend phenotyping as generally preferred for coreceptor tropism screening. |
| Trofile<sup>j</sup> Select | - Trofile<sup>j</sup> Select allows for the ordering of HIV-1 coreceptor tropism status to be completed using the appropriate results of an initial prescreening viral assessment  
- The coreceptor tropism status may be used to determine eligibility for CCR5 antagonist therapy, such as maraviroc. |

For additional test information, including specimen requirements, CPT coding and RUO/IUO status, consult the Online Test Menu at www.LabCorp.com.
**LabCorp’s HIV resistance and specialty assays offer comprehensive and accurate information.**

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Viral Load Requirement</th>
<th>Specimen Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>551700 (MGRM-P5000)</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA) or PPT tubes; centrifuge within 6 hours, transfer 5 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>551697 (MGRM-G50000)</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA), PPT, or yellow-top (ACD) tubes; centrifuge within 2 hours, transfer 5 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>551800 (MGRM-V3200)</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA) or PPT tubes; centrifuge within 6 hours, transfer 3 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>551690 (MGRM-V7000)</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA) or PPT tubes; centrifuge within 6 hours, transfer 3 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>551920 (MGRM-M7000)</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in three lavender-top (EDTA) or PPT tubes; centrifuge within 6 hours, transfer 5 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>551776 (MGRM-R6000)</td>
<td>Undetectable viral load</td>
<td>Collect whole blood specimen in 4mL lavender top (EDTA) top tube. Do not centrifuge. Ship frozen.</td>
</tr>
<tr>
<td>829670 (MGRM-E36000)</td>
<td>Undetectable viral load</td>
<td>Collect whole blood specimen in 4mL lavender top (EDTA) top tube. Do not centrifuge. Ship frozen.</td>
</tr>
<tr>
<td>551871</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA), yellow-top (ACD), or PPT tubes; centrifuge within 6 hours, transfer 5 mL plasma to a screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>550230 (MGRM-S3200)</td>
<td>≥ 500 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA) or PPT tubes; centrifuge within 6 hours, transfer 3 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>553100 (MGRM-E3100)</td>
<td>≥ 1,000 copies/mL plasma</td>
<td>Collect specimen in two lavender-top (EDTA) or PPT tubes; centrifuge within 6 hours, transfer 3 mL plasma to screw-cap transport tube, and freeze. Ship frozen.</td>
</tr>
<tr>
<td>553355 (MGRM-E3000T)</td>
<td>Use when viral load is unknown</td>
<td>Both frozen plasma and frozen whole blood are required. Draw four lavender-top (EDTA) tubes. PLASMA: Centrifuge three tubes within six hours of collection. Transfer plasma to screw-cap tubes and freeze. Ship frozen. WHOLE BLOOD: Do not centrifuge. Freeze tube immediately after draw. Ship frozen.</td>
</tr>
</tbody>
</table>
HIV/HCV Co-infection

**Hepatitis C**

According to the CDC, about one quarter of HIV-infected persons in the United States are also infected with Hepatitis C virus (HCV). HCV is one of the most important causes of chronic liver disease in the United States and HCV infection progresses more rapidly to liver damage in HIV-infected persons. HCV infection may also impact the course and management of HIV infection. The Department of Health and Human Services (DHHS) guidelines recommend that all HIV-infected persons be screened for HCV infection.

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**Screening Approach**

- **HCV Antibody With Reflex to Quantitative RNA Testing**
  - **Negative**
  - **Positive**

- **Hepatitis C Virus (HCV) Antibody Cascade to Quantitative PCR and Genotyping**
  - **Positive**

**Evaluation & Treatment Decision Options**

- **Genotype 1**
  - Perform Hepatitis C Virus (HCV) NS5A in patients with genotype 1a that are being considered for elbasvir/grazoprevir.
  - Consider Hepatitis C Virus (HCV) NS5A in patients with genotype 1a that are treatment-experienced being considered for ledipasvir/sofosbuvir.
  - Consider HCV GenoSure® NS3/4A.
  - Consider Hepatitis C Virus (HCV) NS5B Drug Resistance Assay.

- **Genotype 2, 4, 5 or 6**

- **Genotype 3**
  - Perform Hepatitis C Virus (HCV) Genotype 3 NS5A in patients with and without cirrhosis and treatment-experienced patients with cirrhosis who are being considered for sofosbuvir/velpatasvir.
  - in treatment-experienced patients without cirrhosis and treatment-naive patients with cirrhosis being considered for daclatasvir+sofosbuvir.

**Patient Management Options**

- **HCV RNA Quantitative**
  - Monitor HCV RNA levels per treatment guidelines.

- **Treatment Failure at any time point**
  - Monitor Disease Progression
  - Counsel to prevent transmission and consider for retreatment.

- **Relapse per package insert**

- **Genotype 1**
  - Consider drug resistance testing to evaluate for resistance-associated variants.
  - HCV GenoSure NS3/4A
  - HCV NS5A Drug Resistance Assay
  - HCV NS5B Drug Resistance Assay

- **Genotype 3**
  - Consider drug resistance testing to evaluate for resistance-associated variants.
  - HCV Genotype 3 NS5A Drug Resistance Assay
PrEP (pre-exposure prophylaxis)

Pre-exposure prophylaxis (PrEP) reduces the chance of becoming infected with HIV for individuals at risk. High-risk individuals following a PrEP regimen should be evaluated per PrEP guidelines.

Laboratory Tests to Manage Patients on PrEP

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Test Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial PrEP Screening</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Confirmation of HIV negative status</strong></td>
<td></td>
</tr>
<tr>
<td>083935</td>
<td>Human Immunodeficiency Virus 1/O/2 (HIV-1/O/2) Antigen/Antibody (Fourth Generation) Preliminary Test With Cascade Reflex to Supplementary Testing</td>
</tr>
<tr>
<td><strong>Evaluation for HBV</strong></td>
<td></td>
</tr>
<tr>
<td>037215</td>
<td>Hepatitis B Virus (HBV) Evaluation Profile</td>
</tr>
<tr>
<td><strong>PrEP Monitoring</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Monitor renal function</strong></td>
<td></td>
</tr>
<tr>
<td>003004</td>
<td>Creatinine Clearance</td>
</tr>
<tr>
<td><strong>Routine testing for HIV</strong></td>
<td></td>
</tr>
<tr>
<td>083935</td>
<td>Human Immunodeficiency Virus 1/O/2 (HIV-1/O/2) Antigen/Antibody (Fourth Generation) Preliminary Test With Cascade Reflex to Supplementary Testing</td>
</tr>
<tr>
<td><strong>Routine testing for other STIs</strong></td>
<td></td>
</tr>
<tr>
<td>183194</td>
<td>Chlamydia/Gonococcus, NAA (urine)</td>
</tr>
<tr>
<td>188698</td>
<td>Chlamydia/Gonococcus, Pharyngeal Swab, NAA</td>
</tr>
<tr>
<td>188672</td>
<td>Chlamydia/Gonococcus, Rectal Swab, NAA</td>
</tr>
<tr>
<td>082345</td>
<td>Treponema pallidum (Syphilis) Screening Cascade</td>
</tr>
</tbody>
</table>

Visit the online Test Menu at www.LabCorp.com for full test information, including CPT codes and specimen collection requirements.
Count on LabCorp
as your single-source solution for HIV diagnostics

Unsurpassed Scientific Expertise
• With the added strengths of Monogram Biosciences®— an acknowledged world leader in HIV resistance and tropism testing—LabCorp now brings an incomparable level of scientific expertise to HIV diagnostics.
• Our uniquely qualified team includes renowned MD- and PhD-level scientists committed to advancing HIV diagnostics and the success of individualized treatment.
• Monogram’s experienced medical affairs professionals are available for consultations and educational programs.

A History of Vision and Innovation
• Pioneers in polymerase chain reaction (PCR) and molecular diagnostics
• First-to-market companion diagnostics for integrase inhibitors, fusion inhibitors (enfuvirtide), and CCR5 antagonists (maraviroc)
• Ongoing collaborations with leading pharmaceutical companies to help bring additional therapeutic innovations to market

Superior Service every step of the way
• A committed staff and a national infrastructure of more than 1,700 patient service centers
• Connectivity solutions ranging from easy-to-use Web-based applications to sophisticated integrations that allow efficient and effective communication
• Dedicated infectious disease client services
  - Center for Esoteric Testing - 800-788-9223
  - Monogram Biosciences - 800-777-0177

References