RESULTS *for* LIFE
LAB TESTING: BETTER HEALTH, IMPROVED OUTCOMES

Lab Tests for HIV: Turning a Killer into a Chronic Disease

Lab tests have been central in transforming HIV from a disease that meant rapid progression and death to a chronic disease that can be managed for decades.

"All I knew was that so many of the friends I had in college had died of AIDS or HIV."

The dramatic decline in deaths from HIV over the past 20 years could not have occurred without lab tests.

- ✓ HIV **screening tests** tell whether an individual is infected with the HIV virus—so treatment can begin promptly.
- ✓ HIV **diagnostic tests** (as well as other non-HIV tests) help physicians assess a patient's health and the patient's stage of disease. They also guide the physician's choice of treatment.

HIV screening tests command the most media attention, but diagnostic tests have quietly teamed with anti-HIV drugs to create a kind of "one-two" punch that has dramatically lowered the number of HIV deaths during the past 20 years. Here's how it works:

- ✓ **The viral load test** is a measure of the level of the HIV virus in the patient's blood. This tells clinicians which drug combination is best for the patient, and helps them monitor whether the drugs are working. If the viral load is going up, the clinician can adjust the drug

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A Virtual Case Study

David's Story

It was 2004. Home sales in Florida were booming. And David was leading in year-to-date sales in his local real estate office. So when the doctor told him that the HIV screening test came back positive, he was stunned. "I was so upset. I assumed that I was finished," said David. "All I knew was that so many of the friends I had in college had died of AIDS or HIV."

But his doctor told him that things had changed—that he still had lots of options. The first step, he explained, was to run some additional lab tests to figure out the degree and nature of David's infection. The follow-up tests found that his CD-4 T cell count—a measure of the strength of his immune system—was very low, just over 100 and well below the normal range of 450–1400. And his viral load, which reflects the level of HIV virus, was very high.

His doctor also ran a drug resistance test to find out if David's particular strain of HIV was resistant to any of the HIV drugs. The results were negative for resistance. So the physician was very hopeful that the combination of drugs he selected for David would be successful.

And they were. It took David some time to get used to taking so many pills, and he had to wrestle with a frequent upset stomach. He followed the doctor's orders religiously and

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combination, or try an entirely different group of drugs.

✓ HIV **resistance testing** is used by physicians to determine whether the fast-morphing HIV virus has developed a resistance to one or more of the drugs being used. This lets clinicians adjust the combination, or switch to entirely new drugs.

By combining the benefits of lab tests and HIV drugs, clinicians are able to better match drugs to the unique HIV strain, and continually update their treatment to combat the rapidly mutating virus. An added benefit is that this removes the guesswork from picking drugs and allows optimized combinations—saving alternative drugs for later use.

There is still no cure for HIV. But lab tests are enabling longer and healthier lives. While HIV patients may have lived only a few months in the 1970s, today's patients— with proper care and careful management—can live long and productive lives.

David's Story CONTINUED FROM PAGE 1

returned regularly for follow-up screening. When David showed his clients new homes or closed a deal, he often thought how lucky he was that—despite HIV—he was working and well enough to enjoy his life.

But in 2006, the terrible fatigue returned, along with a high fever. Viral load tests showed that his virus had rebounded. When David's doctor ran another drug resistance test, it showed that David's virus had developed a strong resistance to one of the drugs he was taking. The doctor replaced the drug with another that clinical studies had shown was especially effective for David's strain of the virus.

Since then, David has been fine. The business is going well—with a regional award for sales in late 2006. David continues to follow the doctor's orders exactly. "I can't believe I am still alive, and I'm living well," says David. "For me, HIV isn't a death sentence. My dad has heart problems that he manages with drugs. I have HIV that I manage with drugs. And we are both doing fine."

David is not a real person, but the facts and information presented here accurately depict the role of lab tests in HIV and the circumstances faced by many patients.

KEY ROLE OF LAB TESTS CONFIRMED IN CLINICAL STUDIES

A review of 13 prospective clinical studies involving more than 12,000 HIV infected patients found that two lab tests—CD4 and viral load—were critical in estimating the likelihood that HIV patients would ultimately proceed to AIDS or death. This information is critical to physicians in understanding the patient's condition, and in planning treatment and health services.

Source: *The Lancet*, 7/13/02

Federal Guidelines Describe Key Role of Lab Tests in HIV Treatment

The Department of Health and Human Services released guidelines in October 2006 on how clinicians should use anti-HIV drugs to treat adults and adolescents with HIV infection. The guidelines identify the central role that lab tests play in guiding treatment decisions. They recommend use of lab tests in evaluating whether drugs are appropriate for a patient, in deciding which HIV drugs are best, and in monitoring how well they work. HHS also recommends use of lab tests to identify resistance to the drugs and help guide decisions in adjusting the combination of drugs. The information provided by lab tests is particularly critical in light of the fact that there are more than 20 approved drugs that belong to four different drug classes that physicians can use to design combinations to treat HIV.

Federal guidelines say Lab Tests should be used...

When	Reason	Therapy Decision	Specific Tests
When Treatment is Started...	...to evaluate the level of the HIV virus in a patient and to plan treatment based on patient's unique circumstances	...this helps physicians decide whether drugs are needed, their strength, and various combinations	✓ CD4 T-cell count to evaluate the strength of a person's immune system ✓ Viral load testing to evaluate a patient's response to therapy ✓ Drug resistance testing to evaluate HIV strain and mutations
When Treatment is Underway...	...to judge degree of response to treatment	...this signals whether the current approach is working or may need to be changed	
	...to understand whether HIV strain is resistant to specific drugs	...this allows physicians to refine and target drug combinations or change types of drugs based on the unique response in each patient. ...this also allows physicians to avoid exhausting future treatment options	

Source: See *Guidelines for the Use of Antiretroviral Agents in HIV-1-Infected Adults and Adolescents*, Panel on Antiretroviral Guidelines for Adults and Adolescents, U.S. Department of Health and Human Services, October 10, 2006

LAB TESTS LIFT THE VIRTUAL "DEATH SENTENCE"

"Twenty years ago, a diagnosis of HIV/AIDS was a virtual death sentence. Now, by the use of phenotypic and genotypic resistance information, physicians can reject only those drugs to which the virus has become resistant, and preserve alternative therapies for future use. As a result, physicians can manage the patient's HIV as a chronic disease over a long period of time. HIV genotyping has become an integral part of AIDS patient management since 1996, and could become a model for the implementation of personalized medicine in other areas."

Source: The Personalized Medicine Coalition, November, 2006

How are Lab Tests used in Diagnosing and Treating HIV?

After screening tests identify patients with the HIV virus, lab tests then help guide physicians in selecting the most appropriate drugs for the patient. One of the primary diagnostic tests is the viral load test to measure the level of the virus in the patient. If the viral load is going up, then one or more of the drugs is likely not working. With this information, physicians can adjust medications—perhaps using a stronger combination—or do additional diagnostic tests to find out if the patient's HIV virus is developing resistance to HIV drugs. When resistance develops, the physician can replace the drugs that are no longer effective.

Screening Tests DETECT HIV **Diagnostic Tests DEFINE AND REFINE HIV Treatment**

Screening Test
Does the patient have HIV?

→

Diagnostic Test
If patient has HIV, what is the best treatment?

→

Diagnostic Test
Once medications are provided, how well do they work?

→

Adjust Drugs
If patient doesn't improve or develops drug resistance, physician adjusts medications

↓

Diagnostic Test
How well does the new treatment work?

←

Adjust Drugs
If patient doesn't improve or new drug resistance develops, physician makes further adjustments

↑

What the Experts are saying about HIV tests...

for Screening...

- ✓ Early detection can add longevity and improve the quality of life for HIV-positive patients
- ✓ Screening tests once every 3–5 years are cost-effective and clinically justified.

for Diagnosis...

- ✓ Lab tests at the beginning of and during therapy = dramatic improvement in outcomes
- ✓ Drug resistance tests cost-effective and can lead to selection of more effective drugs
- ✓ Drug resistance tests and drugs reduce cost 32% over two years.

Physicians use lab tests to identify drug resistance that can develop with HIV infection during treatment. This lets them select a more effective drug combination, which again starts the process of testing to monitor effectiveness and new drug resistance.

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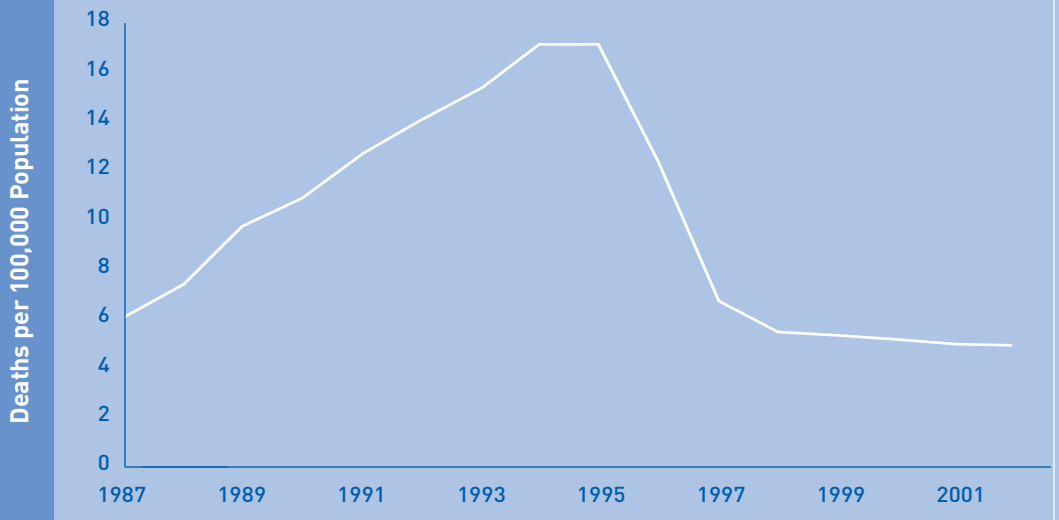
Lab Tests and HIV Drugs Transform HIV from a Deadly to a Chronic Disease

The one-two punch of anti-HIV drugs and lab tests are primary contributors to the dramatic decline in deaths from HIV disease. The largest decline occurred in the mid-1990s, as combinations of HIV drugs, including a group known as protease inhibitors, combined with information from lab tests to tell researchers which treatments were working and which were not. These findings introduced a treatment approach—finding the targets with lab tests, then aiming precisely with powerful drugs—that successfully countered the deadly impact of HIV in many patients, as witnessed by the dramatic drop in deaths between 1995–1998.

This combination of powerful drugs and sophisticated lab tests also began the transformation of HIV from a uniformly fatal disease to a disease that could be chronically managed. Whereas many patients in the 1970s and 1980s lived only a few months, patients with HIV today can live for decades. This treatment strategy has led to "the most dramatic change in the prognosis of any disease in the last 2 decades, from usually lethal to regularly manageable," according to a recent editorial in the *Journal of the American Medical Association*.

Trends in Annual Age Adjusted* Rate of Death due to HIV Disease—USA, 1987-2002



*Standard: age distribution of 2000 US population.

Note: for comparison with data for 1999 and later years, data for 1987-1998 were modified to account for ICD-10 rules instead of ICD-9 rules.

Sources: Henry, WK, *Journal of the American Medical Association*, Sept, 27, 2006; Palella, FJ, *New England Journal of Medicine*, March 26, 1998; Centers for Disease Control and Prevention

DIAGNOSTIC LAB TESTS FOR HIV

- ✓ *CD4: Indicates the condition of the patient's immune system*
- ✓ *Viral Load: Measures the level of the HIV virus and tells whether the current drugs are working.*
- ✓ *Genotyping: Identifies mutations in the HIV virus that are resistant to anti-viral drugs.*
- ✓ *Phenotyping: Determines whether the drug that is being used inhibits the growth of the virus.*

LAB TESTS AND HIV AT A GLANCE

Lab tests are essential in every step of HIV care:

- ✓ *Screening tests identify whether a person has HIV*
- ✓ *Diagnostic tests help medical professionals:*
  1. *Identify the best therapy*
  2. *Monitor its progress*
  3. *Adjust treatments to improve results*
  4. *Change therapies when drug resistance emerges*
  5. *Monitor drug resistance changes*

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