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TAG Treatment Action Group

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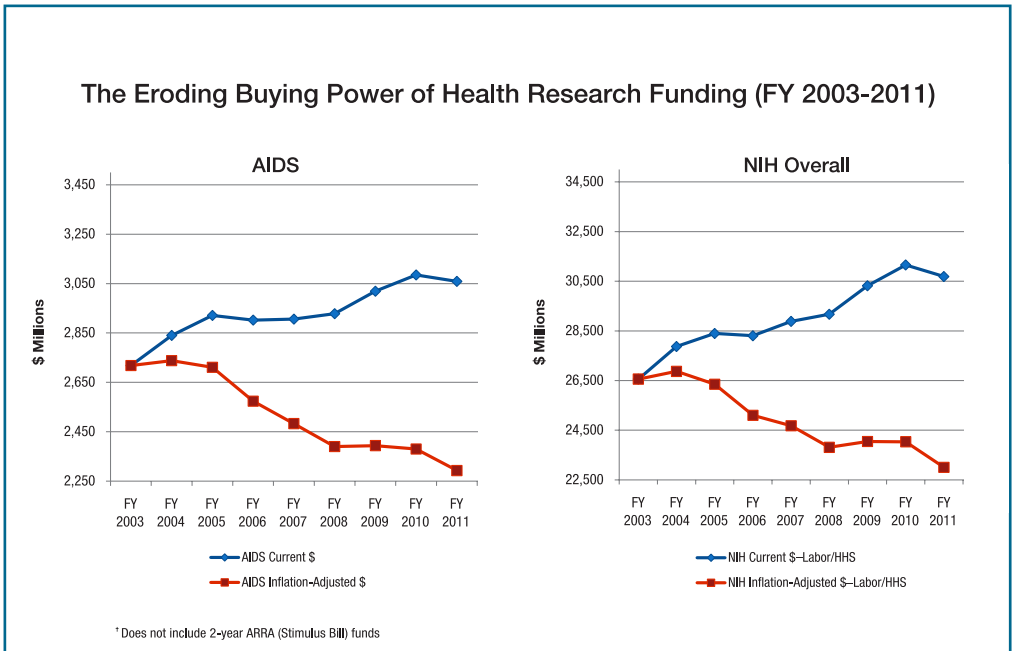
ISSUE BRIEF

AIDS Research: Broad Health and Economic Benefits

Investments in health research at the National Institutes of Health (NIH) have paid enormous dividends in the health and well-being of people in the U.S. and around the world. HIV and AIDS research supported by NIH has yielded important recent advances and holds great promise for significantly reducing HIV infection rates and providing more effective treatments for people living with HIV/AIDS.

Yet years of erratic funding levels for NIH and declining purchasing power have undermined our nation's leadership in health research and our scientists' ability to take advantage of the expanding opportunities to advance healthcare. The race to find better treatments and cures for cancer, heart disease, AIDS, and other diseases—and to control global epidemics such as AIDS, tuberculosis, and malaria—depends on robust long-term investment in health research at NIH.



Funding for AIDS and overall NIH health research, FY2003–FY2011, in current and inflation-adjusted dollars. The red lines show funding in constant 2003 dollars and show the progressive loss of purchasing power for AIDS and overall health research funding. (Source: Office of AIDS Research, National Institutes of Health)

Extraordinary Accomplishments in AIDS Research

The U.S. has been the global leader in research to prevent and treat HIV/AIDS and related serious health conditions. Over the past decades, the comprehensive AIDS research program at the NIH has led to scientific advances that have saved the lives of millions of people with HIV/AIDS and prevented millions more from becoming infected. The story of AIDS research is remarkable.

1982: Scientists name a new disease, acquired immune deficiency syndrome (AIDS), a year after its discovery.

1984: American and French scientists confirm that the human immunodeficiency virus (HIV) causes AIDS.

> "Medical miracles do not happen simply by accident. They result from painstaking and costly research—from years of lonely trial and error, much of which never bears fruit—and from a government willing to support that work. From life-saving vaccines, to pioneering cancer treatments, to the sequencing of the human genome—that is the story of scientific progress in America. When government fails to make these investments, opportunities are missed. Promising avenues go unexplored. Some of our best scientists leave for other countries that will sponsor their work. And those countries may surge ahead of ours in the advances that transform our lives."
>
> *— President Barack Obama, March 9, 2009*

The Broad Benefits of AIDS Research in Fighting Disease[1, 2]

The benefits of HIV/AIDS research extend far beyond helping those people at risk for or living with HIV. Investment in AIDS research has provided scientists worldwide with a model for combating an array of other diseases and conditions. For example, AIDS research has led to:

Promising Experimental Treatments for Cancer

- Various cancers: Several natural body hormones called growth factors promote the activity of HIV. Many of these hormones also promote the growth and spread of cancer cells. Blocking the activity of these hormones is a strategy first used experimentally to treat Kaposi's sarcoma, a cancer found in patients with HIV/AIDS.
- Immune suppression: The profound immune suppression necessary for a successful bone marrow transplant, required for the treatment of leukemias and other cancers, often leads to devastating, even fatal, infections such as cytomegalovirus (CMV) and pneumocystis pneumonia, which also affect people with AIDS. New drugs to treat and prevent these infections in cancer patients have come directly from AIDS-targeted research.

Potential Benefits for Heart Attack and Stroke Patients

HIV-positive children and adults, both on and off certain anti-HIV medications, can suffer heart attacks and strokes because HIV appears to affect small blood vessels in the heart and the brain, which makes these patients vulnerable to spasm, blood clots, and early atherosclerosis. In HIV infection, a process of programmed cell death injures the cells that line the small blood vessels of the heart. Inflammation appears to play a significant role in this process, as it does in non-HIV-infected individuals. Methods to control inflammation and detect it early should limit those damaging processes in all affected individuals.

New Approaches to Treating Hepatitis, Osteoporosis, Heart Damage, and Influenza

- Hepatitis B: Three drugs developed against HIV—lamivudine, tenofovir, and entecavir—are now the mainstay of therapy for hepatitis B virus (HBV) infections. Another antiviral drug called adefovir, which failed as an HIV treatment, was found to suppress HBV at much lower dosages and has been approved for treatment of chronic HBV disease.
- Hepatitis C, influenza, osteoporosis, heart damage: Protease inhibitors are being developed to combat infections such as hepatitis C (HCV) and influenza, and medical conditions such as osteoporosis and the heart muscle damage that results from heart attack.

1985: The first HIV antibody test is licensed by the U.S. Food and Drug Administration (FDA), and screening of the U.S. blood supply begins.

1987: The first antiretroviral drug to fight HIV is approved by the FDA. The drug is called AZT (or zidovudine) and is in a class of antiretroviral drugs called nucleoside reverse transcriptase inhibitors (NRTIs), which act to prevent HIV from reproducing in the body. The FDA licenses the HIV Western blot test, a confirmatory antibody test.

New Hope for Alzheimer's Patients

Profound dementia is commonly seen in the late stages of AIDS, so drugs that are successful in reducing nerve damage and dementia in AIDS, for example, could potentially benefit patients with Alzheimer's. The characteristic plaques that fill the brain cells of an Alzheimer's patient are formed partly by proteases, so scientists are now investigating the use of protease inhibitors to treat this debilitating dementia affecting millions of people in the U.S. and worldwide.

Experimental Treatments for Autoimmune Disorders

HIV-positive people can develop autoimmune problems such as psoriasis or blood abnormalities associated with lupus. For these autoimmune diseases, treatments developed for AIDS may also work when the same conditions occur spontaneously. A new class of anti-HIV drug that blocks a protein known as CCR5, the key co-receptor for HIV's entry into cells, is also being evaluated in inflammatory bowel disease and other autoimmune disorders.

New Technologies for Diagnosing Other Infections

New PCR (polymerase chain reaction) tests, developed for diagnosing HIV, are now routinely used to rapidly detect a number of other infectious diseases including hepatitis C, tuberculosis, chlamydia, influenza, Lyme disease, and many fungal infections. These PCR techniques have also made it possible to measure otherwise undetectable levels of cancer cells in people who appear to have been cured.

New Approaches to the Design and Conduct of Clinical Trials

- Recruiting and enrolling: AIDS research has resulted in new approaches to the design and conduct of clinical trials, including community-based trials that capture the expertise of community physicians, as well as in recruiting and enrolling patients from diverse populations. These models are now being applied to test diagnostic, prevention, and treatment approaches for other diseases using faster, more efficient, and more inclusive protocols.
- Community advisory boards: AIDS clinical studies pioneered the development of community advisory boards to bring community perspectives into the planning, development, and implementation of the research, including recruiting study participants, educating community members about issues of consent, and helping with retention of participants.
- Parallel-track mechanism: In 1992, the "parallel-track" mechanism was established to allow select people with HIV to access new and safe drugs prior to the completion of clinical trials and formal approval by the FDA. This mechanism has been lifesaving for people with HIV/AIDS and for individuals suffering from other serious or life-threatening diseases for which existing therapies were either ineffective or had failed.

Insights into the Function of Human Systems

- Immune system studies: AIDS research has led to advances in the understanding of the thymus gland, a small endocrine organ that produces a type of white blood cells—T lymphocytes—that help cells in the body to fight infections.
- Neurological studies: Studies of the mechanisms involved when HIV crosses the blood-brain barrier could shed light on how drug therapies can be delivered to the brain and nervous system to fight debilitating neurological disorders.

Innovative Behavioral, Social, Psychological, and Outreach Preventive Interventions

- Behavioral and social interventions: In the case of HIV/AIDS, these include increasing condom use, reducing the number of sex partners, delaying the onset of sexual intercourse, reducing the frequency of needle sharing among injection drug users (IDUs), and referring IDUs to drug treatment programs. These interventions have reduced HIV-related risk behaviors and lowered the incidence of HIV and other sexually transmitted infections (STIs) in a range of population groups and settings. The development and improvement of HIV-related behavioral intervention science

1992: The FDA approves another NRTI-based antiretroviral drug, ddC (or zalcitabine), for use with AZT, and the first clinical trial of combination antiretroviral therapy begins. The FDA also licenses the first rapid HIV test, which provides results in as little as ten minutes.

1994: An NIH-funded trial demonstrates that AZT can reduce the risk of mother-to-child HIV transmission.

1995: Saquinavir, the first antiretroviral drug in the protease inhibitor class, is approved by the FDA.

> "We are faced with compelling scientific challenges to develop truly transforming interventions such as a cure for HIV infection and powerful new prevention modalities. Without these interventions, the scope and burden of the HIV pandemic will continue to grow."
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> —*Anthony Fauci, M.D., Director, National Institute of Allergy and Infectious Diseases, and Gregory Folkers, M.S., M.P.H., Chief of Staff to Dr. Fauci.* Health Affairs, *November 2009*

has benefited all areas of health promotion and disease prevention, including nutrition, smoking, alcohol and drug use, and unintended pregnancy prevention.

- Psychosocial interventions: These interventions emphasize the development of behavioral skills, such as confidence in one's ability to negotiate with partners about condom use or sexual abstinence. These skills are applicable to other health and social life situations, including unintended pregnancy prevention, avoidance of drug and alcohol abuse, and conflict resolution/violence prevention.
- Outreach interventions: Employing peer leaders and social networks, such as those developed for out-of-treatment drug users to deliver HIV prevention messages and services, are applicable to other health promotion and disease prevention efforts that would benefit from peer outreach, such as nutrition and exercise campaigns.
- Research on enhancing adherence: This area of research among HIV-infected patients has also produced a number of new psychosocial and technological methods that are applicable to other health arenas, especially those that involve taking numerous medications on different schedules such as with advanced cancer and heart disease.

Methodologies for Measuring Behavioral and Social Factors

HIV/AIDS researchers have pioneered the use of qualitative and quantitative techniques for mapping social networks to understand patterns in epidemics. The use of social and biostatistical modeling research has helped to improve understanding of trends in epidemics and their impact at the community level.

Follow-Through Needed on Dramatic Recent Advances

Additional funding for AIDS and other health research is essential if we are to take advantage of significant scientific opportunities to prevent and treat HIV/AIDS and other diseases. Startling recent advances in HIV prevention and treatment science require further research and investigation to confirm results, refine biomedical products, and understand how new interventions can be used most effectively.

- Vaccines: An HIV vaccine clinical trial supported by the NIH and the Department of Defense and conducted in Thailand identified for the first time a modest but positive effect from a vaccine in preventing HIV infection.
- Vaccines: A group of scientists led by NIH researchers discovered two potent human antibodies that can stop more than 90 percent of known global HIV strains from infecting human cells, potentially accelerating research on vaccines for HIV and other infectious diseases.
- Microbicides: A clinical trial of a microbicide gel conducted in South Africa with NIH infrastructure support for the first time demonstrated that a microbicide can reduce the risk of HIV infection.
- Pre-exposure prophylaxis (PrEP): Clinical trials at multiple international sites have found that oral pre-exposure prophylaxis can reduce the risk of HIV infection.

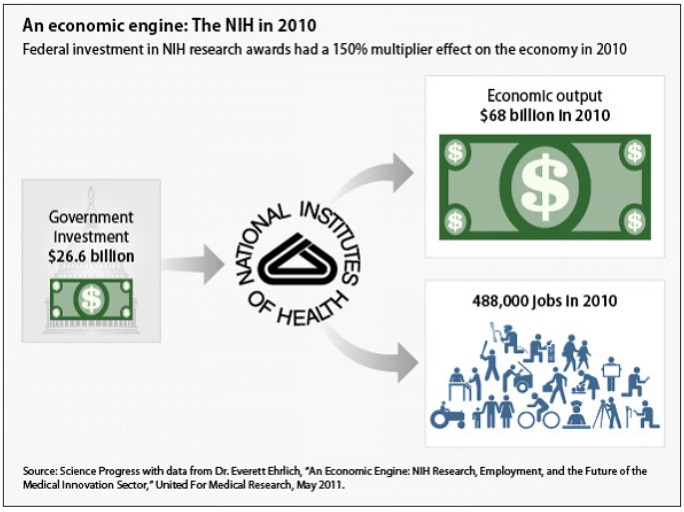
1996: The FDA approves the first antiretroviral drug in the non-nucleoside reverse transcriptase inhibitor (NNRTI) class. Similar to NRTIs and protease inhibitors, NNRTIs prevent HIV from reproducing in the body. The FDA approves the first urine test for HIV as well as the first test that detects the level of HIV in the blood.

1999: Trial results from a study in Uganda first demonstrate that a single dose of an antiretroviral drug, nevirapine, when given to the mother at the onset of labor and to the baby after delivery, roughly halves the rate of HIV transmission.

- Treatment as prevention: A large NIH-sponsored clinical trial demonstrated that putting people on treatment early in the course of HIV infection reduced their chances of transmitting the virus to others by 96%.
- Cure: Progress on basic science and treatment research has led scientists to expand research aimed at a cure for AIDS.

Investing in America's Health and Economic Growth

The NIH is a major employer of Americans across the country. The Federation of American Societies for Experimental Biology (FASEB) noted that "NIH funds the research of more than 325,000 scientists at over 3,000 universities, medical schools, and other research institutions across the United States. Eighty percent of NIH funding is distributed through competitive grants to researchers in nearly every Congressional district and the U.S. territories, and more than 130 Nobel Prize winners have received support from the agency."[3] NIH Director Dr. Francis Collins brought this point home during a public town hall meeting on September 9, 2009, by citing that for every research grant awarded by the NIH, on average seven new jobs are created.[4] With additional dollars, scientists are given valuable opportunities to advance science while creating more jobs to boost the economy.



Impact of Declining Purchasing Power of AIDS and Health Research Funding

While the NIH budget increased by 14.5%[5] between FY 2003 and FY 2010, the cost of NIH activities increased by 29.6% over the same period,[6] according to the Biomedical Research and Development Price Index. Thus in real terms, health research at NIH sustained a budget decrease of approximately 15% over the last eight years.

Missed Scientific Opportunities

- The percentage of research proposals supported by NIH has dropped dramatically from 32 percent of proposals received in 2001 to a projected 18 percent in 2009.[9]
- Funded grants are routinely cut by 10 percent or more.[8] At the National Cancer Institute and the National Institute on Aging, funded grants are cut by even more—24 percent and 18 percent on average respectively.[8]
- For AIDS research, flat funding has resulted in an 18 percent decline in NIH's ability to support new research grants.[9]
- Flat funding combined with inflation has resulted in a nearly 20 percent loss in buying power for NIH over the past five years.[7]

Discouraging the Next Generation of Scientists and Researchers

The reality that young researchers face, knowing that the likelihood of receiving funding support is not high, has dampened the energy and enthusiasm of many of those aiming for a career in biomedical research. A 2005 report

2000: The Centers for Disease Control and Prevention (CDC), the FDA, the NIH, and the U.S. Agency for International Development (USAID) jointly conclude that male condoms significantly reduce the risk of HIV transmission for both men and women during vaginal intercourse when used correctly and consistently.[18]

2002: The FDA approves the first rapid finger-prick HIV diagnostic (or screening) test.

2003: The FDA approves the antiretroviral drug enfuvirtide (Fuzeon), the first entry inhibitor.

2004: The FDA approves the first saliva-based HIV diagnostic (or screening) test.

by the National Academy of Sciences noted that young investigators play a crucial role in bringing novel, potentially breakthrough ideas to the research table. Appropriate funding to nurture their careers is vital to the future of health research.

- New grant applications to the NIH now have a less than 12 percent chance of being funded.[10]
- In 2006, the chance of an established investigator being awarded an NIH grant on the first try was seven percent.[8]
- The intense difficulty in obtaining NIH support is forcing researchers to spend excessive amounts of time writing and resubmitting grants. Some researchers are reporting that their laboratories are in peril as a consequence.[8]
- The average age at which an investigator receives his or her first grant has increased by nearly a decade, from 34 years in 1970 to 43 years in 2007.[10,11]
- In 2006, the *New England Journal of Medicine* observed that, "as it becomes increasingly difficult for established investigators to renew their grants, their frustration is transmitted to trainees, who increasingly opt for alternative career paths, shrinking the pipeline of future investigators."[12]

Loss of U.S. Competitive Edge

The 2006 report from the American Competitiveness Initiative of the Domestic Policy Council of the White House Office of Science and Technology Policy begins by stating that "keeping our competitive edge in the world economy requires policies that lay the groundwork for continued leadership in innovation, exploration, and ingenuity."[13] When a career in science appears unachievable and insecure, the research industry suffers and top-tier U.S. researchers are increasingly tempted to migrate to countries that provide greater opportunities to test innovative ideas.

> "America's economic destiny depends upon maintaining and enhancing our lead in technology, innovation, science, and research."
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> *—John Porter, former Chairman of the House Labor-HHS-Education Appropriations Subcommittee*

In January 2010, the National Science Foundation released a report[14] on science and technology investments by countries around the world, noting the "gradual erosion" of the U.S. leadership position in this area given rapidly increasing investments by Asian and European Union countries. Through increased and consistent opportunities to foster new research, the U.S. can maintain its competitive edge.

The NIH's long-term vision cannot be realized without a consistent and robust investment strategy. This is key to securing the NIH's future global competitiveness, realizing its potential for powering biomedical innovation and economic growth, and improving health in the U.S. and worldwide.

The bottom line: Congress must redress five years of flat funding for NIH by significantly increasing overall NIH appropriations to take advantage of growing scientific opportunitics in health research.

2005: Results from a trial in South Africa show for the first time that adult male circumcision significantly reduces the risk of acquiring HIV.

2006: The FDA approves the first single-pill, once-a-day, combination drug for AIDS patients, eliminating the need for complicated, multi-pill treatments. The single pill is called Atripla (a combination of the drugs efavirenz, tenofovir, and emtricitabine) and is considered a major breakthrough in AIDS treatment.

2007: The FDA approves two new types of HIV drugs that block HIV from infecting healthy cells: raltegravir, the first integrase inhibitor, and maraviroc, the first CCR5 blocker.

2010: Clinical trials establish the efficacy of both a microbicide and oral pre-exposure prophylaxis (PrEP) to reduce the likelihood of HIV infection.

2011: An NIH-sponsored clinical trial demonstrates that putting people on treatment early in the course of HIV infection reduces their chances of transmitting the virus to others by 96%. Two additional clinical trials report the efficacy of PrEP in preventing infection.

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